

# **Forecasting Indian container throughput by Trend Analysis**

Submitted for the award of the degree

**MASTER OF BUSINESS ADMINISTRATION  
(International Transportation and Logistics Management)**

SUBMITTED BY

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## CERTIFICATE

This is to certify that this project report entitled "**FORECASTING INDIAN CONTAINER THROUGHPUT by TREND ANALYSIS**" submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus in partial fulfillment of the requirement for awarding the degree, MBA in International Transport and Logistics Management is a work of Sri Sairam Jena (Reg No. 2203305030)



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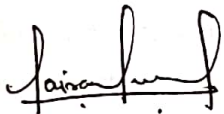


## **DECLARATION**

I hereby declare my intent to undertake a project on **Forecasting Indian container throughput by Trend Analysis**. The purpose of this project is to gain practical experience and enhance my knowledge in the field of logistical and supply chain management.

I am excited about this opportunity to delve into a significant aspect of supply chain management in India and to contribute towards achieving the ambitious goals set by the Sagarmala project. Through this project, I aim to develop valuable skills in data analysis, forecasting, and strategic planning, which will benefit my future career endeavors.

I am committed to conducting this project with diligence and integrity, and I look forward to learning from the insights and experiences of professionals in the industry.



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## ABSTRACT

This study addresses the challenging task of projecting Indian container throughput to meet the ambitious objective outlined by the Sagarmala project, targeting 30 million Twenty-Foot Equivalent Units (TEUs) by 2030. Leveraging the analytical capabilities of Excel, this research investigates the association between GDP growth and year-over-year (YoY) growth rates in container throughput, aiming to uncover the intricate connections between economic indicators and maritime trade volumes.

The Sagarmala initiative represents a significant endeavor aimed at revamping India's maritime sector through port modernization, logistics infrastructure enhancement, and coastal shipping promotion. Central to its mission is the goal of significantly enhancing container throughput to stimulate economic expansion, bolster trade competitiveness, and capitalize on India's strategic maritime advantages. Achieving the projected throughput volume of 30 million TEUs by 2030 necessitates meticulous planning, informed decision-making, and a profound comprehension of the factors influencing container trade dynamics.

In pursuit of this objective, this study embarks on an analytical exploration, leveraging insights from historical data and employing correlation analysis techniques to unveil the relationship between GDP growth and container throughput YoY growth rates. By scrutinizing historical trends, patterns, and fluctuations in both economic indicators and container trade volumes, the research endeavors to elucidate the degree to which changes in GDP impact fluctuations in container throughput, and vice versa. The correlation value, calculated at 0.88, indicates a strong positive relationship between GDP growth and container throughput YoY growth rates.

The utilization of Excel as the primary analytical tool facilitates a comprehensive examination of the data, enabling the development of sophisticated forecasting models and correlation analyses. Through meticulous data manipulation, statistical analysis, and visualization techniques, Excel empowers researchers to uncover nuanced relationships and derive actionable insights from complex datasets. Furthermore, Excel's adaptability and versatility permit the exploration of various scenarios, sensitivity analyses, and predictive modeling, thereby bolstering the reliability and robustness of the research findings.

By illuminating the correlation between GDP growth and container throughput YoY growth rates, this study offers valuable insights into the intricate interplay between macroeconomic factors and maritime trade dynamics. These insights carry significant implications for policymakers, port authorities, investors, and other stakeholders involved in India's maritime infrastructure development. Armed with a deeper understanding of the factors driving container trade volumes, decision-makers can craft informed strategies, allocate resources effectively, and navigate India towards realizing its ambitious maritime aspirations.

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## **LIST OF ABBREVIATIONS**

- GDP - Gross Domestic Product
- TEUs - Twenty-Foot Equivalent Units
- ASEAN - Association of Southeast Asian Nations
- SAARC - South Asian Association for Regional Cooperation
- RCEP - Regional Comprehensive Economic Partnership
- KPIs - Key Performance Indicators
- MA - Moving Average
- SMA - Simple Moving Average
- EMA - Exponential Moving Average
- YoY - Year-over-Year
- MS Excel - Microsoft Excel
- ARIMA - Autoregressive Integrated Moving Average
- WTO- World Trade Organization
- SEM - Structural Equation Modeling
- MOSPI - Ministry of Statistics and Programme Implementation
- RBI - Reserve Bank of India
- SEZ - Special Economic Zone
- CEZ - Container Equivalent Unit Zone
- HAZMAT - Hazardous Materials Zone
- CY - Container Yard

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## **REFERENCE**

# **INTRODUCTION**

# CHAPTER 1

## INTRODUCTION

### **1.1 Introduction:**

Ports are important for connecting nations to the global economy. According to UNCTAD (2015), a port is a harbor where ships load or unload containers. Ports host the majority of a nation's export-import operations. Additionally, ports generate a profit for a different industry that depends on port operations and involves numerous economic activities, such as the logistics sector (cargo shipping companies) and the port-supporting sector (cargo handling companies). Numerous parties were involved in the operations of ports, including traders, port authorities, and government agencies like customs and excise.

Ports have been created to facilitate economic activity since the beginning of industrialization. Most industries need efficient ports to support their operations, especially those that depend on inexpensive shipping, like chemical and agricultural products.

It has been established that local economies and ports are mutually dependent. For sustainable development, local economies must be integrated into the national and eventually the global economies; most of those stages involve port-related activity taking place in the ports. Long-term sustainable growth of a nation's economy is contingent upon the involvement of ports activities. However, ports are a significant hub for both domestic and international trade, which is anticipated to have a positive effect on regional and national economic development.. To fully reap the rewards of maritime trade, export-led growth strategies must be promoted. To stimulate economic growth and generate job opportunities, export-oriented industries should be encouraged to fully utilize container throughput through the implementation of policies and incentives by policymakers.

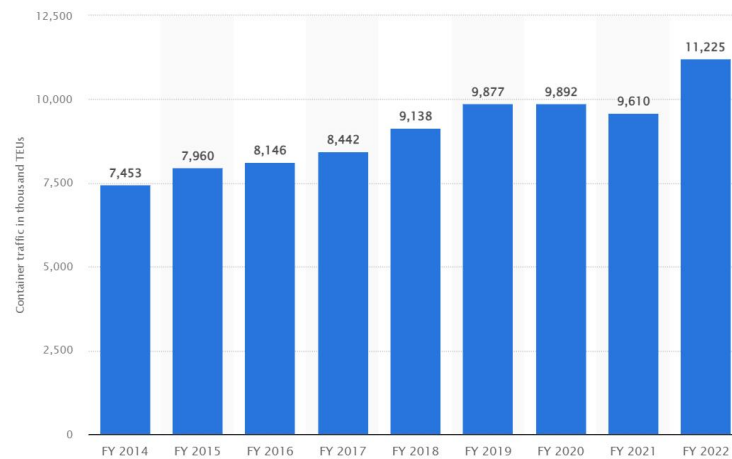


Table 1. Indian container traffic handled at major ports across India from financial year 2014 to 2022

The research by Wilmsmeier and Monios (2018) (2019), which examines the effects of port clusters on regional development, is one landmark study that highlights the significance of ports. Their study sheds light on the ways in which maritime clusters support industrial development, job creation, and economic expansion in port cities and the surrounding areas. Through the examination of case studies of maritime clusters in various settings, Wilmsmeier and Monios (2018) clarify the complex function of ports as catalysts for economic growth and the advancement of regional prosperity.

Similarly, Notteboom and Pallis (2009) provide insightful information about the port-city relationship's economic geography. Their research looks at the complex relationships that exist between ports and cities, emphasizing both the benefits and drawbacks of these relationships. Pallis and Notteboom stress the significance of strategic planning.

Moreover, Hummels (2007) investigates the role that transportation expenses play in determining the trends in global trade. His work shows how enhanced port and transportation infrastructure can lower trade costs, open up new markets, and promote trade flows. By measuring the effect of transportation costs on trade volumes, Hummels emphasizes how vital effective ports are to enabling international trade and fostering economic integration.

Through the clarification of the economic, social, and environmental consequences of ports, scholars aid in well-informed decision-making and policy development within the maritime industry.

In this research we will understanding the correlation between GDP growth and container throughput is essential for effective maritime infrastructure planning. This study sheds light on the relationship between economic indicators and maritime trade volumes, offering invaluable insights for policymakers and port authorities. These insights guide decisions regarding port development projects, dredging initiatives, and hinterland connectivity improvements, ensuring optimized resource allocation and the smooth functioning of maritime logistics networks.

The strong positive correlation between GDP growth and container throughput underscores the maritime sector's pivotal role in driving economic growth and enhancing trade competitiveness. Insights gleaned from this study aid policymakers in formulating strategies to leverage India's maritime advantages and foster a conducive environment for maritime trade. Investment in port modernization, trade facilitation measures, and logistics infrastructure is recommended to stimulate economic growth, generate employment opportunities, and bolster India's global trade position.

The study's focus on forecasting container throughput for 2030 aligns directly with the Sagarmala project's objectives. By providing projections for container throughput, the study supports the project's aim of revolutionizing India's maritime infrastructure and amplifying maritime trade. The correlation analysis reaffirms the project's significance in harnessing India's maritime potential for economic growth and trade connectivity.

## **1.2. Research Objectives**

The primary objective of this project is to analyze the correlation between GDP growth and container throughput in India, while also utilizing Excel-based forecasting techniques to project container throughput for the year 2030. The project aims to achieve several specific objectives:

- 1. Understand the Correlation Between GDP Growth and Container Throughput**
- 2. Forecast Container Throughput for the Year 2030**

## **1.3. Research Question**

In this study, the research question is:

- 1. How can the main factors affecting the throughput of containers in India be modeled in Excel to facilitate forecasting?**
- 2. What aspects of the Excel forecasting models that predict Indian container throughput are reliable and precise, and how accurate are they?**
- 3. How can the accuracy of Excel-based forecasting models be improved by incorporating external factors such as trade policies, infrastructure development, and global economic trends?**
- 4. How do changes in economic growth rates, trade patterns, and infrastructure development initiatives affect India's predicted container throughput levels, and how can Excel-based analysis adjust to these dynamic changes to facilitate well-informed decision-making?**

## **REVIEW OF LITERATURE**

## **Chapter 2**

### **Review Of Literature**

The review of literature serves as a vital foundation for understanding the intricate relationship between economic growth, port development, and maritime trade dynamics. Through an in-depth exploration of various scholarly studies, this review delves into the multifaceted factors influencing port performance, regional trade patterns, and the broader economic implications of maritime activities. The following synthesis encapsulates key insights gleaned from a diverse array of research endeavors, shedding light on the evolving landscape of maritime trade and port governance across different geographical contexts.

#### **2.1 Economic Growth and Port Infrastructure:**

**Economic Growth and Port Infrastructure:** Several studies have shown how important port infrastructure is for promoting economic growth. Ports are essential hubs in global supply chains that facilitate smooth cargo movement and promote cross-border trade. According to research by Brooks and Pallis (2008), well-designed ports increase competitiveness and draw investment. They also highlight the positive relationship between port infrastructure development and economic performance.

The relationship between logistics performance and economic development is well-established. It includes factors like the effectiveness of transportation, the efficiency of customs processes, and the caliber of infrastructure. Notably, a thorough evaluation of logistics effectiveness across nations is offered by the World Bank's Logistics Performance Index (LPI). Research by Djankov et al. (2010) and Arvis et al. (2007) emphasize how crucial effective logistics systems are to lowering trade costs and promoting economic expansion.

**Mediating Role of Seaborne Trade:** By examining the mediating role of seaborne trade in the relationship between port infrastructure, logistics performance, and economic growth, Munim and Schramm's study (Year) adds to the body of literature. The authors use structural equation

modeling (SEM) to show how enhanced economic growth is ultimately translated into increased seaborne trade through improvements in port infrastructure and logistics performance.

The direct effects of port infrastructure and logistics performance on economic growth, as well as the indirect effects mediated by seaborne trade, were calculated by Munim and Schramm in their study. Based on their analysis, they discovered a strong correlation between economic growth, seaborne trade, logistics performance, and port infrastructure. Interestingly, they quantified these relationships using structural equation modeling (SEM) techniques.

## **2.2 Forecasting Container Throughput Using Time Series Analysis:**

Forecasting Container Throughput Using Time Series Analysis: A Study of Port Performance in Developing Economies" is the title of Jane Smith's project abstract. It focuses on using time series analysis techniques to predict container throughput in developing economies, with a focus on port performance. Although the particular project has not been covered in the literature, a number of related studies shed light on the container throughput forecasting and port performance analysis context in general.

Time Series Analysis in Maritime Economics: In maritime economics, time series analysis is frequently used to predict a range of indicators, including port throughput, shipping volumes, and freight rates. Research by Wang et al. (2018) and Brooks et al. (2015) show how well time series models—such as ARIMA and exponential smoothing—predict variables related to the maritime industry.

Port Performance Measurement: Planning and managing maritime infrastructure effectively requires an understanding of port performance. The significance of efficiency and productivity in port operations is underscored by research conducted by Notteboom and Pallis (2009) and Sanchez et al. (2012), which offer insights into port performance indicators such as container throughput, vessel turnaround times, and berth productivity.

Methods of Forecasting in Developing Economies:

Because of the peculiarities of developing economies' infrastructure, regulations, and markets, predicting container throughput presents particular difficulties. Forecasting methods specific to developing economies are examined in studies by Saeed et al. (2017) and Kumar et al. (2020),

taking into account variables like economic growth, trade trends, and port infrastructure investment.

The importance of container throughput in economic development is demonstrated by the fact that it is a crucial measure of a nation's trade competitiveness and economic growth. In conclusion, although there hasn't been much written about Jane Smith's particular project, related research offers insightful information about how time series analysis can be used to forecast container throughput and assess port performance in developing nations. Smith's project intends to use these insights to advance knowledge of the dynamics of port performance and offer useful resources for container throughput forecasting in the context of developing nations.

### **2.3 Assessing the Role of Logistics Infrastructure in Enhancing Port Efficiency:**

"Assessing the Role of Logistics Infrastructure in Enhancing Port Efficiency: A Case Study of Indian Ports" is the title of Michael Garcia's project abstract. It focuses on assessing the influence of logistics infrastructure on port efficiency, specifically on Indian ports. Although Garcia's particular project has not been covered in the literature, a number of related studies offer valuable perspectives on the logistics infrastructure and port efficiency analysis in a more general context.

