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A COMPARITIVE ASSESSMENT OF CARGO HANDLING METHODS THROUGH QUALITY BENCHMARKING IN INDIAN PORTS

Vaishali B[1], Dr. Anitha Kumari[2]

[1]MBA (Shipping & Logistics Management), School of Management Studies, Vels Institute of Science, Technology & Advanced Studies Chennai 600 117, India.

[2]Associate Professor, MBA, School of Management Studies, Vels Institute of Science, Technology & Advanced Studies Chennai 600 117, India.

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ABSTRACT

Efficient cargo handling methods play a pivotal role in optimizing port operations and enhancing trade competitiveness. This paper conducts a comparative assessment of cargo handling methods in Indian ports through quality benchmarking. By employing a rigorous qualitative and quantitative analysis, it evaluates various aspects such as operational efficiency, productivity, safety standards, and customer satisfaction across different cargo handling methods. The study examines conventional methods alongside modern technological interventions, including automated systems and digital solutions. Key performance indicators are identified and utilized to benchmark the quality of cargo handling services provided by Indian ports. Furthermore, the paper explores best practices and innovative approaches adopted by leading ports globally to improve cargo handling efficiency. Insights from this comparative assessment aim to facilitate informed decision-making for port authorities, policymakers, and stakeholders in the Indian maritime sector to enhance the overall quality and effectiveness of cargo handling operations.

Keywords: Cargo Handling Methods, Quality Benchmarking, Indian Ports, Operational Efficiency, Productivity, Safety Standards, Technological Interventions.

1. INTRODUCTION

Cargo handling is the process of loading, unloading, storing, and moving goods during transportation, often between different modes of transport or within logistics facilities. Efficient cargo handling is crucial for the smooth flow of goods in the supply chain and international trade. Key aspects include manual labor, equipment operation, inventory management, safety and security protocols, customs clearance, and record keeping. Technology integration includes RFID and barcode systems, as well as advanced technologies like automated guided vehicles and robotic systems. The process also involves intermodal transportation, where goods are transferred between different modes, and coordination between different transportation modes is essential for smooth cargo handling. Cargo handling methods in major Indian ports involve a combination of traditional practices and modern technologies. Major ports like Jawaharlal Nehru Port Trust (JNPT) in Mumbai, Chennai Port, Mormugao Port, Kolkata Port, Vishakhapatnam Port, Paradip Port, New Mangalore Port, Ennore Port, Tuticorin Port, Kandla Port, Cochin Port, Haldia Port, and Mumbai Port handle various types of cargo, including containers, bulk cargo, and liquid bulk commodities.

Port authorities face challenges due to globalization of terminal operations, which has significantly impacted containerized terminal operations. The Major Port Trusts Act of 1963 brought major ports under the control of the Central Government, leading to the establishment of port trusts for better management and administration. The introduction of containerization revolutionized cargo handling, making it more efficient and reducing turnaround times. JNPT, inaugurated in 1989 near Mumbai, became a flagship port for containerization, adopting advanced technologies and accommodating larger vessels. Economic liberalization in the 1990s marked a shift towards market-oriented reforms, leading to the development of container terminals and specialized facilities. Containerization gained prominence, allowing for the seamless handling of standardized cargo units.

2. PROBLEM OF THE STUDY

The current state of cargo handling methods in Indian ports lacks a standardized framework for assessment, hindering the ability to measure and enhance operational efficiency. The absence of quality benchmarks poses a challenge in evaluating the effectiveness of different handling practices across ports. The need for a comprehensive assessment arises to identify inefficiencies and areas for improvement in the existing cargo handling procedures. Without a clear benchmark, it is challenging to ensure consistency and adherence to best practices, impacting the overall reliability of

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the cargo handling process. Addressing these issues is crucial for streamlining operations, reducing cargo damage, and fostering a more competitive and efficient port environment. The study aims to fill this gap by establishing quality benchmarks, allowing for a systematic evaluation and improvement of cargo handling methods in Indian ports.

NEED FOR THE STUDY

Investigate the underlying factors contributing to port inefficiency, examining operational bottlenecks, infrastructural constraints, and regulatory frameworks to propose targeted interventions for performance enhancement.

The study is essential to assess and enhance the port infrastructure, facilities, and connectivity of 13 major Indian ports, ensuring optimal trade efficiency and competitiveness Research and analyze international best practices in cargo handling, incorporating benchmarking data to recommend and implement industry-leading methods for increased competitiveness and customer satisfaction in Indian ports.