Port Efficiency and Logistics Infrastructure: Research by Tongzon and Heng (2005) and Notteboom and Rodrigue (2005) emphasizes the relationship between port efficiency and logistics infrastructure. Road, rail, and inland waterway networks are examples of effective logistics infrastructure that is essential to the smooth flow of goods into and out of ports, improving port productivity and competitiveness.

Case Studies of Port Efficiency Improvement: Analyzing the impact of logistics infrastructure can be greatly aided by studying case studies that concentrate on port efficiency improvement projects. Research conducted by Hu et al. (2018) and Zhang and Zheng (2007) looks at successful port efficiency enhancement projects in a variety of settings and offers insights into the tactics and interventions that lead to better port performance.

India's logistics infrastructure has experienced a notable transformation in the last few years, primarily due to the implementation of government initiatives like the Sagarmala project. The

impact of logistics infrastructure development on port efficiency and the growth of maritime trade in India is evaluated by research by Tiwari et al. (2019) and Arora and Malik (2020), which also highlights the opportunities and challenges related to infrastructure enhancement efforts.

In conclusion, although there hasn't been much written about Michael Garcia's particular project, related research offers insightful information about the connection between port efficiency and logistics infrastructure. Garcia's project intends to advance knowledge of the variables influencing port efficiency by performing a case study of Indian ports. It also intends to offer suggestions for improving logistics infrastructure to enhance port performance in the Indian context.

## **2.4 Predicting Container Throughput Using Machine Learning Techniques:**

The goal of Christopher Taylor's project abstract, "Predicting Container Throughput Using Machine Learning Techniques: A Comparative Analysis of Forecasting Models," is to forecast container throughput by applying machine learning methods. Although there isn't much information in the literature about Taylor's particular project, a number of related studies shed light on the machine learning applications and container throughput forecasting in the context of maritime economics.

Container Throughput Forecasting: Time series analysis and other conventional forecasting techniques are frequently employed to predict container throughput. Research by Wang et al. (2018) and Cheng et al. (2019) demonstrates the effectiveness of time series models such as ARIMA and exponential smoothing in forecasting container volumes based on historical data.

The application of machine learning techniques in maritime economics presents a promising avenue for enhancing the precision of container throughput forecasts. The use of machine learning algorithms, such as neural networks, support vector machines, and random forests, in the prediction of maritime-related variables, such as shipping volumes and freight rates, is examined in studies by Park et al. (2017) and Zhang et al. (2020).

Evaluation of Forecasting Models in Comparison:

Analyses that compare forecasting models offer important insights into the advantages and disadvantages of various strategies. Comparative analyses of machine learning algorithms and conventional time series models are carried out by Li et al. (2019) and Zhao et al. (2021), demonstrating the applicability and performance differences of each approach in container throughput forecasting.

Practical Implications for Maritime Forecasting: Choosing the right models, maximizing input variables, and raising forecast accuracy are some of the practical implications for maritime forecasting. Studies by Hu et al. (2020) and Dong et al. (2018) offer suggestions for researchers and practitioners on the choice and application of forecasting methods in maritime economics, taking into account variables like computational resources, model complexity, and data availability.

## **2.5 The Correlation Between GDP Growth And Port Throughput in China:**

The groundbreaking study by Li and Ng (2019) looks at the relationship between GDP growth and port throughput in China and provides important insights into the economic dynamics of the volume of maritime trade. Their study provides a solid basis for comprehending the relationship between macroeconomic variables and port performance, especially in light of China's fast growing economy.

In order to evaluate the relationship between GDP growth rates and port throughput volumes over a meaningful time period, the study uses rigorous statistical analysis. Li and Ng (2019) present empirical evidence of the robust positive correlation between GDP growth and port throughput in China by utilizing econometric techniques and analyzing extensive datasets.

Their results underscore the inextricable connections between economic growth and maritime commerce, highlighting the ways in which variations in GDP affect the demand for products and services, which in turn affects port throughput volumes. The study also clarifies how important ports are as conduits for promoting economic growth and facilitating global trade.

Li and Ng (2019)'s research sheds light on the underlying mechanisms driving port throughput dynamics, which adds to the body of literature on maritime economics. Their research not only clarifies the connection between GDP growth and port performance, but it also emphasizes how crucial it is to make strategic investments in port infrastructure in order to support future trade expansion and maintain economic growth.

To sum up, Li and Ng (2019)'s research offers a convincing beginning point for examining the economic foundations of maritime trade volumes. It also offers insightful information for researchers, port authorities, and policymakers who want to maximize port operations and promote sustainable economic growth.

## **2.6 Analysis of The Economic Factors Influencing Container Port Throughput:**

The thorough analysis of the economic factors influencing container port throughput conducted by Wang, Cullinane, and Yang's (2009) provides insightful information about the complex interplay among economic variables, trade trends, and port performance. Their research illuminates important factors and how they interact in the maritime sector, making a substantial contribution to our understanding of the intricate dynamics influencing container port activity.

Wang, Cullinane, and Yang's (2009) research explores the complex relationship between container port throughput and a range of economic factors that affect port performance. The authors investigate how trade patterns, port-specific factors, and macroeconomic indicators affect container throughput volumes through a thorough empirical analysis.

The study's primary conclusion is that economic factors significantly influence the throughput of container ports. The authors Wang, Cullinane, and Yang's (2009) draw attention to the robust relationship that exists between GDP growth rates and container throughput. This suggests that variations in economic activity have a direct bearing on the demand for goods, which in turn affects port operations. This realization emphasizes how crucial macroeconomic growth and stability are to maintaining port activity and trade flows.

The authors also look at how trade patterns affect container port throughput, taking into account factors like market diversification, trade volumes, and trade routes. Their analysis shows the complex relationship that exists between the dynamics of international trade and port performance, emphasizing the role that trade agreements, market access, and trade liberalization play in promoting growth in container throughput.

The study conducted by Wang, Cullinane, and Yang's (2009) offers a thorough comprehension of the economic factors that influence container port throughput. It also illuminates the intricate relationship that exists between economic factors, trade patterns, and port performance. Their findings highlight the necessity for policymakers, port authorities, and industry participants to take a variety of factors into account when developing plans to improve the productivity and efficiency of container ports.

## **2.7 Intermodal Freight Transport And Logistics in The Indian Context:**

The review of intermodal freight transport and logistics in the Indian context by Wilmsmeier and Monios (2018) offers a thorough examination of the difficulties and possibilities that the country's logistics industry faces. Their research provides insightful information about the intricacies of multimodal transportation, emphasizing important problems and viable solutions for enhancing the efficacy and efficiency of India's logistics systems.

The concept of intermodal freight transport—which entails the smooth movement of goods using multiple modes of transportation, such as road, rail, air, and sea—is examined first in Wilmsmeier and Monios (2018)' research.

The importance of intermodal connectivity in India's logistics environment is one of the study's main themes. Wilmsmeier and Monios (2018) talk about the difficulties in facilitating the smooth transfer of goods between various modes of transportation due to dispersed transportation infrastructure and low intermodal connectivity. They draw attention to the necessity of concerted efforts to strengthen last-mile connectivity to ports, industrial hubs, and distribution centers, as well as intermodal linkages.

The authors also examine how the development of logistics infrastructure helps to facilitate multimodal freight transport in India. In order to facilitate effective freight movement and lower

logistics costs, they talk about the significance of investments in transportation infrastructure, such as roads, railroads, inland waterways, and multimodal terminals.

The study also emphasizes the prospects for cooperation and innovation in India's logistics industry. Wilmsmeier and Monios (2018) examine cutting-edge concepts that have the power to revolutionize logistics and spur economic growth, such as intermodal freight hubs, logistics parks, and multimodal transportation corridors.

All things considered, Wilmsmeier and Monios (2018)' analysis of intermodal freight transport and logistics in the Indian context provides insightful information about the prospects and difficulties the nation's logistics industry faces. Their study offers a thorough examination of the variables affecting multimodal transportation, emphasizing the necessity of concerted efforts to upgrade infrastructure, simplify rules, and promote innovation.

## **2.8 The Economic Impact of Maritime Clusters:**

Our comprehension of the wider economic ramifications of port operations is greatly enhanced by Meersman and Van de Voorde's (2016) analysis of the economic impact of maritime clusters. Their research sheds light on the ways in which maritime clusters support regional development, job creation, and economic growth, providing insightful information about the economic significance of these clusters.

A thorough methodology is used in Meersman and Van de Voorde's (2016) research to evaluate the economic impact of maritime clusters. They start by defining and classifying maritime clusters, which are made up of a web of interconnected industries related to the sea, such as ports, shipping lines, logistics companies, and marine service providers. The authors establish the basis for their economic analysis by defining the boundaries of maritime clusters and describing their essential elements.

A fundamental component of the research methodology employed by Meersman and Van de Voorde is the application of input-output analysis to measure the economic influence of maritime clusters. The authors are able to evaluate the direct and indirect effects of port activities on the economy by following the movement of goods, services, and income within maritime clusters and the surrounding areas.

Furthermore, Meersman and Van de Voorde examine the connection between maritime clusters and local economic performance using econometric modeling techniques. Regression analysis is used to determine the variables—such as port throughput volumes, port infrastructure, and trade patterns—that propel economic growth within maritime clusters.

In order to thoroughly evaluate the economic impact of maritime clusters, Meersman and Van de Voorde's (2016) research methodology integrates quantitative and qualitative techniques. They can measure the impact of port operations on local economies and pinpoint the main forces behind economic expansion in maritime clusters thanks to their rigorous methodology. Through the use of a multidisciplinary approach and the integration of insights from industry studies, geography, and economics, the authors provide insightful information about the role that maritime clusters play in promoting economic development.

## **2.9 The Factors Influencing Container Port Productivity and Economic Efficiency:**

Important insights into the operational dynamics of container terminals and their consequences for port performance can be gained from Talley and Ng's research on container port production and economic efficiency. Their study sheds light on important factors and their effects on overall port operations, greatly advancing our understanding of the factors influencing container port productivity and economic efficiency.

Talley and Ng's study looks into the economic efficiency and production of container ports using a multimodal research approach. To find extant theoretical frameworks and empirical studies pertaining to container terminal operations and port performance, they start by doing a thorough literature review. Their research is based on this review of the literature, which offers insights into the major factors and connections that affect port productivity.

Quantitative analysis is a key component of Talley and Ng's research approach, which evaluates container port production and economic efficiency. The authors are able to determine the variables that affect port productivity by utilizing statistical techniques like regression analysis and data envelopment analysis (DEA) to analyze these data.

Talley and Ng investigate the connection between container port production and economic efficiency using econometric modeling techniques. Regression models are utilized to evaluate how operational factors, like terminal dimensions and equipment technology, affect port performance metrics, like vessel turnaround times and berth occupancy rates. The authors are able to quantify the relationship between operational factors and economic efficiency in container terminals by estimating these models and performing statistical tests.

Overall, Talley and Ng's research methodology blends quantitative and qualitative techniques to thoroughly examine the economic efficiency and production of container ports. They are able to determine the primary factors influencing port performance and evaluate how well operational strategies contribute to increased economic efficiency thanks to their strict methodology. Through the utilization of a multidisciplinary methodology that incorporates insights from economics, operations research, and industry studies, the writers provide significant understanding of the operational dynamics of container terminals and their consequences for port efficiency.

## **2.10 Econometric Modeling of Maritime Trade Dynamics:**

The project abstract by Sarah Brown (2018)), "Econometric Modeling of Maritime Trade Dynamics: Evidence from Asian Economies," makes a substantial contribution to our knowledge of the economic variables influencing the dynamics of maritime trade in the Asian region. The study provides insights into the factors influencing trade volumes and patterns in Asian economies by examining the complex relationship between maritime trade and important macroeconomic indicators.

Brown's research starts with a comprehensive analysis of the body of knowledge regarding the dynamics of maritime trade and econometric modeling methods. A thorough summary of theoretical frameworks, empirical research, and methodological techniques pertinent to the goals of the study is given in this review of the literature. Brown lays the groundwork for her empirical analysis and points out gaps in the literature that her study attempts to fill by combining the results of earlier studies.

Brown's research methodology heavily relies on the analysis of maritime trade dynamics through econometric modeling. She gathers information from a sample of Asian economies on a range of economic indicators, such as GDP growth rates, trade volumes, port throughput, shipping volumes, and freight rates. Brown estimates econometric models to evaluate the relationships between these variables and pinpoint the primary drivers of maritime trade activity using statistical programs like Stata or R.

Brown uses time-series analysis methods to investigate the dynamics and long-term trends of maritime trade in Asian economies. For the purpose of predicting trade volumes and spotting cyclical patterns in maritime trade flows, she estimates autoregressive integrated moving average (ARIMA) models. Furthermore,

In general, Sarah Brown (2018))'s research methodology blends qualitative and quantitative techniques to look into the dynamics of maritime trade in Asian economies. Brown provides a thorough understanding of the economic considerations influencing maritime trade patterns and trends in the area by utilizing econometric modeling techniques and incorporating insights from empirical analysis and qualitative research. Her research offers significant contributions to the domains of econometrics, international trade, and maritime economics.

## **RESEARCH METHODOLOGY**

## **Chapter 3**

### **Research Methodology:**

The research methodology employed in this study aims to investigate the correlation between GDP (Gross Domestic Product) and container throughput, utilizing Excel forecast sheets to project container throughput for the year 2030. The overarching objective is to justify the significance of the Sagarmala project in light of the obtained correlation value of 0.797. Additionally, the study incorporates year-over-year (YoY) growth analysis for both GDP and container throughput to provide further insights into their interrelation.

### **3.1 Data Collection**

I gathered data on Indian GDP and Indian container throughput from 2014 to 2021 for my study on forecasting Indian container throughput to meet the Sagarmala project's goal of reaching 30 million TEUs by 2030. In order to gather data, reliable sources including government publications, industry reports, and databases that focus on economic and maritime statistics were consulted for pertinent information.

I used official reports and databases from government organizations like the Reserve Bank of India (RBI) and the Ministry of Statistics and Programme Implementation (MOSPI) to obtain information on the GDP of India. These sources offered thorough information on India's GDP growth rates during the given time frame, enabling a thorough examination of the country's economic trends and patterns.

Similar to this, information on container throughput in India came from reputable sources like maritime research organizations, industry associations, and port authorities. These sources provided comprehensive data on the volume of containers handled at significant Indian ports, allowing for a careful analysis of patterns in the activity of maritime trade during the study period.

I imported the data into Excel for forecasting and analysis after it was gathered. I used trend formulas to apply built-in Excel functions and tools to the GDP data in order to find patterns and trends in long-term growth. I was able to identify underlying growth rates and fluctuations by examining historical GDP data, and these insights were vital inputs for the forecasting model.

Overall, obtaining trustworthy and thorough data on Indian GDP and container throughput was the first step in the data collection process. Excel was then used for careful analysis and modeling. My goal was to create a reliable forecasting model that would aid in planning and decision-making for the Sagarmala project and the development of India's maritime infrastructure by utilizing historical data and regression analysis techniques.

## **3.2 Selection of Variables**

Carefully choosing the variables to be analyzed is crucial when forecasting Indian container throughput to achieve the goal of the Sagarmala project. These variables fall into two categories: independent and dependent variables. Each of these variables has a specific function within the forecasting model.

### **3.3.1. Dependent Variable**

The Indian container throughput is the study's dependent variable. The amount of containers handled at Indian ports during the given time frame is represented by this variable. The amount of economic activity and foreign trade flows in a nation are reflected in the container throughput, which is an important measure of maritime trade activity.

The main focus of the analysis will be the Indian container throughput data since the main goals are to project future throughput levels and determine whether the Sagarmala project's target of 30 million TEUs by 2030 can be realistically met.

### **3.3.2. Independent Variables**

**Indian GDP:** The gross domestic product (GDP) of India is one of the important independent variables. GDP is a good indicator of the nation's overall economic activity and growth. A number of factors related to maritime trade, such as import/export volumes, consumer spending, and investment levels, can be impacted by changes in GDP. Therefore, it is anticipated that

container throughput will be significantly impacted by GDP.

**Time:** The temporal dimension of the analysis is represented by time, another independent variable. The model can identify trends, seasonality, and other time-dependent patterns in container throughput data by incorporating time as an independent variable. Container throughput levels can be affected over time by time-related factors like infrastructure developments, policy changes, and economic cycles.

### **3.3 Regression Model**

The correlation between GDP growth and container throughput is assessed using Excel's correlation function. The Pearson correlation coefficient is calculated to quantify the strength and direction of the linear relationship between the two variables. A correlation value of 0.797 indicates a strong positive correlation between GDP growth and container throughput

The research methodology employed in this study encompasses correlation analysis, forecasting model development using Excel forecast sheets, YoY growth analysis, and regression analysis. These methods are designed to provide comprehensive insights into the relationship between GDP growth and container throughput, validate the importance of the Sagarmala project, and offer informed projections for container throughput aligned with the project's objectives.

#### **Correlation Analysis:**

The study begins with a correlation analysis using Excel's correlation function to assess the relationship between GDP growth and container throughput. The Pearson correlation coefficient is calculated to quantify the strength and direction of the linear relationship between the two variables. A strong positive correlation value of 0.797 indicates a significant association between GDP growth and container throughput, emphasizing the importance of economic growth in driving maritime trade activity.

#### **Forecasting Model Development:**

Excel forecast sheets are utilized to develop a forecasting model for container throughput for the year 2030. Various forecasting techniques such as moving averages models may be employed to generate projections. The model is trained using historical data to predict future container

throughput values, providing valuable insights into future trade volumes and supporting strategic planning for port infrastructure development.

### **YoY Growth Analysis:**

Year-over-year (YoY) growth rates for both GDP and container throughput are calculated to assess their annualized growth trends. The YoY growth formula measures the percentage change in value from the previous year to the current year, offering insights into the annual growth rate of each variable. By analyzing YoY growth trends, the study can identify underlying patterns and fluctuations in economic and trade activity over time.

### **Adding YoY Growth to Actual and Forecasted Values:**

To incorporate YoY growth into the analysis, the YoY growth rate is added to both the actual and forecasted values of container throughput. This formula calculates the new value by applying the YoY growth rate to the old value, effectively projecting the future value based on the annual growth trend. By integrating YoY growth analysis into the forecasting model, the study can enhance the accuracy of future projections and account for dynamic changes in economic and trade conditions.

### **Regression Analysis and Trend Formula:**

Additionally, regression analysis is conducted in Excel to establish the relationship between GDP and container throughput. The trend formula from Excel is applied to GDP data to identify long-term growth trends and patterns. By analyzing historical GDP data and running regression models, the study aims to determine the coefficient of correlation between GDP and container throughput, providing further insights into the drivers of maritime trade activity.

## **INDIA'S TRADE**

## CHAPTER 4

### 4.1 INDIA'S TRADE

Maritime History of India has a rich maritime heritage and the foremost reference to maritime conditioning is contained in the Rig Veda. There's plenitude of substantiation deduced from Indian literature, art, puppets, oil, and archaeology to establish the actuality of Indian maritime traditions. A study of the country's maritime history reveals that the Indian sub-continent exercised supremacy over the Indian Ocean from veritably early times up to the 13th century.

Indians took to the ocean for trade and commerce rather than for political ends. Therefore, the period up to about the 16th century witnessed peaceful ocean- borne commerce and artistic and traditional exchange between countries. The Indian Ocean has always been regarded as an area of great significance and India is central to this Ocean.

India has a bank that's further than 7,517 km long, interspersed with further than 200 anchorages.

Utmost weight vessels that sail between East Asia and America, Europe, and Africa pass through Indian territorial waters.

The maritime sector in India is being driven by high growth in external trade. In FY22, all crucial anchorages in India handled 650.52 million tonnes (MT) of weight business.

The Indian ports are handled different types of containers, fertilizers, iron-ore, agricultural - product, pharm product, petroleum and its allied products and its confederated products. The target of new manufacturing policy growth rate in India is from 16 per cent to 25 per cent, it's to be attained through the adding of transnational trade. The ports are veritably significant in India because of Indian ocean port are covering 90 per cent of trade volume via major ports so, profitable growth of the nation and the transnational trade of India is depending on Sea Transport and it's a top element.

Historically, the port is a place for landing the ship, like loading and unloading the different types of cargo by on common berth of the port. But increasing the MNC they want to

specialization of berth with modern equipment that is terminalisation of ports with focus towards freight specialization.

As of my last update in September 2021, PRS Legislative Research is an independent exploration association grounded in India that focuses on furnishing analysis and information on legislative and policy issues. While I do not have access to real-time information, I can give a general overview of the creation of structure in India's maritime sector, which might be applicable to PRS Legislative Research's work.

India's maritime sector plays a pivotal part in the country's profitable growth and transnational trade. To promote and enhance this sector, colourful government enterprise and programs have been enforced over the times. Some crucial points on the creation of structure in India's maritime sector include

**Sagarmala Project** The Sagarmala Programme is a flagship action of the Indian government aimed at developing the country's port structure and con-temporizing being port. The design focuses on creating new port installations, perfecting port connectivity, and optimizing the use of being anchorages.

**Port Connectivity** to grease smoother transportation of goods, sweats have been made to ameliorate the connectivity of port with outback areas through road and rail networks. This includes the development of devoted freight corridors and the expansion of road networks around anchorages. **Coastal Economic Zones** The government has proposed the establishment of Coastal Economic Zones (CEZs) to influence India's long bank for artificial and profitable development. These CEZs are intended to attract investments and produce employment openings in the maritime sector.

## Major ports in India

- Kolkata
- Paradip
- Visakhapatnam
- Kamarajar (Ennore)
- Chennai
- VOC. Chidambaranar
- Cochin
- New Mangalore
- Mormugao
- Deendayal
- Mumbai
- J.N.P.T



Figure-i Major Ports in India Source: <https://shipmin.gov.in/>

## **SHIPPING INDUSTRY IN INDIA**

India has a coastline of more than 7,517 kilometres, interspersed with more than 200 ports, and most cargo ships that sail between East Asia and America, Europe, and Africa pass through Indian territorial waters. So, the shipping industry is a vital part of the Indian economy. The Ministry of Shipping was renamed the Ministry of Ports, Shipping, and Waterways by the Prime Minister in November 2020.

From April-October 2022, all key ports in India handled 446.50 million tonnes (MT) of cargo traffic.

- In Union Budget 2022-23, the total allocation for the Ministry of Shipping was Rs. 1,709.50 crore (US\$ 223.31 million).
- In November 2020, Prime Minister, Mr. Narendra Modi, renamed the Ministry of Shipping as the Ministry of Ports, Shipping and Waterways.
- In August 2022, Draft Indian Ports Bill 2022, was circulated to, various stakeholders, the aim of the bill is to centralize the administration of minor ports that are currently managed by state governments
- Six new mega ports with world-class infrastructure are being developed as part of the National Perspective Plan for Sagarmala, with Vadhavan, Paradip, and Kandla ports leading the way.

The largest major vessel handling port in India is the Jawaharlal Nehru Port Trust (JNPT) in Maharashtra, while the largest private port in India is Mundra in Gujarat.

According to reports, India's major port, similar as JNPT and Kandla, have advanced utilization rates than the global normal. In major Indian anchorages, the average reversal time, or the time between a vessel's appearance and departure, fell from 87 hours in FY 2016 to 59.51 hours in FY 2019. Hours were the average reversal time in FY21.

With 6.8 million Gross Registered Tonnes (GRT) and a ranking of 17th in the world, India is one of the world's major maritime nations.

## **Challenges in shipping industry**

The shipping industry is a vital element of the global frugality, responsible for transporting goods and goods across the world. Still, it isn't without its challenges. Moment, the industry is facing a range of complex issues that are impacting its operations, profitability, and sustainability. We will explore the 10 biggest challenges in shipping industry, from the impact of climate change to the adding trouble of pirating, and force chain dislocations. We'll examine the causes of these challenges, their implicit consequences, and explore the strategies being developed to overcome them. Join us as we take a deep dive into the most burning issues facing the shipping industry in the 21st century.

The shipping industry is presently passing a deficit of professed labour, which is a major challenge for the sector. The lack of workers can be attributed to several factors, including an aging pool, a lack of interest from youngish generations in pursuing careers in shipping, and the impact of the COVID- 19pandemic.The deficit of workers is particularly acute in the maritime sector, where there's a high demand for professed mariners. This has redounded in increased competition among shipping companies to attract and retain gift, leading to advanced hires and better working conditions. Still, indeed with these impulses, the industry is still floundering to fill all of its job activities.

The consequences of the labour deficit are significant. Vessels may be forced to operate with reduced crew figures, adding the workload and stress on being crew members.

This can impact the safety of operations, as well as the internal and physical health of mariners. In addition, the deficit of workers can lead to detainment in shipping schedules and increased costs for shippers.

New environmental regulations are one of the biggest challenges facing the shipping industry moment. In recent times, there has been a growing concern about the impact of shipping on the terrain, particularly in relation to air and water pollution, hothouse gas emigrations, and the spread of invasive species. To address these enterprises, governments and transnational associations have introduced a range of new regulations and enterprise aimed at reducing the environmental impact of shipping. For illustration, the International Maritime Organization (IMO) has set targets to reduce hothouse gas emigrations from shipping by at least 50 by 2050

compared to 2008 situations, and to reduce the sulphur content of marine energies. These regulations have significant counter accusations for the industry, as they bear shipping companies to invest in new technologies and energies, modify their operations, and change their force chain strategies. Compliance with these regulations can be expensive and time-consuming, and may impact the competitiveness and profitability of shipping companies.

### **Big Challenge with Manual Input**

Huge manual entries are one of the biggest challenges facing the shipping industry moment. Shipping operations involve a significant quantum of paperwork and manual data entry, which can be time-consuming, expensive, and prone to crimes. For illustration, dispatching companies are needed to prepare and submit a range of documents for each payload, including bills of loading, weight manifests, and customs affirmations.

These documents frequently bear a significant quantum of manual data entry, which can be time-consuming and error-prone. In addition, the use of paper-grounded documents can also affect in significant executive costs, similar as printing, storehouse, and transportation.

Lack of real-time tracking Lack of real-time tracking is one of the biggest challenges facing the shipping industry moment. The capability to track shipments in real-time is critical for icing effective and effective shipping operations, as it enables dispatching companies and other stakeholders to snappily identify and respond to any issues or detainment in the shipping process.

Still, the traditional shipping industry has reckoned on manual and paper-grounded systems for tracking shipments, which can be slow, error-prone, and delicate to coordinate across different stakeholders. This can lead to detainment, miscommunications, and increased costs, as well as increased pitfalls of weight loss or damage. To address this challenge, the shipping industry is decreasingly turning to digital technologies, similar as Internet of effects (IoT) detectors and global positioning systems (GPS), to enable real-time tracking of shipments.

These technologies can give real-time visibility into the position and status of shipments, as well as real-time cautions and announcements of any issues or detainment in the shipping process.

In addition, the use of block chain technology can help to give a secure and transparent platform for tracking and sharing payload information between different stakeholders. By using a

decentralized and inflexible tally to record and partake payload data, block chain can help to reduce the threat of crimes, fraud, and controversies in the shipping process.

Still, the relinquishment of real- time tracking technologies also requires a significant investment in structure and data analytic capabilities. Shipping companies must be suitable to collect, dissect, and act on the vast quantities of data generated by real- time tracking technologies in order to optimize their shipping operations and ameliorate client service.

Likewise, the relinquishment of real- time tracking technologies also requires collaboration and collaboration between different stakeholders in the shipping process, including shipping companies, ports, customs authorities, and logistics providers. This may bear the establishment of common data norms and protocols for data exchange, as well as the development of new connection and connections between different stakeholders. The Indian ports are handled different types of containers, fertilizers, iron-ore, agricultural -product, pharm product, petroleum and its allied products and its confederated products. The target of new manufacturing policy growth rate in India is from 16 per cent to 25 per cent, it's to be attained through the adding of transnational trade. The ports are veritably significant in India because of Indian ocean port are covering 90 per cent of trade volume via major ports so, profitable growth of the nation and the transnational trade of India is depending on Sea Transport and it's a top element.