3. OBJECTIVE OF THE STUDY

Primary Objective

To analyse and compare the operational performance and revenue of 13 major Indian ports using statistical techniques.

Secondary Objective

To analyse the port infrastructure & facilities and port connectivity's of 13 major Indian ports.

To identify port inefficiencies and implement improvements to streamline operations for enhanced overall efficiency

SCOPE OF THE STUDY:

This study will focus on analysing and comparing the operational performance and revenue of 13 major Indian ports using statistical techniques.

This includes evaluating cargo handling efficiency, turnaround times, and revenue generation to identify high-performing ports and areas for improvement.

The scope also encompasses an in-depth analysis of the port infrastructure, facilities, and connectivity of the 13 major Indian ports.

It will identify port inefficiencies and propose targeted interventions and improvements to streamline operations and enhance overall efficiency

4. LITERATURE REVIEW

Rao, Ambati Janardhana, (2017): In both organizations and industries where benchmarking criteria are put into practice, the study has shown a discernible increase in overall efficiencies. According to the report, methods for creating benchmarks are always changing and drawn from a variety of scientific fields. Furthermore, the investigation discovered the process of seaport benchmarking is currently being developed. In light of the findings of this study, the authors suggest that container terminals at India's principal ports set performance benchmarks for themselves. In order to assess the current state of research on benchmarking and determine the viability of benchmarking container terminals in India's principal ports, the authors have undertaken this study of the related literature.

Solanki, Sandip, and Krishna Murthy Inumula, (2020): The present analysis employs annual time series data spanning from 1999 to 2017 pertaining to specific physical performance indicators, such as vessel traffic, average pre-berthing waiting time, and average turn round time (ATRT), average production per ship berth day (AOPBD), and proportion of idle time at berth to time at working berth (PIBTW) of major Indian ports. The ports were rated according to the total score obtained from the examination of these particular physical performance indicators using the principal component factor analysis approach, which assigned equal weights to each indication. The findings show that JNPT port, which received rank 1, has the highest overall score of 966, followed by Ennore port, which received rank 2, with a score of 789, and Kandla port, which received rank 3, with a total score of 712, Kolkata, Haldia and Tuticorin ports showed.

Abhilash, K. K., and P. V. Gopinathan, (2013): A significant portion of a nation's GDP is derived from the import and export of goods, which are mostly done by air or sea. An important factor in increasing GDP and international trade is port infrastructure. Over its 7,517 km coast, India has 13 major ports and 187 minor ports, the largest of which being Cochin port. Through benchmarking, the thesis compares Cochin Port's performance to that of the best-in-class performer in order to determine which port in India is performing at the highest level. By examining the best practices that the top performer in the class uses, it also makes recommendations for ways to improve.

Burns, Maria G, (2018): The global economy's dependence on sea transportation is the main topic of Port Management and Operations, a thorough resource for maritime managers and experts. In addition to regulatory,

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commercial, technological, operational, financial, and sociopolitical aspects, the book looks at worldwide port management techniques at several levels. In addition to assessing the new regulatory framework and pointing out possible trouble spots, it emphasizes how changes are affecting seaports. Port Strategy and Structure, Legal and Regulatory Framework, Input: Factors of Production, and Output and Economic Framework are the four pillars around which the book organizes port management concepts, tactics, and operations. The text underscores the nascent obstacles facing port managers and the imperative nature of preemptive synchronization of legislation, protocols, and guidelines among the marine, oil, and gas sectors. With the book's thorough explanation of the intricacies of the shipping business, readers can

Bichou, Khalid, (2014): A reliable and well-organized labor force was needed for ship and cargo handling operations; therefore, the UK National Dock Labour Scheme (NDLS) was created. The National Port Unions formed the International Dockworkers Council (IDC) or joined the International Transport Workers Federation (ITWF) because they believed that this project would jeopardize job stability. Port education has also been incorporated into national further education plans by the transport and logistics departments of major universities and academic institutes in Europe and Asia. Contradictory outcomes have been obtained, meanwhile, as a result of the impact of new academic programs on port labor training as well as the shifting port industry's influence on them.

5. RESEARCH METHODOLOGY

The arrangement of gathering information for research ventures is known as research system. The information might be gathered for either hypothetical or down to earth look into for instance the board research might be deliberately conceptualized alongside operational arranging strategies and change Management.