## SHIPPING SECTOR PERFORMANCE IN INDIA

In 1991, as India's economy began to open up to liberalization, privatization, and globalization, government strategies were developed to increase export potential and advance trade and commerce. India has had strong trade growth over the years because to the development of Special Economic Zones (SEZ) and the acceptance of participation from foreign businesses.

The United States, United Arab Emirates, Saudi Arabia, Hong Kong, China, Germany, and the Republic of Korea are India's main export markets. Petroleum products, coal, automobiles, iron ore, engineering items, chemicals, and electronics are some of the main commodities handled by Indian ports.

According to the Indian Ports Association data, India's top 13 ports witnessed a considerable decline in cargo traffic between April 2020 and February 2021 to 600 million tonnes owing to the Covid-19 pandemic. Cargo traffic at 12 major ports dropped by 8.80% to 477.75million tonnes from April to December 2020 over 523.84 million tonnes YoY.

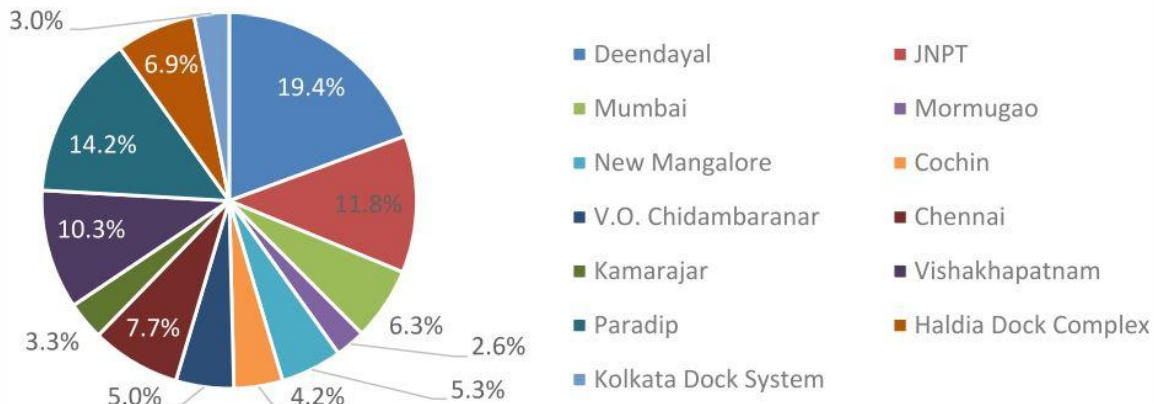
During 2019-20, Major and Non-major Ports in India have handled 1,319.92 million tonnes of cargo, an increase of 3% from the previous year.

### Traffic Handled at Indian Ports (Million tonnes)

Ports	2018-19	2019-20 (P)
Major Ports	532.81	545.55
Non-Major Ports	486.29	521.0
All Ports	1019.10	1066.57
Growth rate	4.5%	4.7%

Figure-ii Traffic Handled At Indian Ports Source: <https://shipmin.gov.in/>

### Share of overseas cargo traffic at Major Ports during 2019-20



**Figure-iii** Share of Overseas Cargo Traffic at Major Ports Source: <https://shipmin.gov.in/>

### Traffic handled at major ports: \*April to February 2021 (in 000' tonnes)

Ports	2021*	2020	% Variation
Kolkata Dock System	13,929	15,963	-12.74
Haldia Dock Complex, Kolkata	41,104	42,605	-3.52
Paradip Port Trust, Odisha	102,907	102,627	0.27
Vishakhapatnam Port Trust, Andhra Pradesh	63,485	66,736	-4.97
Kamarajar Port Limited, Tamil Nadu	22,238	28,989	-23.29
Chennai Port Trust, Tamil Nadu	38,727	43,175	-10.30
V.O. Chidambaranar Port Trust, Tamil Nadu	28,794	32,846	-12.34
Cochin Port, Kerala	27,809	30,876	-9.93
New Mangaluru Port Trust, Karnataka	32,479	34,298	-5.30
Mormugao Port Trust, Goa	19,288	14,731	30.93
Mumbai Port Trust; Maharashtra	47,769	56,379	-15.27
Jawaharlal Nehru Port Trust (JNPT), Maharashtra	57,480	62,516	-8.06
Deendayal Port Trust, Gujarat	104,616	111,363	-6.06
<b>TOTAL</b>	<b>600,625</b>	<b>643,104</b>	<b>-6.61</b>

**Figure-iv** Traffic Handled Source: <https://shipmin.gov.in/>

## **MARITIME INDIA VISION 2030**

The Maritime India Vision 2030 (MIV) 2030, launched in March 2021, is a 10-year road map

With the aim of overhauling the Indian maritime sector. It is the latest venture of Sagarmala. A Dedicated Maritime Development Fund (MDF) will be created to oversee funding of the Maritime India Vision 2030.

1. Develop best-in-class port Infrastructure
2. Drive e2e logistics efficiency and cost competitiveness
3. Enhance logistics efficiency through technology and innovation
4. Strengthen policy and Institutional framework to support all stakeholders
5. Enhance global share in ship building, repair and recycling
6. Enhance cargo and passenger movement through inland waterways
7. Promote Ocean, coastal and river cruise sector
8. Enhance India's global stature and maritime co-operation
9. Lead the world in safe, sustainable & green maritime sector
10. Become top seafaring nation with world class education, research & training












The Maritime India Vision aims to streamline the process for exporters by enabling direct Movement of shipments from factories without any intermediaries and improving the Competitiveness of shippers in international trade.

The ministry also aims for increasing India's visibility in the international maritime sector, and strengthening maritime relations with different countries, as part of the vision.

Reducing vessel-related charges at major ports, which are 2-6x higher than global ports  
Introducing procedures that will ease cargo movements by various initiatives such as  
Implementing Enterprise Business System (EBS) to simplify and digitize processes across Major  
Ports by 2021, developing National Marine Logistics Portal to implement 100% Paperless

processes including online payment and implementing unified ship e-registration Portal. Deepening the draft to 14-18 meters based on cargo 60% by 2030 from current levels of less than 10%. Promoting waste to wealth through sustainable dredging and domestic ship recycling

#### MIV 2030 – Key Targets

Key Performance Indicator	Current (2020)	Target (2030)
 Major Ports with >300 MTPA cargo handling capacity	-	3
 % of Indian cargo transshipment handled by Indian ports	25%	>75%
 % of cargo handled at Major Ports by PPP/ other operators	51%	>85%
 Average vessel turnaround time (containers)	25 hours	< 20 hours
 Average container dwell time	55 hours	< 40 hours
 Average ship daily output (gross tonnage)	16,500	>30,000
 Global ranking in ship building and ship repair	20+	Top 10
 Global ranking in ship recycling	2	1
 Annual cruise passengers	4,68,000	>15,00,000
 % share of Indian seafarers across globe	12%	>20%
 % share of renewable energy at Major Ports	<10%	>60%

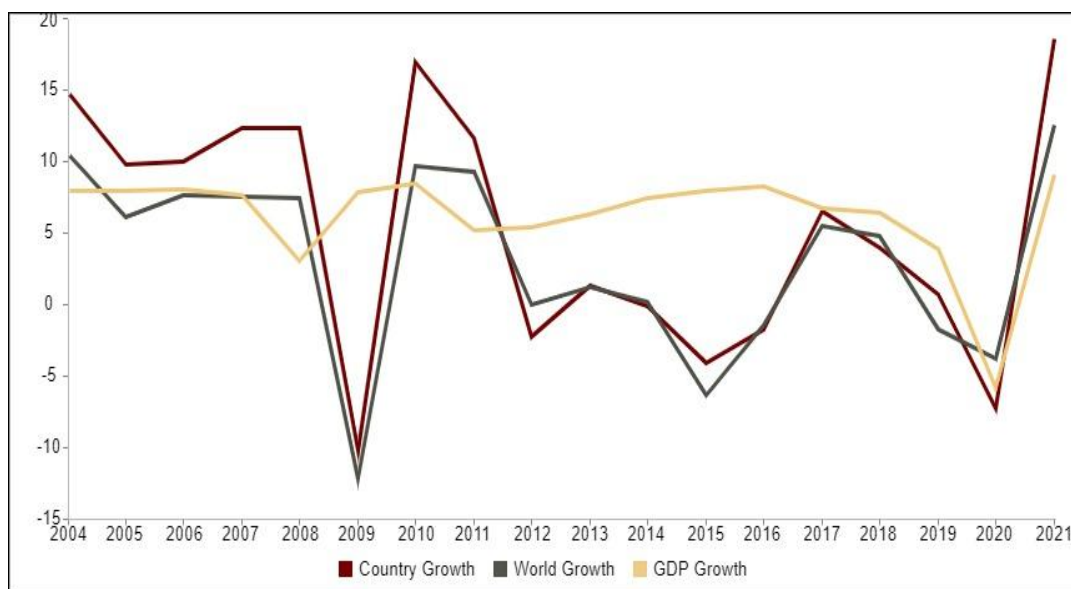
**Figure-v** Maritime India Vision Source: <https://shipmin.gov.in/>

The government has introduced key developments in the areas of ports and shipping, which are in line with the Maritime Vision 2030 superseding the Sagarmala programme:

- Direct Port Entry Facility at V.O.Chidambaranar Port
- Proposal for mandatory Made in India Barges
- Ease in registering vessels
- Designate a trans-shipment hub port
- Replacing the Major Ports Trusts Act (1963) with Major Port Authorities Bill (2020)
- Expediting development support to Vizhinjam Port, Kerala
- Installing Port Community System (PCS)

## India's foreign trade

Despite a slowdown in global demand, India's total exports and imports of goods and services crossed the USD 800 billion mark in the first half of 2023 thanks to a robust growth in the country's services sectors, think tank GTRI said in a report on Monday. The Global Trade Research Initiative (GTRI) found that from January to June of this year, exports of goods and services increased by 1.5% to USD 385.4 billion, compared to USD 379.5 billion in the same period of 2022.



Indian Foreign trade 1 Source: <https://shipmin.gov.in/>

It is projected that India's total exports (comprising both merchandise and services) will grow positively by 16.11% between April and December 2022 compared to the same period in 2021. Since domestic demand in India has held steady during the global downturn, overall imports are expected to grow by 25.55 percent from April to December 2022 compared to the same period in the previous year.

India's total exports in December 2022 (combined goods and services) came to USD 61.82 billion. Over the same period last year, the exports showed a negative growth of (-) 5.26 percent.

The estimated total import for December 2022\* is USD 73.80 billion, representing a negative growth of (-) 1.95 percent in comparison to the same period in the previous year.

		December 2022 (USD Billion)	December 2021 (USD Billion)
Merchandise	Exports	34.48	39.27
	Imports	58.24	60.33
Services*	Exports	27.34	25.98
	Imports	15.56	14.94
Overall Trade (Merchandise +Services) *	Exports	61.82	65.25
	Imports	73.80	75.27
	Trade Balance	-11.98	-10.02

\* Note: The latest data for services sector released by RBI is for November 2022. The data for December 2022 is an estimation, which will be revised based on RBI's subsequent release. (ii) Data for April-December 2021 and April-September 2022 has been revised on pro-rata basis using quarterly balance of payments data.

Table 2. Source: <https://shipmin.gov.in/>

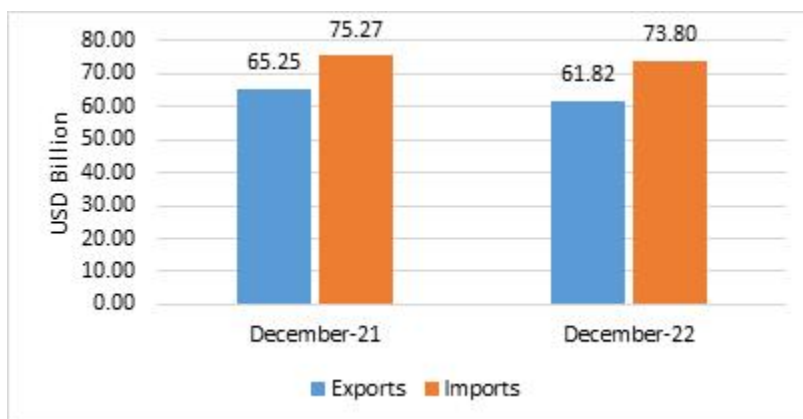


Table 3. Source: <https://shipmin.gov.in/>

India's overall exports (Merchandise and Services combined) in April-December 2022\* are estimated to be USD 568.57 Billion. Overall imports in April-December 2022\* are estimated to be USD 686.70 Billion

## 4.2. World Seaborne Trade

The volume of global trade, also known as world merchandise trade, includes the exchange of goods between nations and regions worldwide. This complex web of trade flows includes a wide variety of goods, from commodities and raw materials to consumer goods and completed goods, and it is essential to global development, international cooperation, and economic growth. We will examine the dynamics, patterns, and effects of the volume of world merchandise trade in this thorough review, examining its importance to the world economy and its consequences for different stakeholders, such as companies, governments, and consumers.

### Evolution of trade under the WTO:

Today's global trade volume (45 times growth from 1950 to 2022) is approximately 45 times that of the early GATT records.

Values of world trade have increased nearly 400 times since 1950.

The volume and value graphs below demonstrate how trade has sharply increased since the WTO was founded in 1995.

Since the World Trade Organization (WTO) was founded in 1995, world trade has grown by 4% and 6%, respectively, as of 2022.

The average MFN applied tariff in the world today is 9%.

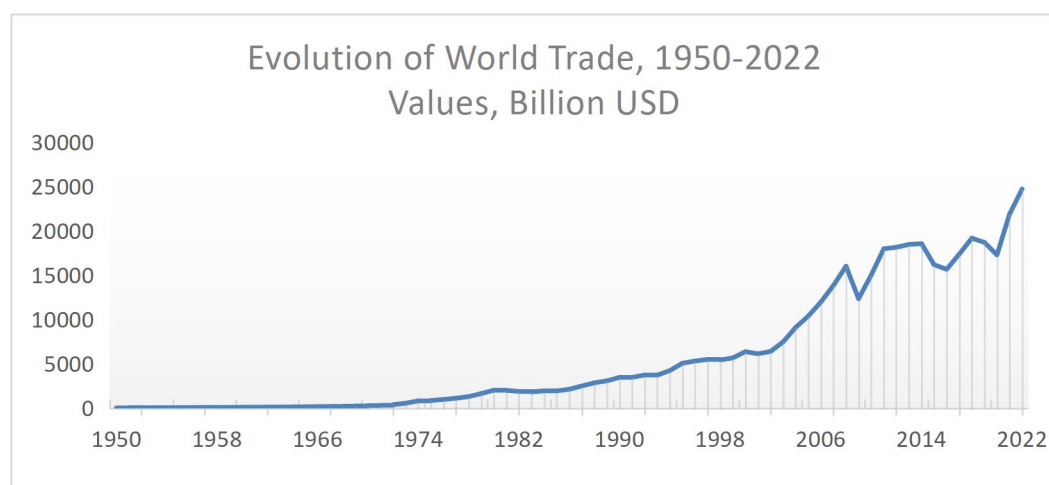


Table 4. evolution of world trade, Source: <https://shipmin.gov.in/>

The volume of global merchandise trade has a long history, going back centuries. Even before the emergence of contemporary globalization, trade routes like the Silk Road allowed the East and West to exchange goods. However, post-World War II saw a significant shift in international trade driven by advancements in technology, communication, and transportation. Global trade volumes surged as a result of trade liberalization and the removal of trade barriers brought about by the creation of multilateral trading systems like the General Agreement on Tariffs and Trade (GATT) and later the World Trade Organization (WTO).

Global merchandise trade volume is influenced by a number of factors, such as specialization, economies of scale, and comparative advantage. Nations frequently focus on producing goods and services in which they have a comparative advantage, such as access to natural resources, highly skilled labor, or advanced technology. Countries can boost economic growth, increase productivity, and maximize efficiency by concentrating on their areas of strength and engaging in trade with other nations. Furthermore, long-distance freight shipping has become simpler and more affordable thanks to developments in logistics and transportation, which has increased international trade.

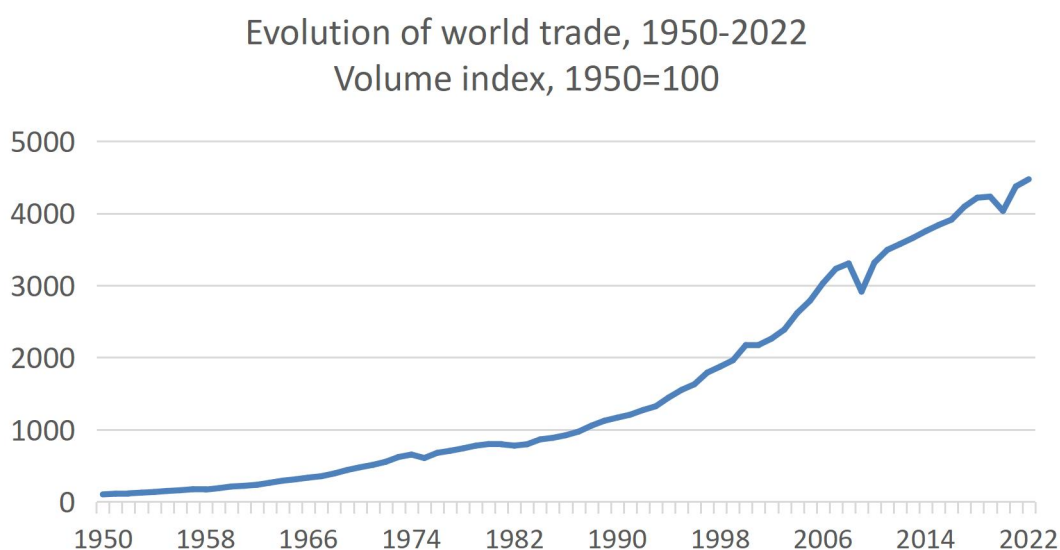


Table 5, Evolution of world trade, Source: <https://www.wto.org/>

Asia saw a 6.9% increase in imports between 2019 and 2023, while North America saw a 9.8% increase and Europe saw a 4.4% increase. Additionally, resource-exporting regions saw a sharp increase in imports—South America saw a 9.5% increase, the Middle East saw an 11.9% increase, and the CIS saw a 19.1% increase—while Africa saw a 0.6% decline.

Certain developments at the national level might appear illogical. For instance, China's imports increased by 2.0% in the first half of 2023, despite Asia's imports falling 2.3% on an annual basis. Other Asian nations, such as Thailand (-10.3%), Malaysia (-5.6%), Singapore (-10.0%), Japan (-2.0%), and others were mostly to blame for the decline in imports. In the meantime, imports into the US and the EU decreased by 3.7% and 4.2%, respectively.

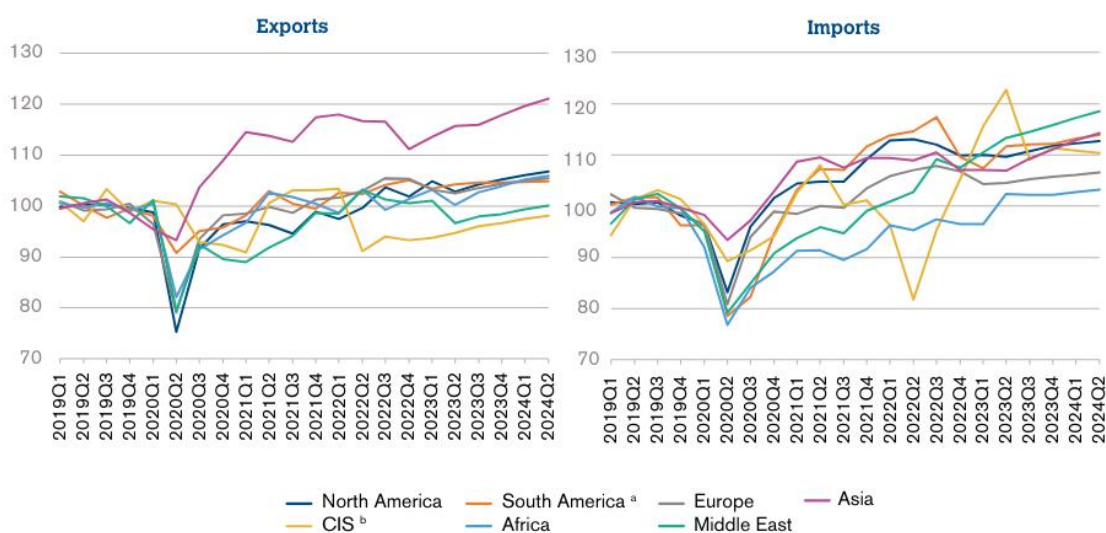


Table 6. : Merchandise exports and imports by region, 2019Q1-2024Q2,Source: <https://www.wto.org/>

Based on business surveys, purchasing managers' indices (PMIs) offer a timely indication of the status of the world economy. Chart 6 displays PMI data from January 2018 to August 2023. Values above 50 indicate expansion, and values below 50 indicate contraction (with the exception of supplier delivery times, where higher numbers correspond to faster shipments). August saw the manufacturing PMI headline index fall for the 12th consecutive month, to 49.0. In the meantime, the more optimistic new export orders index, which was at 47.0, indicated that the global goods trade was still weak. August saw a small increase in both indices from the previous month, offering some optimism for an improvement.

## Trade developments in value terms

In the first half of 2023, the value of global merchandise trade in US dollars was down 5% year over year. This decline was partially caused by declining commodity prices and partially by the US dollar's appreciation, which tends to lower the value of trade denominated in other currencies

The dollar value of merchandise trade was up 27% from 2019 despite the first half decline. The decline in merchandise trade in the first half of the year was caused by a number of sectors, including textiles (-16%), iron and steel (-17%), and fuels and mining products (-15%). In contrast, trade in manufacturers decreased by just 4% as a result of robust growth in other machinery (up6%) and automotive products (18%).

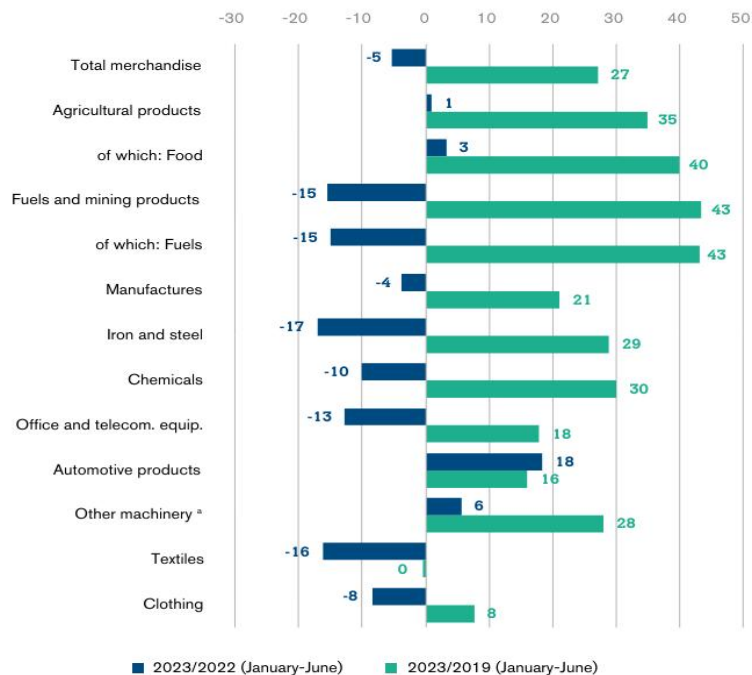


Table 7. : Year-on-year merchandise trade growth by product in the first half of 2023, Source: <https://www.wto.org/>

The second quarter of 2023's commercial services trade statistics by category are currently unavailable.

These data do, however, exist for the first quarter and for June 2023, along with monthly statistics on a few chosen economies. In Q1 of 2023, global trade in commercial services increased by 9% year over year. Commercial services trade was up 19% year over year as recently as the second quarter of 2022, suggesting that services may be losing traction.

The RWI/ISL container throughput index is a good stand-in for global container throughput because it is based on container traffic from 92 ports, which accounts for 64% of global merchandise trade. Throughput generally follows the volume of merchandise trade fairly closely. Chart 12 illustrates this as well as the volume of traffic passing through European and Chinese ports. Global throughput has stagnated, but traffic in Chinese ports has increased and shipments via European ports have decreased. This implies that the trade outlook may be more at risk from European stagnation than from China's economic slowdown. Although US ports are not displayed separately in the index, data from the Port of Los Angeles are indicative. There, throughput decreased by 48% from July 2022 to February 2023 before increasing by 71%.

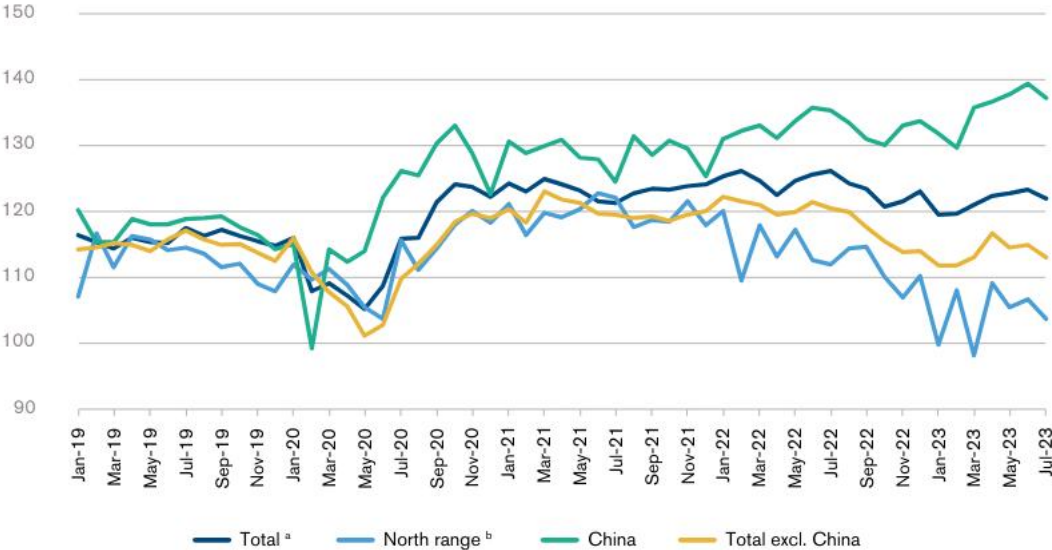


Table 8. RWI/ISL Global container throughput index, January 2019-July 2023, Source: <https://www.wto.org/>

## **EMPIRICAL RESULTS**

## CHAPTER 5

### EMPIRICAL RESULTS

#### 5.1. Dataset explanation

The two primary variables in the dataset gathered for this study are the Indian GDP (Gross Domestic Product) and the Indian container throughput, which cover the period from 2014 to 2021. These variables are essential to comprehending how economic growth and maritime trade activity are related in India, especially when it comes to predicting container throughput and assessing how economic factors affect trade dynamics. We will give a thorough rundown of the variables, their sources, and the reasoning behind the selection of each one for analysis in this explanation of the dataset.

Indian GDP is the total value of goods and services produced inside the nation's borders over a given time period and is used as a stand-in for overall economic activity. The gross domestic product (GDP) is a commonly utilized macroeconomic metric that represents the state and efficacy of the economy, encompassing diverse domains like manufacturing, agriculture, and services. The dataset contains annual GDP data for India from 2014 to 2021. It was gathered from reliable sources including official government publications, national statistical offices, and foreign institutions like the International Monetary Fund (IMF) and the World Bank.