METHOD OF DATA COLLECTION

The Data collection is the activity of gathering facts of information about a subject in a research study there are two types of data

- Primary data
- Secondary data

SECONDARY DATA

The information that has already been collected and published by someone else, such as government agencies, research institutions, or commercial organizations. It includes data gathered from sources like academic journals, reports, databases, and official records. Researchers use secondary data to complement or validate their own findings, saving time and resources compared to collecting primary data. However, limitations may arise regarding data accuracy, relevance, and availability, requiring careful evaluation before use in research projects. Overall, secondary data serves as a valuable resource for conducting comprehensive analyses and gaining insights across various disciplines.

RESEARCH DESIGN

Research design is the specification of the method and procedure for acquiring the information needed to solve the problem by following statistical tools

- Comparative Analysis
- Trend Analysis

6. COMAPRATIVE ANALYSIS

A comparison study between the fiscal years 2021–22 and 2022–2023 reveals some interesting differences in the examination of India’s twelve major ports. Key performance indicators include the average ship berth day output in tonnes, the number of vessels handled, and the average cargo turnaround time of boats. Examining the data in detail reveals subtle changes and patterns in each of these categories. While 2022–2023 shows a refined efficiency in vessel handling operations, perhaps the 2021–2022 timeframe saw substantial growth in throughput. Turnaround time variances highlight operational improvements or difficulties the ports confront in controlling the flow of cargo. Enhancing port efficiency and supporting India's maritime infrastructure are two goals of this analytical lens, which provides stakeholders with a holistic perspective and helps shape strategic decisions.

TREND ANALYSIS

The revenue trends of India's 12 major ports can be clearly observed by looking at the last five fiscal years. As a result of the dynamic nature of marine commerce, revenue trajectories fluctuate from one fiscal year to the next. It's possible that some ports exhibit steady expansion, signifying wise investments and prosperous trading alliances. On the other hand, variations in a port's income sources could be an indication of unstable markets or major infrastructure issues.

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Extending an analysis of these patterns provides significant understanding of the port-specific dynamics and economic environment. In order to strengthen revenue resilience and reinforce India's marine dominance in the international arena, policymakers and business executives use this trend analysis as a compass.

ANALYSIS & INTERPRETATION

COMPARIVITVE ANALYSIS BETWEEM OPERATIONAL PERFORMANCE INDICATORS OF 2021-2022 & 2022-2023.

TABLE 1: Port - Wise Operational Performance Indicators of 2021 -22

PORTS	AVERAGE SHIP BERTH DAY OUTPUT - IN TONNES	VESSELS HANDLED IN NUMBERS	AVERAGE TURNAROUND TIME OF VESSELS CARGO WISE (IN DAYS)
CHENNAI	15672	1444	2.25
JNPT	28938	2,837	2.07
MORMUGAO	11824	384	3.11
KOLKATA	14403	1310	2.76
VISHKHAPATNAM	11923	961	3.11
PARADIP	14852	722	2.35
NEW MANGALORE	18613	319	1.80
ENNORE	24292	863	0.851
TUTICORIN	16811	1238	2.02
KANDLA	13650	1311	2.41
COCHIN	17147	1550	2.57
MUMBAI	19251	1887	3.04

TABLE 2: Port Wise Operational Performance Indicators of 2022 -23

PORTS	AVERAGE SHIP BERTH DAY OUTPUT - IN TONNES	VESSELS HANDLED IN NUMBERS	AVERAGE TURNAROUND TIME OF VESSELS CARGO WISE (IN DAYS)
CHENNAI	17183	1616	2.00
JNPT	27643	3,273	2.42
MORMUGAO	15699	431	2.64
KOLKATA	15782	1683	2.32
VISHKHAPATNAM	12423	1054	3.12
PARADIP	15240	895	2.08
NEW MANGALORE	19368	362	1.69
ENNORE	26075	927	1.061
TUTICORIN	15852	1524	1.95
KANDLA	15574	1496	2.89
COCHIN	17976	1617	2.04
MUMBAI	19934	1916	2.80

OBSERVATION:

CHENNAI: The average ship berth day output increased from 15,672 tonnes in 2021-2022 to 17,183 tonnes in 2022-2023. The number of vessels handled also increased from 1,444 to 1,616.

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MUMBAI: Both the average ship berth day output and vessels handled increased from 19,251 tonnes and 1,887 vessels in 2021-2022 to 19,934 tonnes and 1,916 vessels in 2022-2023 respectively.

JNPT, KOLKATA, VIZAG, PARADIP, KANDLA, and COCHIN also showed an increase in both ship berth day output and vessels handled, indicating an overall growth in port activities.

ENNORE: Ennore port exhibited a remarkable increase in the average ship berth day output, rising from 24,292 tonnes in 2021-2022 to 26,075 tonnes in 2022-2023. The number of vessels handled also increased from 863 to 927.

ENNORE: The average turnaround time of vessels cargo-wise at the Ennore port significantly decreased from 0.851 days in 2021-2022 to 1.061 days in 2022-2023, indicating improved efficiency.

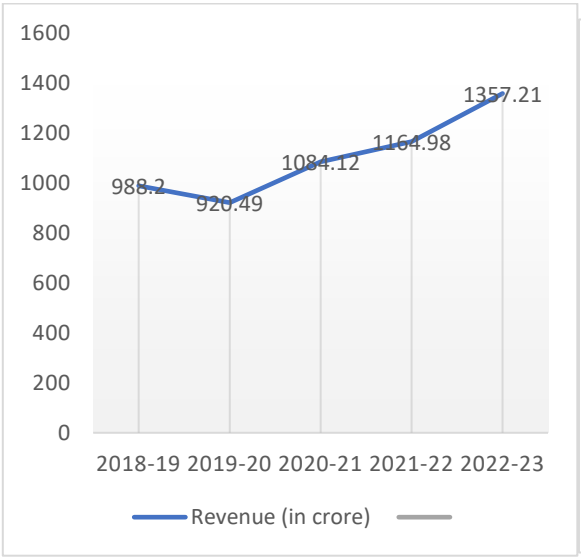
TUTICORIN: Similarly, the Tuticorin port also witnessed a reduction in turnaround time from 2.02 days to 1.95 days.

JNPT: The average turnaround time at JNPT increased from 2.07 days in 2021-2022 to 2.42 days in 2022-2023.

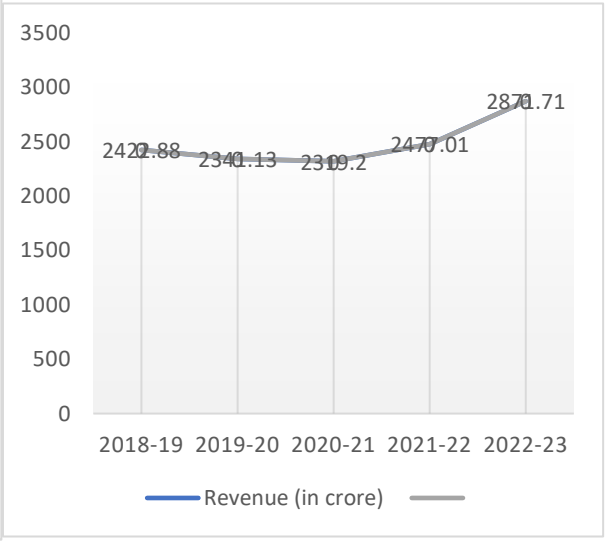
KANDLA: The Kandla port also experienced an increase in turnaround time from 2.41 days to 2.89 days.

NEW MANGALORE: The port maintained a relatively stable performance with a slight increase in the average ship berth day output and a decrease in the number of vessels handled. The turnaround time improved from 1.80 days to 1.69 days, indicating consistent or slightly improved efficiency.

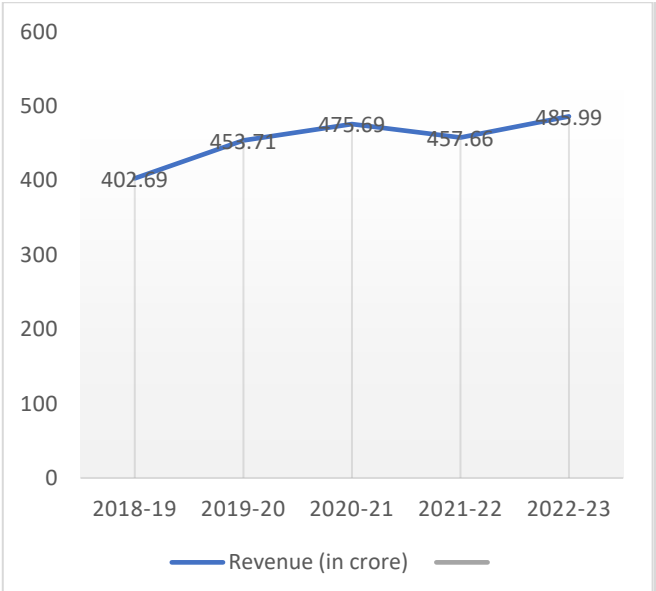
The Trend Analysis of Port Revenue to Assess the Financial Performance and Growth Patterns of The Major Indian Ports Over Five Years of Period