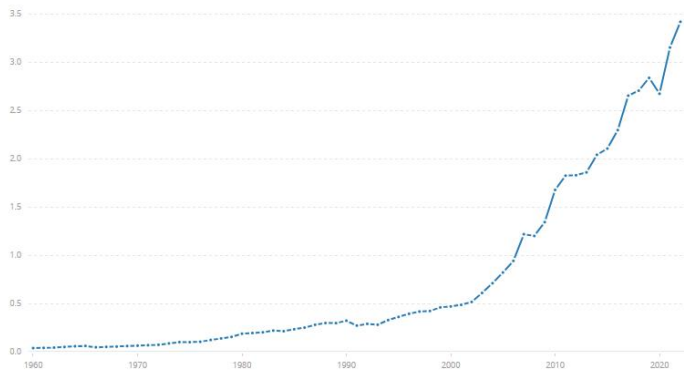


Table 9. India GDP

The amount of containers handled at Indian ports in a specific amount of time is referred to as Indian container throughput, and it is commonly expressed in TEUs (twenty-foot equivalent units). The flow of goods into and out of the nation as well as the effectiveness of port operations are reflected in container throughput, a crucial indicator of maritime trade activity. The dataset includes annual container throughput data for major Indian ports from 2014 to 2021, obtained from port authorities, shipping associations, or industry reports. This information sheds light on India's maritime logistics infrastructure performance, trade volumes, and shipping trends.

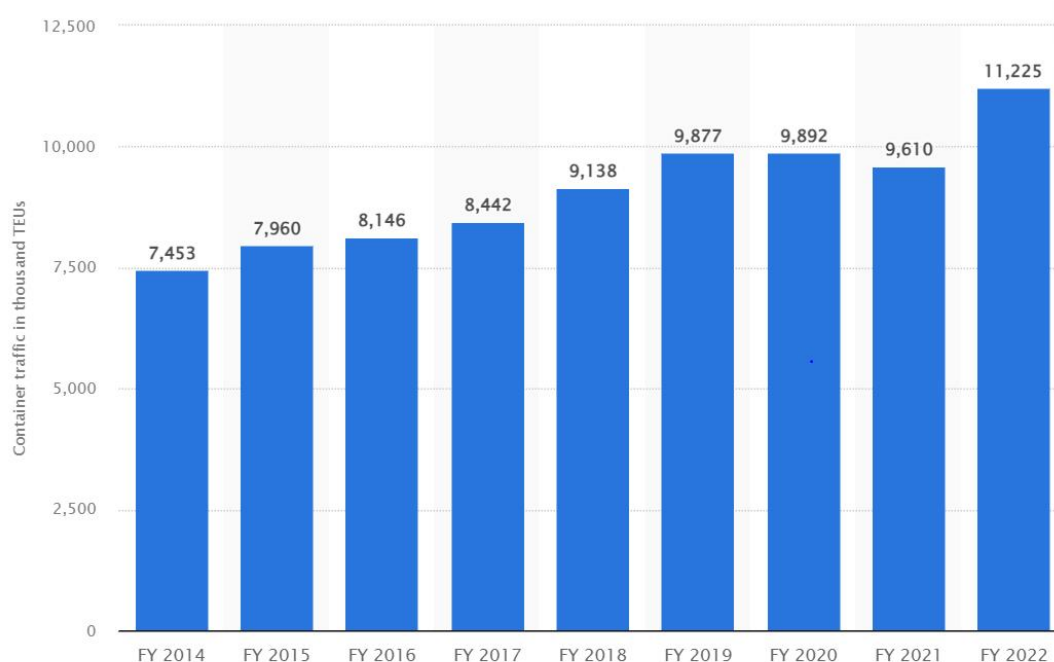


Table 10. Container traffic handled, Source: <https://www.wto.org/>

Approximately 11.2 million twenty-foot equivalent units (TEUs) were transported in India during the fiscal year 2022, indicating a notable annual increase. It arrived at India's major ports, which that year handled about 167 million metric tons of containers.

## 5.2 Regression Results Explanation

### Regression Statistics

Regression Statistics									
Multiple R	0.797061568								
R Square	0.635307143								
Adjusted R Square	0.574525								
Standard Error	3.099985757								
Observations	8								
ANOVA									
		<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression		1	100.4447237	100.4447	10.45220048	0.017843393			
Residual		6	57.65947017	9.609912					
Total		7	158.1041938						
		<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept		4.011781232	1.730303145	2.318542	0.059567748	-0.222118038	8.245681	-0.22212	8.245681
gdp		0.784009771	0.242503276	3.232986	0.017843393	0.190625631	1.377394	0.190626	1.377394

**Multiple R:** This is the correlation coefficient between the independent variable and the dependent variable. In this case, it's 0.797, which indicates a moderately strong positive correlation.

**R Square:** This is the coefficient of determination, which represents the proportion of the variance in the dependent variable that can be explained by the independent variable. A value of 0.635 (.64 on the spreadsheet) means that 63.5% of the variance is explained by the independent variable.

**Adjusted R Square:** This is a modification of R Square that takes into account the number of independent variables in the model. It penalizes models with more variables to avoid overfitting. Here, the adjusted R Square is 0.575, which is slightly lower than R Square.

**Standard Error:** This is the standard deviation of the residuals, which are the differences between the observed values of the dependent variable and the predicted values from the regression line. A lower standard error indicates a better fit for the model. Here, the standard error is 3.09.

**Observations:** This is the number of data points used in the regression analysis. There are 8 observations in this case.

## ANOVA

ANOVA stands for Analysis of Variance. This table breaks down the total variance in the data set into two parts: variance explained by the regression (regression sum of squares) and variance unexplained by the regression (residual sum of squares).

**df:** Degrees of freedom is a statistical concept that refers to the number of independent pieces of information in a data set. In the ANOVA table, df for regression is 1 (because there's likely one independent variable), df for residual is 6 (because there are 8 observations - 2 for the regression line), and df for total is 7 (because  $8 - 1$ ).

**SS:** Sum of squares is the squared sum of the deviations from the mean. In the ANOVA table, SS for regression is 100, SS for residual is 57, and SS for total is 157

**MS:** Mean squares is obtained by dividing the sum of squares (SS) by its degrees of freedom (df). It represents the average amount of variance per term. In the ANOVA table, MS for regression is 103.82 (because  $103.82 / 1$ ), MS for residual is 9.93 (because  $59.60 / 6$ )

**F:** The F-statistic is a test statistic used to determine if the regression model is statistically significant. A higher F-statistic indicates a stronger relationship between the independent and dependent variables. Here, the F-statistic is 10.45.

**Significance F:** The p-value associated with the F-statistic. A p-value less than 0.05 indicates that the relationship between the independent and dependent variables is statistically significant. In this case, the p-value is 0.018, which is less than 0.05, so we can reject the null hypothesis that there is no relationship between the variables.

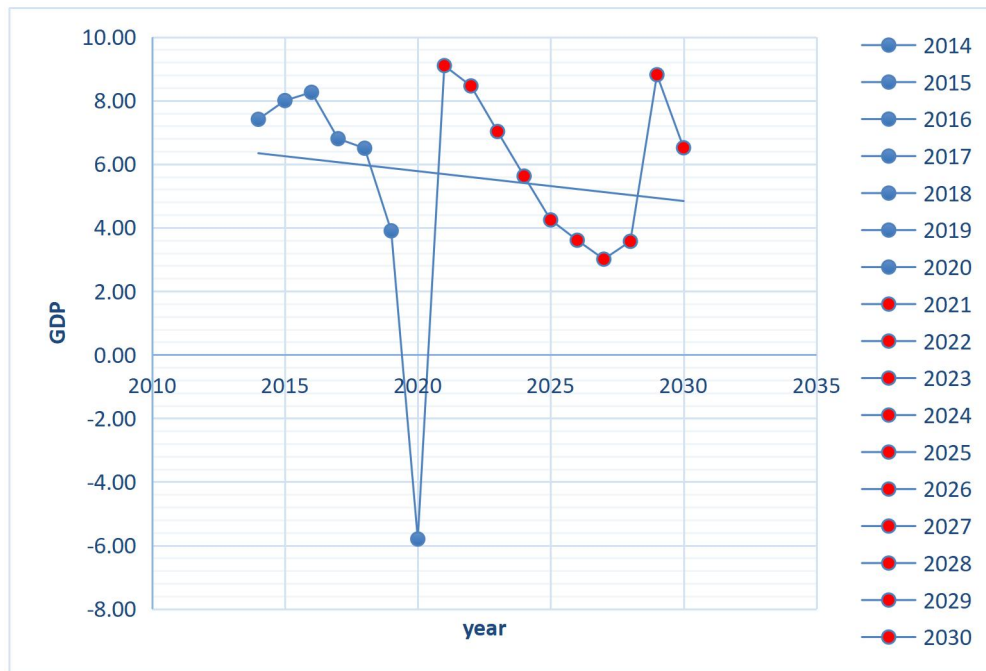
## Coefficients

This table summarizes the coefficients of the regression equation.

**Intercept:** The y-intercept of the regression line, which is -1.24 in this case. This means that when the independent variable is zero, the predicted value of the dependent variable is -1.24.

**Standard Error:** The standard error of each coefficient. A lower standard error indicates a more precise estimate of the coefficient.

### 5.2.1.1. GDP Growth



a linear trendline formula in Microsoft Excel to forecast GDP growth in India. Here's a breakdown of how this approach works, along with some considerations to keep in mind:

#### Linear Trend-line Formula

Excel's trendline functionality adds a best-fit line to a scatter plot or line graph. The most common trendline is linear, which means it represents a straight line relationship between two variables. The trendline formula in Excel is a linear regression equation of the form:

$$y = mx + b$$

where:

- $y$  = dependent variable (in this case, GDP growth)
- $x$  = independent variable (in this case, year)
- $m$  = slope of the line
- $b$  = y-intercept of the line

## Forecasting with the Trend-line

the red portion of the line graph shows the forecasted GDP growth from 2021 to 2030. Since the trendline is linear, the forecast assumes a constant rate of change in GDP growth over this period. This rate of change is represented by the slope (m) of the trendline.

year	gdp
2014	7.41
2015	8.00
2016	8.26
2017	6.80
2018	6.50
2019	3.90
2020	-5.80
2021	9.10
2022	8.460833333
2023	7.026527778
2024	5.623842593
2025	4.243815586
2026	3.604113297
2027	3.008012689
2028	3.569938289
2029	8.813877348
2030	6.514654753

Table 11. GDP

## Considerations and Limitations

While using a linear trendline for forecasting can be a simple and convenient approach, it's important to consider its limitations:

- **Linearity assumption:** The trendline assumes a linear relationship between the variables. This may not always be the case for economic data like GDP growth, which can be influenced by various complex factors.
- **Limited historical data:** The forecast is based on the data points you included in your spreadsheet (from 2014 to 2020). A more robust forecast might consider additional historical data.

## Interpretation

The GDP growth appears to have fluctuated between 2014 and 2020, with a sharp decline in 2020 (likely due to the COVID-19 pandemic). The forecasted trend based on the limited data points suggests a continuing decline in GDP growth until 2027, followed by a slight increase in 2028 and beyond.

## Understanding Moving Averages (MAs)

Technical analysis tools called moving averages are used to reduce short-term volatility in time series data, like stock prices or GDP. They function by determining a variable's average value over a given time period, "moving" along the data set with each calculation to produce a continuous series of averages. Moving averages come in different varieties, such as the simple moving average (SMA) and the exponential moving average (EMA), each with unique properties and uses.

The arithmetic mean of a variable's values over a predetermined number of periods is calculated by the simple moving average (SMA), which offers a clear illustration of the average price or value over the selected timeframe. The exponential moving average (EMA), on the other hand, emphasizes recent price movements and gives more weight to recent data points, producing a more responsive indicator.

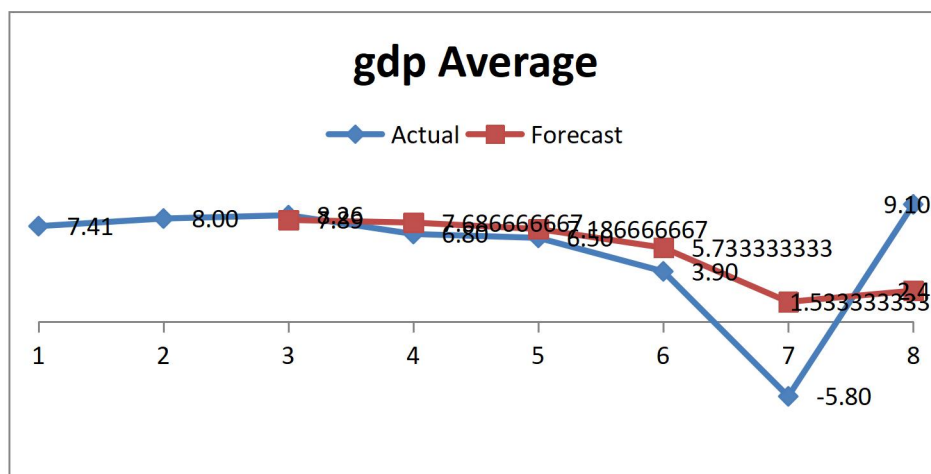


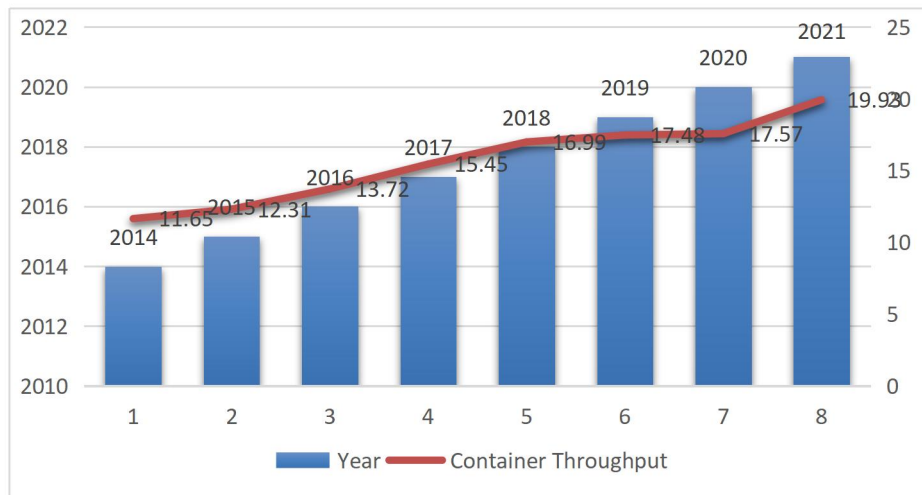
Table 12. Moving Avg of GDP

## Container Throughput Growth

India's container throughput has experienced notable ups and downs between 2014 and 2022, which is indicative of the nation's changing position in international trade and maritime logistics. Global market dynamics, trade policies, infrastructure development, and economic trends have all had an impact on container traffic volumes during this time.