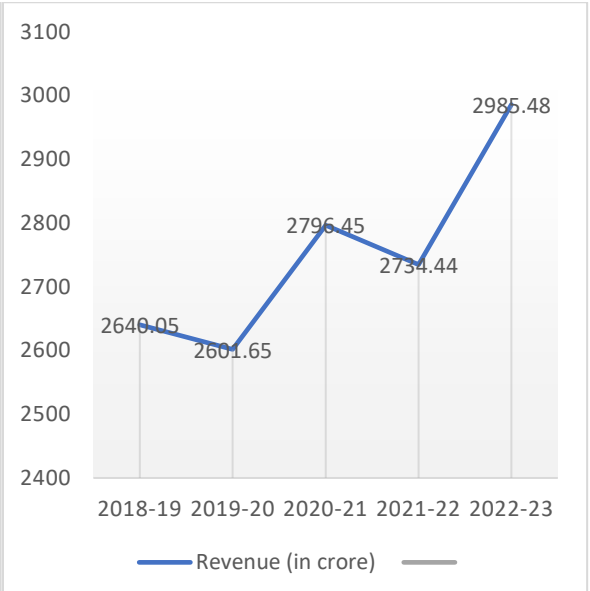
Chennai Port



JNPT Port



Mormugao Port



Kolkata Port

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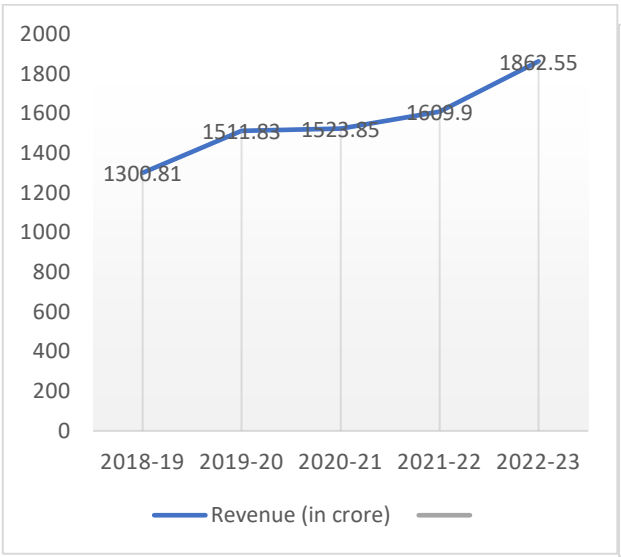
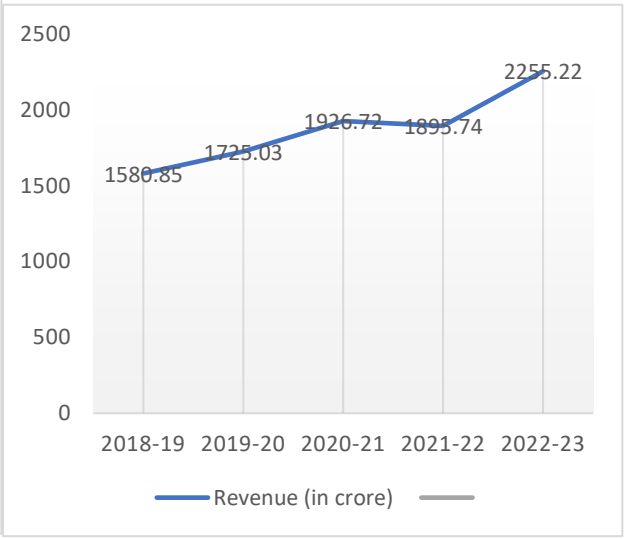
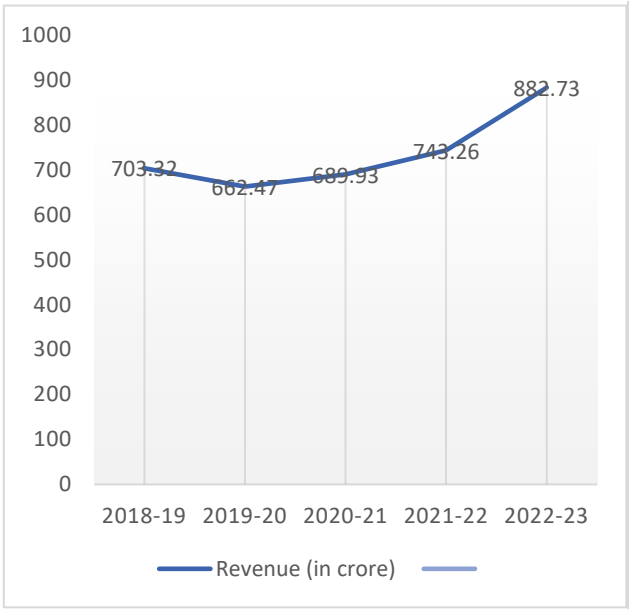


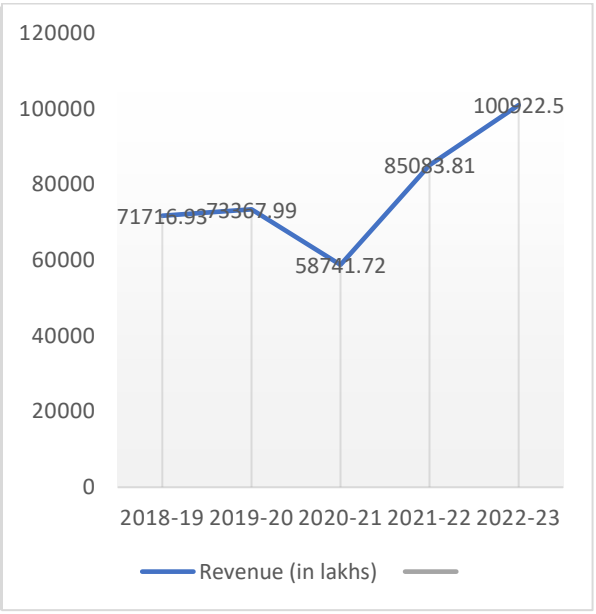
Vishakhapatnam Port



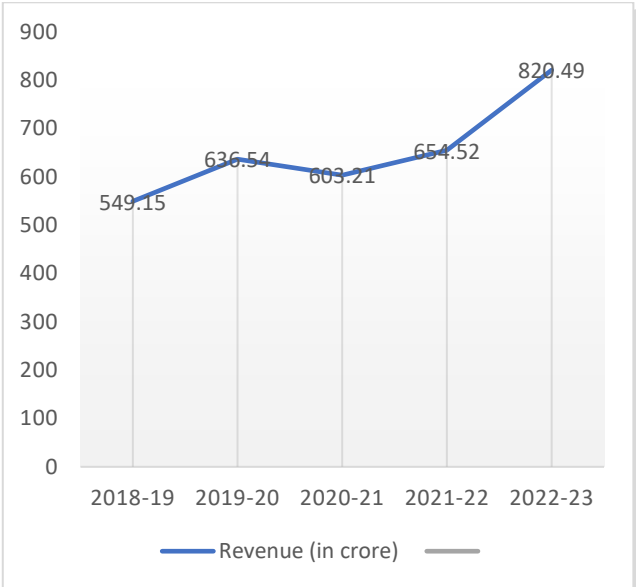
Paradip Port



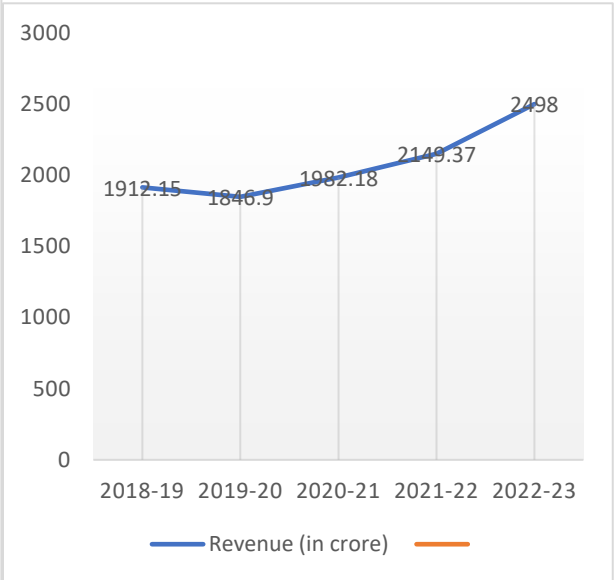
New Mangalore



Ennore Port



Tuticorin Port



Kandla port

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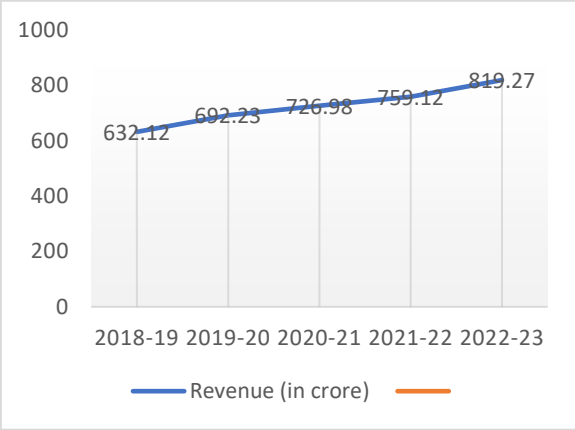
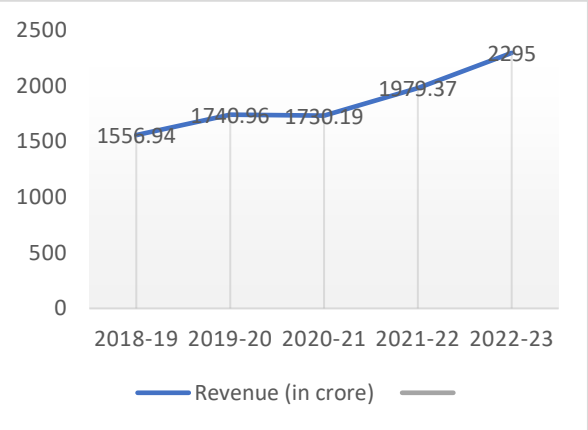