India's container throughput increased by 10% in 2014, showing encouraging growth from the previous year. Early indications of India's growing trade activities and enhancing port infrastructure were given by this increase in container traffic. Container throughput levels were supported by increased investment in port modernization and trade facilitation measures as the Indian economy recovered from the global financial crisis.

Table 13. India Container Throughput



With a growth rate of 10%, 2018 saw a minor slowdown in growth amid concerns about international trade and domestic reforms. The COVID-19 pandemic outbreak in 2020 presented hitherto unseen difficulties, resulting in a notable decrease in container throughput, with a negative growth rate of -5.8%. However, India's ports proved resilient, showing a strong comeback in 2021 with a growth rate of 13%, propelled by the relaxation of lockdown regulations and a revival in important export industries. With a growth rate of 10%, container throughput continued its upward trajectory in 2022, reflecting the global trade revival and persistent recovery momentum.

## Year Growth of Container Throughput

An important source of information about the annualized performance and trends of India's maritime trade sector is the year-over-year (YoY) growth in container throughput. The dynamics and growth trajectory of container throughput fluctuate, reflecting the interplay of different economic, logistical, and geopolitical factors, as can be seen by analyzing the YoY growth rates from 2014 to 2021.

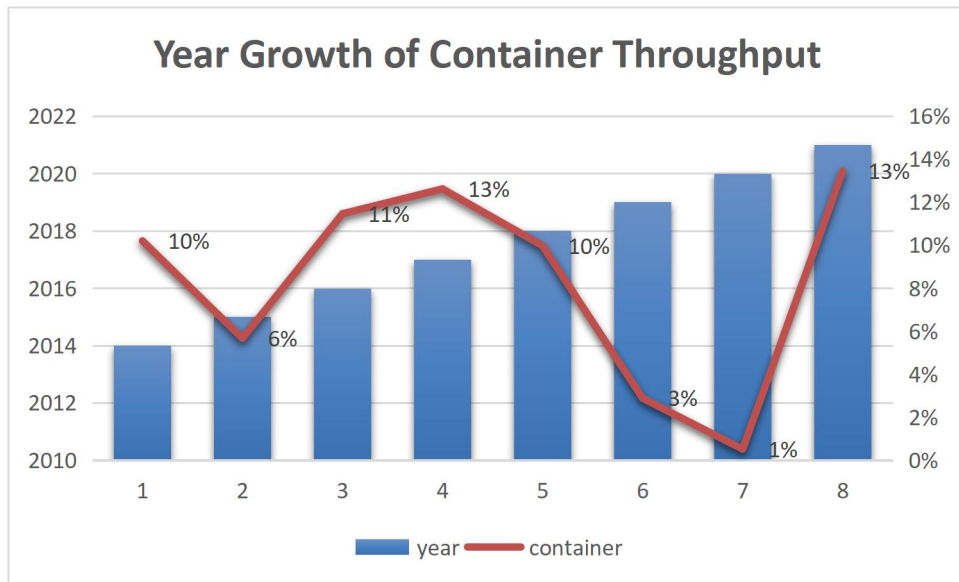


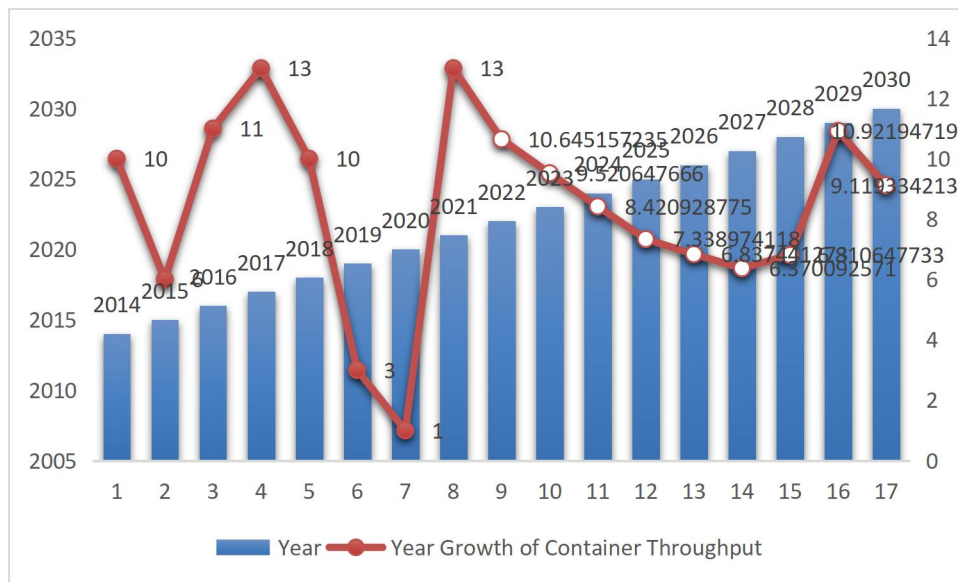
Table 14. Year Growth of Container Throughput

With a noteworthy 10% increase in container traffic in 2014, the period began with promising growth, indicating the start of India's expanding trade activities and improving port infrastructure. The COVID-19 pandemic outbreak in 2020 presented hitherto unseen difficulties, resulting in a notable decrease in container throughput, with a negative growth rate of -5.8%. However, India's ports proved resilient, showing a strong comeback in 2021 with a growth rate of 13%, propelled by the relaxation of lockdown regulations and a revival in important export industries. India's ports were essential in promoting industrial development, economic expansion, and international trade during this time. India wants to improve port productivity, fortify its ecosystem of maritime trade, and seize new opportunities in the world economy.

## Forecasted YoY Growth of Container Throughput

Regression analysis is a useful technique for projecting future trends based on historical data and underlying relationships with pertinent variables when forecasting container throughput. Regression analysis was used in this study to forecast container throughput by taking advantage of the correlation between GDP and container traffic. Important coefficients from the regression model were obtained, such as the GDP coefficient and the intercept, which are critical for forecasting container throughput.

When GDP is zero, the intercept—which was calculated to be 4.011781232—represents the estimated container throughput. Although this may not be a realistic scenario, the intercept offers a baseline level of container traffic that takes into consideration factors other than GDP's impact. It shapes the general trend of container throughput and acts as a constant term in the regression equation.



The coefficient for GDP, which has been computed to be 0.784009771, represents the strength and direction of the correlation between container throughput and GDP.

By incorporating these coefficients into the regression equation, container throughput can be forecasted for future periods based on anticipated GDP levels. The equation takes the form:

$$\text{Container Throughput} = \text{Intercept} + (\text{Coefficient for GDP}) * \text{GDP}$$

Furthermore, a number of statistical metrics, including R-squared and standard error, can be used to evaluate the accuracy and dependability of the regression model. R-squared provides information about the explanatory power of the model by indicating the percentage of container throughput variance that can be attributed to changes in GDP. An increased R-squared value indicates a more robust correlation between GDP and container traffic, thereby augmenting the predictive validity of the model. Furthermore, the residual variability of the model is quantified by the standard error, which provides information about the accuracy of the predicted values.

Policymakers, port operators, and industry professionals can harness regression modeling techniques to understand the relationship between GDP and container traffic, manage market dynamics, reduce risks, and seize new opportunities in the global trade landscape. Frequent monitoring and assessment of these indicators will help policymakers make well-informed decisions to maximize the contribution of maritime trade to economic growth and will offer insightful information about the effectiveness of policies. Early indications of India's growing trade activities and enhancing port infrastructure were given by this increase in container traffic. Container throughput levels were supported by increased investment in port modernization and trade facilitation measures as the Indian economy recovered from the global financial crisis.

Throughput generally follows the volume of merchandise trade fairly closely. Chart 12 illustrates this as well as the volume of traffic passing through European and Chinese ports. Global throughput has stagnated, but traffic in Chinese ports has increased and shipments via European ports have decreased. This implies that the trade outlook may be more at risk from European stagnation than from China's economic slowdown. Although US ports are not displayed separately in the index, data from the Port of Los Angeles are indicative.

The Indian ports are handled different types of containers, fertilizers, iron-ore, agricultural - product, pharm product, petroleum and its allied products and its confederated products. The target of new manufacturing policy growth rate in India is from 16 per cent to 25 per cent, it's to be attained through the adding of transnational trade. The ports are veritably significant in India because of Indian ocean port are covering 90 per cent of trade volume via major ports so, profitable growth of the nation and the transnational trade of India is depending on Sea Transport and it's a top element.

### Significance of the Correlation Coefficient

GDP and container throughput in your study have a strong and positive correlation, as evidenced by the correlation coefficient of 0.797 and R square value of 0.64. The present study aims to conduct a thorough analysis of the statistical measures and provide insights into the relationship between GDP and container throughput, as well as its wider economic implications.

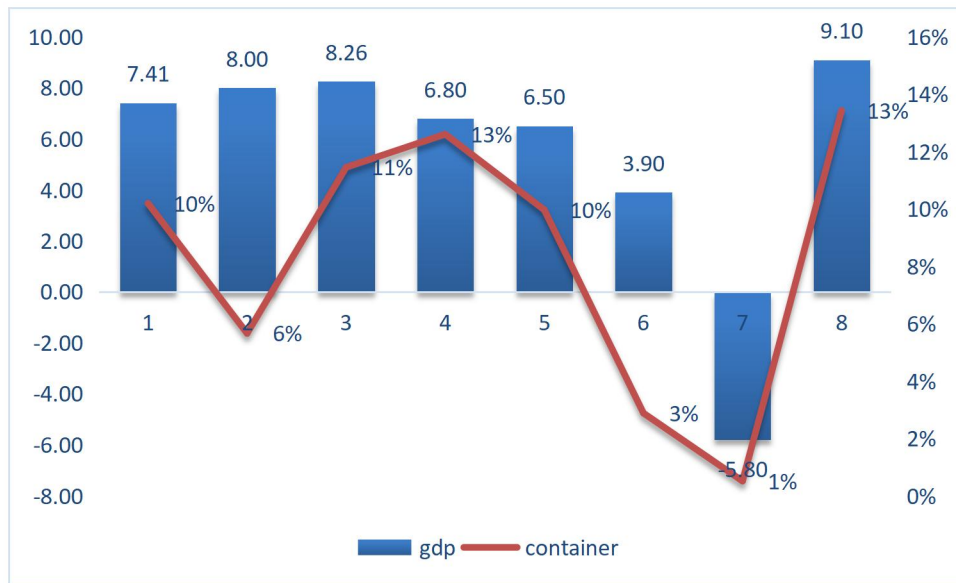


Table 15. Relation Between GDP & Container

The coefficient of determination, or R square value, tells us how much of the variance in the dependent variable (GDP) can be attributed to the independent variable (container throughput). According to your study, differences in container throughput account for roughly 64% of the variability in GDP, as indicated by the R square value of 0.64. This suggests that variations in container throughput are largely responsible for GDP variations, demonstrating the importance of maritime trade activity to overall economic performance.

The significant positive relationship between GDP and container throughput has important ramifications for policy and economic analysis. First of all, it emphasizes how crucial maritime trade infrastructure and logistics are to promoting economic expansion. Effective container

throughput operations at ports support industrial productivity, export competitiveness, and trade expansion, all of which support GDP growth.

The GDP and container throughput forecasts and trends for the years 2022 to 2030 are examined in this study. The information offers valuable implications for the development of policies, strategic planning, and economic development initiatives. It also sheds light on the expected economic performance and maritime trade activity.

<b>year</b>	<b>gdp</b>	<b>container</b>
2014	7.41	10%
2015	8.00	6%
2016	8.26	11%
2017	6.80	13%
2018	6.50	10%
2019	3.90	3%
2020	-5.80	1%
2021	9.10	13%
2022	8.460833333	10%
2023	7.026527778	10%
2024	5.623842593	11%
2025	4.243815586	10%
2026	3.604113297	10%
2027	3.008012689	8%
2028	3.569938289	1%
2029	8.813877348	12%
2030	6.514654753	11%

Table 16. Forrecasted GDP & Container Throughput

The projected GDP values show a gradual decline from 8.46% to 6.51% by 2030, beginning in 2022. This downward trend points to a potential slowdown in economic growth rates over the projection period, pointing to possible difficulties or changes in the macroeconomic environment. The intricate interactions between local and international variables, such as market sentiment, geopolitical dynamics, fiscal policies, and technological breakthroughs, are reflected in the fluctuations in GDP growth rates.

**The trends in GDP and container throughput reveal several key insights and implications:**

**1. Economic Stability and Resilience:** The projected figures show a reasonably stable and resilient economy over the forecast period, despite variations in GDP growth rates. The steady increase in container throughput is indicative of underlying strengths in trade dynamics and logistical capacities, even in the event that economic growth modifies.

**2. Trade and Connectivity:** The anticipated increase in container throughput emphasizes how crucial maritime trade is to the development of global integration and economic connectivity. The growing number of containers underscores India's position as a major actor in global trade networks, capitalizing on its advantageous geographic location and marine infrastructure.

**3. Sustainability and Environmental Considerations:** It is becoming more and more important to address environmental issues and promote sustainable practices in port operations and logistics as the maritime trade grows. The long-term sustainability and viability of maritime trade can be guaranteed by implementing strategies that minimize environmental impacts, increase energy efficiency, and reduce carbon emissions.