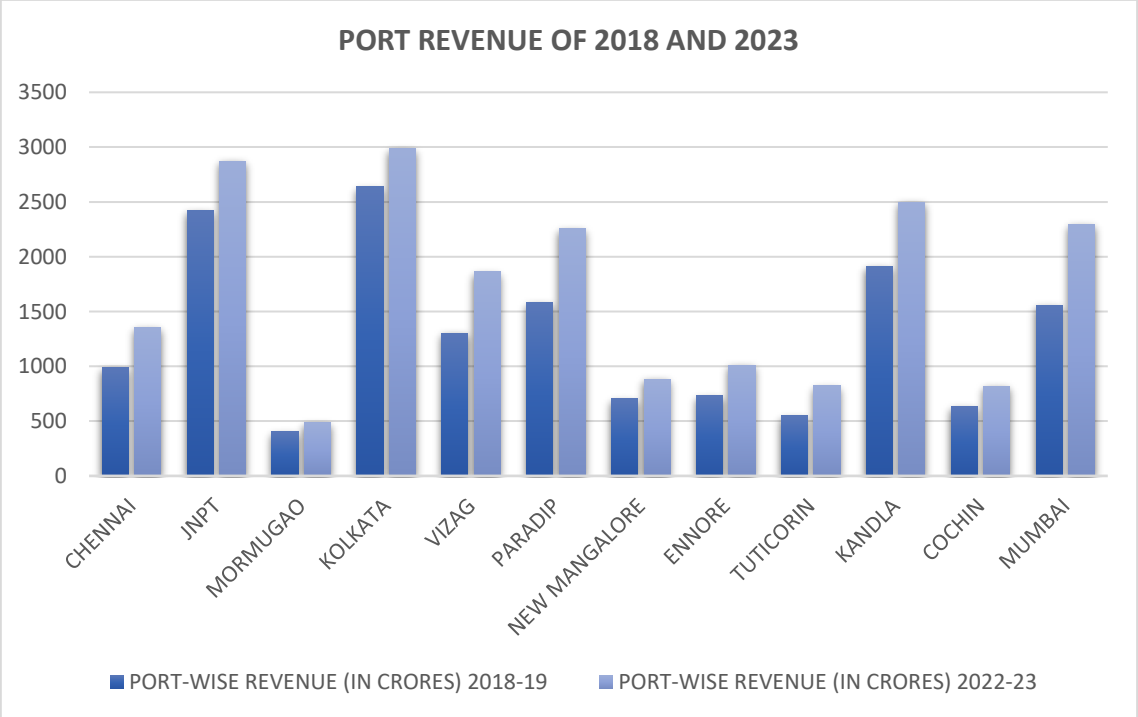
Cochin Port



Mumbai Port

TABLE 3: Port - Wise Revenue From 2018 To 2023

PORT-WISE REVENUE (IN CRORES)	2018-19	2019-20	2020-21	2021-22	2022-23
CHENNAI	988.20	920.49	1084.12	1164.98	1357.21
JNPT	2422.88	2341.13	2319.20	2477.01	2871.71
MORMUGAO	402.69	453.71	475.69	457.66	485.99
KOLKATA	2640.05	2601.65	2796.45	2734.44	2985.48
VIZAG	1300.81	1511.83	1523.85	1609.9	1862.55
PARADIP	1580.85	1725.03	1926.72	1895.74	2255.22
NEW MANGALORE	703.32	662.47	689.93	743.26	882.73
ENNORE	733.67	733.67	587.41	850.83	1009.22
TUTICORIN	49.15	36.54	603.21	654.52	820.49
KANDLA	1912.15	1846.90	1982.18	2149.37	2498.00
COCHIN	632.12	692.23	726.98	759.12	819.27
MUMBAI	1556.94	1740.96	1730.19	1979.37	2295.00



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OBSERVATIONS:

Consistent Leaders: JNPT, Kolkata, and Paradip consistently remain in the top three positions across all the years.

Stable Performers: Vizag, Mumbai, and Kandla also maintain their positions within the top six, although there is some fluctuation in their rankings.

Emerging Ports: Cochin, New Mangalore, and Ennore show a slight increase in their rankings over the years, with Cochin moving from 7th to 6th position, New Mangalore from 8th to 7th, and Ennore from 9th to 8th.

Fluctuating Ports: Tuticorin and Mormugao display fluctuations in their rankings. Tuticorin drops from 10th to 11th position, while Mormugao moves from 11th to 10th.

Most Improved: Chennai shows significant growth, moving from the last position (12th) in 2018-19 to the 7th position in 2022-23.

Overall Growth: Most ports show an increase in revenue over the years, indicating overall growth in the maritime sector.

FINDINGS:

Chennai: Secured the top position with an overall score of 16, excelling in Connectivity and Revenue. (Source: Chennai Port Trust)

JNPT (Jawaharlal Nehru Port Trust): Tied for the first position with Chennai, leading in Infrastructure and Facilities. (Source: JNPT Port Trust)

Mumbai: Holds the third position with an overall score of 19, performing well in Infrastructure and Performance. (Source: Mumbai Port Trust)

Kolkata: Ranked fourth with an overall score of 20, particularly strong in Revenue. (Source: Kolkata Port Trust)

Vishakhapatnam (Vizag): Occupied the fifth spot with an overall score of 21, notable for its Connectivity. (Source: Vishakhapatnam Port Trust)

Cochin: Secured the sixth position with an overall score of 24, recognized for its Infrastructure. (Source: Cochin Port Trust)

Paradip: Ranked seventh with an overall score of 27, standing out in Revenue. (Source: Paradip Port Trust)

New Mangalore: Shared the eighth position, scoring high in Performance. (Source: New Mangalore Port Trust)

Mormugao: Tied for eighth place, performing well in Connectivity. (Source: Mormugao Port Trust)

Tuticorin: Held the ninth position, notable for its Infrastructure. (Source: Tuticorin Port Trust)

Kandla: Occupied the tenth position, excelling in Revenue. (Source: Kandla Port Trust)

Ennore: Placed twelfth, highlighted for its Performance. (Source: Ennore Port Trust)

7. SUGGESTIONS

The Indian government is implementing several strategies to improve port infrastructure, operational efficiency, and sustainability. These include upgrading port infrastructure, adopting advanced technologies like AI and IoT, improving road, rail, and multimodal connectivity, adopting best practices in vessel and cargo handling, implementing environmental management systems, strengthening inland connectivity, reforming port governance, implementing digital platforms, developing new terminals, and enhancing multimodal connectivity. The Sagarmala Project aims to enhance port connectivity, port-led industrialization, and coastal community development, unlocking India's coastline and waterways' potential, stimulate economic growth, and make the maritime sector globally competitive and sustainable.

8. CONCLUSION

The study on cargo handling methods in 13 Indian ports revealed diverse operational performance, infrastructure, and revenue generation. Chennai, Mumbai, Kolkata, and Ennore showed top performers. The study recommends standardizing quality benchmarks, multimodal transportation, infrastructure modernization, advanced technologies, and policy reforms for sustained growth.

9. REFFERENCE

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