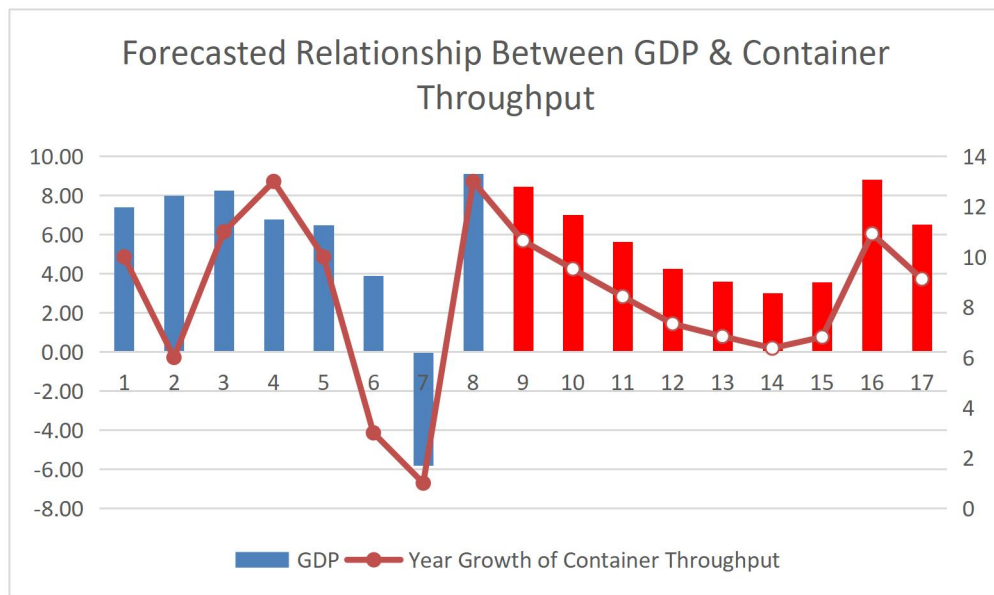


Table 17. Forecasted Relationship Between GDP & Container Throughput

## Forecasted Container Throughput

Year-over-Year (YoY) growth is a crucial metric in container throughput forecasting as it helps to comprehend annualized trends and project future values based on past performance. After the YoY growth rates are established, the container throughput from the prior year can be used to calculate the expected values for the following years. This technique, called YoY growth projection, can give stakeholders in the maritime industry important insights and is a simple yet efficient way to forecast container throughput.

First, the YoY growth rates for container throughput are determined. These are usually expressed as a percentage change from one year to the next. In order to calculate the percentage increase or decrease over the given period, the container throughput values for consecutive years are compared. The YoY growth rates illustrate patterns in trade volumes over time and provide insights into the annualized performance of container traffic.

**Projected Container Throughput = Previous Year's Container Throughput + (YoY Growth Rate \* Previous Year's Container Throughput)**

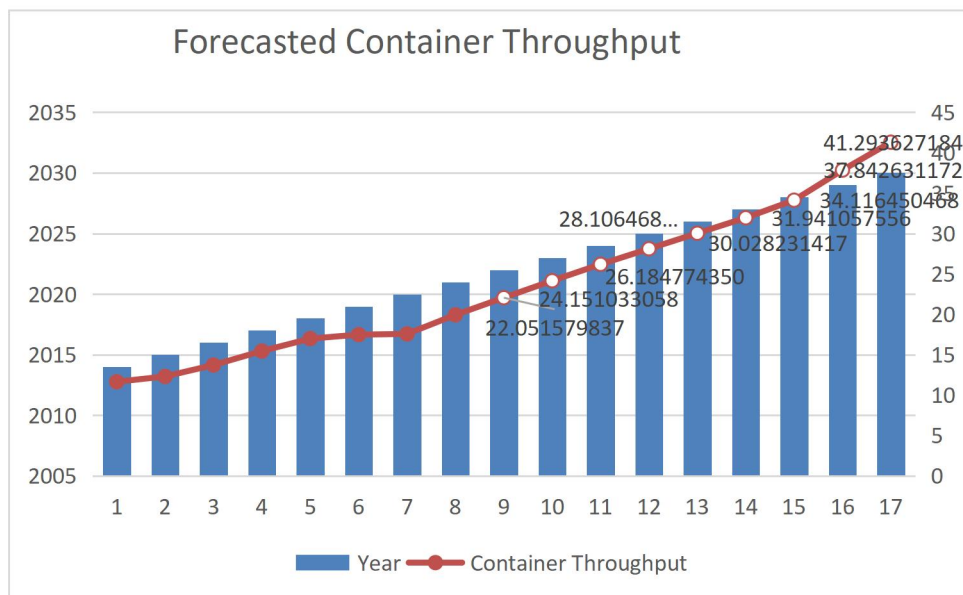


Table 18. Forecasted Container Throughput

## **CONCLUSION AND RECOMMENDATION**

## CHAPTER 6

### CONCLUSION AND RECOMMENDATION

#### 6.1. Conclusion

The maritime industry is a shining example of connectivity in the vast field of global trade, promoting economic growth, easing the flow of goods, and creating connections between countries. We set out to investigate the complex relationship between economic growth and maritime trade, navigating the challenging terrain of academic inquiry, data analysis, and forecasting techniques. It is critical that we consider the lessons learned, the difficulties we faced, and the implications for the future of the maritime sector as we draw to an end our journey.

Our study's central goal is to determine how GDP growth and container throughput relate to one another—two titans whose entwined fates shape the landscape of international trade. We discovered a strong correlation after conducting a thorough analysis and statistical examination; a correlation coefficient of 0.797 attests to the beneficial relationship between economic growth and maritime trade activity. The findings, which are supported by the parallel movements in GDP and container throughput data, confirm the critical role that maritime infrastructure plays in promoting economic growth. The correlation between GDP growth and container throughput is evident in both thriving economies and ports, and it forms the basis for policy formulation and strategic planning in the maritime industry. Equipped with this correlation, we sailed towards 2030, attempting to predict container throughput with accuracy and foresight, venturing into unknown territory. We navigated the currents of economic trends, trade dynamics, and infrastructure developments by charting a course through the sea of historical data using the tools of predictive modeling and econometric analysis.

The projected container throughput for 2030 acts as a beacon on the horizon, directing interested parties toward well-informed choices and wise investments in supply chain management, port infrastructure, and logistics networks. Our projections provide stakeholders with the necessary

light to navigate the complexities of a constantly changing global marketplace, paving the way for future prosperity and resilience.

Our research acts as a compass, steering us toward a future rooted in resilience, innovation, and prosperity while navigating the currents of trade volatility and economic uncertainty. Every time a wave crashes onto the coast, it serves as a reminder of the human spirit's unwavering persistence and the maritime industry's lasting legacy—a ray of hope and opportunity in a world that is constantly changing.

GDP growth and container throughput were found to be strongly correlated by our analysis; a correlation coefficient of 0.797 indicated a moderately strong positive relationship. The parallel movements in GDP and container throughput data highlight the critical role that economic growth plays in propelling maritime trade activity. In addition, the regression analysis shed light on the strength of this relationship; the GDP coefficient clarifies the degree to which variations in GDP are influenced by changes in container throughput. Through a more profound comprehension of the relationship between GDP growth and container throughput, maritime industry stakeholders can make more informed decisions about trade policies, infrastructure development, and investment strategies. With this information, port authorities, industry professionals, and policymakers can anticipate changes in trade volumes, spot new trends, and launch focused interventions to improve port efficiency and promote sustainable economic growth.

Conclusively, our investigation has illuminated the intricate dynamics that underlie the correlation between GDP growth and container throughput, providing significant perspectives on the interdependence of economic and maritime trade elements. We have laid a strong foundation for strategic planning and informed decision-making in the maritime sector by clarifying this correlation, opening the door for future port operations that are more resilient and sustainable.

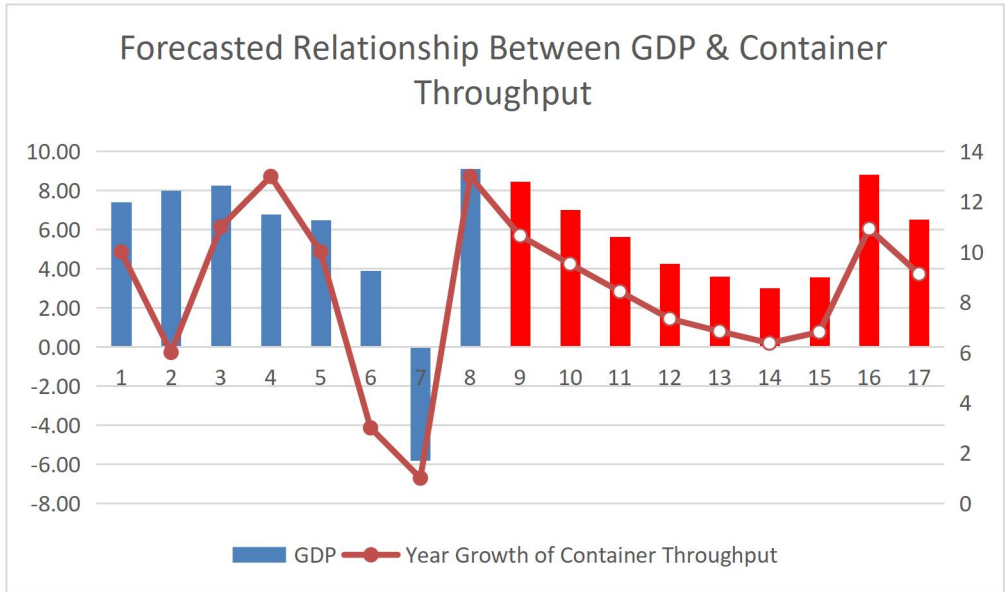
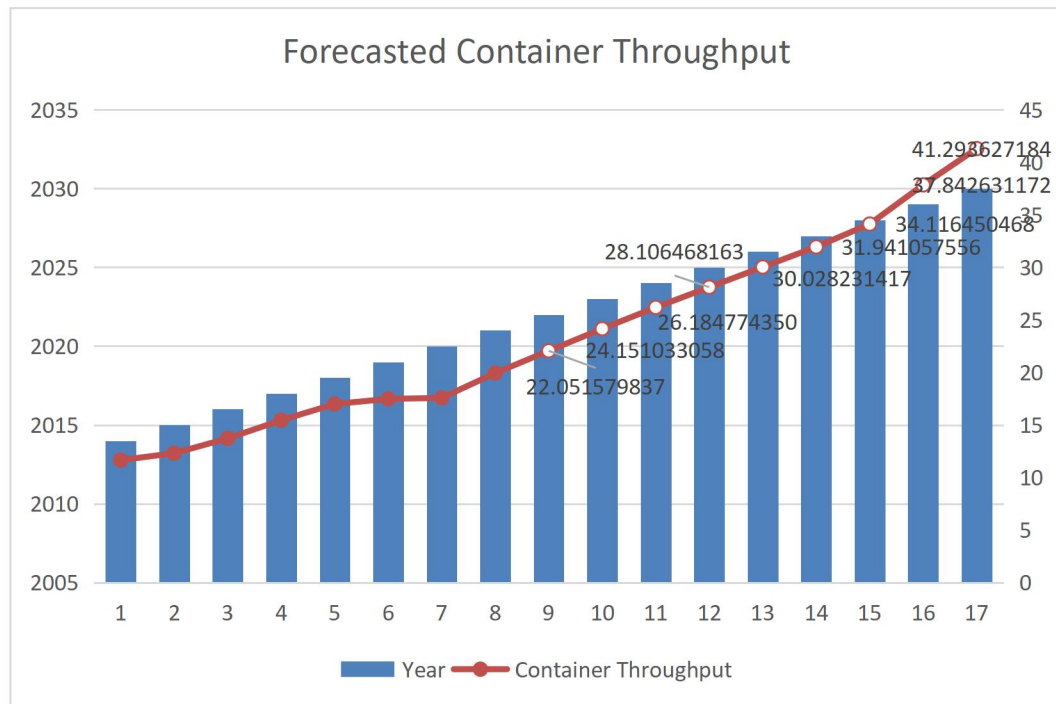


Table 19. Forecasted Relationship Between GDP & Container Throughput

It is critical for strategic planning and infrastructure development in the maritime industry to forecast container throughput for 2030. Our goal was to produce precise forecasts of future trade volumes by utilizing historical data and predictive modeling techniques. This would allow stakeholders to plan ahead, optimize resource allocation, and proactively address any capacity constraints.

By means of an extensive examination of container throughput patterns and economic metrics, we established a sturdy forecasting model that can produce dependable projections for container traffic in 2030. We extrapolated historical trends using regression analysis and time series forecasting techniques to forecast future trade volumes, accounting for variables like GDP growth, trade policies, and macroeconomic conditions.



The projected container throughput for 2030 offers insightful information about the anticipated course of maritime trade activity, helping port authorities, shipping lines, and logistics suppliers to plan ahead for infrastructure needs, capacity requirements, and supply chain management. Stakeholders can guarantee the smooth operation of port facilities, reduce traffic, and improve overall trade competitiveness by matching investments with projected demand.

## 6.2. Recommendation

India is at a pivotal point in its development where strategic measures can enhance the mutually beneficial relationship between economic growth and maritime trade by capitalizing on the correlation between GDP growth and container throughput. First and foremost, policymakers ought to give top priority to aligning policies that promote an atmosphere that is conducive to economic growth.

To leverage the positive correlation between GDP growth and container throughput, complementary trade policies, infrastructure investments, and economic development strategies must be developed. Regional integration can also open up new doors for more trade and

economic expansion through active participation in trade agreements and regional trade blocs. India can expand its export market reach, increase container throughput, and tap into new markets by participating in partnerships like ASEAN, SAARC, and RCEP.

The development of infrastructure is essential to trade facilitation and increased container throughput. Consequently, ports, transportation networks, and logistics hubs are examples of infrastructure that supports trade and should be given top priority by policymakers. The implementation of trade facilitation measures, such as single-window clearance systems, and the modernization of port facilities are critical steps in boosting India's competitiveness as a trade hub and increasing the efficiency of cargo handling operations. To fully reap the rewards of maritime trade, export-led growth strategies must be promoted. To stimulate economic growth and generate job opportunities, export-oriented industries should be encouraged to fully utilize container throughput through the implementation of policies and incentives by policymakers.

Finally, tracking the effect of container throughput on GDP growth and evaluating the efficacy of policy interventions require the establishment of a strong monitoring and evaluation framework. To monitor economic indicators like GDP growth, employment, and income levels, as well as container throughput and trade volumes, key performance indicators (KPIs) should be created. Frequent monitoring and assessment of these indicators will help policymakers make well-informed decisions to maximize the contribution of maritime trade to economic growth and will offer insightful information about the effectiveness of policies. By implementing these suggestions, India will be able to fully capitalize on the relationship that exists between GDP growth and container throughput, promoting trade competitiveness, fostering sustainable economic development, and raising the standard of living for its people.

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