IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2025

DOI: 10.17148/IARJSET.2025.125254

Role Of Multimodal Transportation And Its Impact On Chennai Port

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Abstract: Multimodal transportation—the coordinated use of multiple modes such as road, rail, sea, and inland waterways—is an essential component of efficient logistics systems in modern economies. This study investigates how multimodal transportation affects the performance and competitiveness of Chennai Port. It explores current infrastructure, identifies major challenges, and proposes actionable solutions for improving the port's cargo handling efficiency, reducing logistical bottlenecks, and supporting sustainable development. The research methodology combines both qualitative and quantitative data, using surveys and stakeholder interviews to draw insights. The findings suggest that integrated multimodal transport systems could drastically improve Chennai Port's throughput, reduce environmental impacts, and enhance its role in global supply chains.

Company profile

The Maritime history of Chennai started way back in 1639 with setting up Fort of St.George on the seashore of the erstwhile Madrasapatnam (Madras) from an open roadstead and exposed sandy coast till 1815 with minor port operations. The initial piers were built in 1861. But the storms of 1868 and 1872 made them inoperative, which led to emergence of an artificial harbour. The Madras Port started its commercial operations in 1881 with breakwaters having an eastern entrance.Sir Francis Spring first Chairman of the Madras Port Trust, formulated plans with a long-term vision and in a scientific manner, to overcome both man-made and natural challenges. The shifting of the entrance of the Port from Eastern side to the North Eastern side provided protection to the Port to a long extent from natural calamities. By the end of 1920, the port was equipped with a dock later named as Dr.Ambedkar Dock, consisting of five berths in the West Quay, one each in the East & South Quay, the North Quay berth came up in 1931 and during 1940s two more berths were added along with all infrastructure facilities. The Passenger station at North Quay was inaugurated in 1958.In 1964, Jawahar Dock was commissioned on the southern side of the Port with a capacity to berth 6 vessels to handle Dry Bulk cargoes and non-hazardous liquid cargoes. In tune with the international maritime developments, the port developed an Outer-harbour named Bharathi dock with two deep drafted berths for handling POL cargo in 1972 and one deep drafted berth with mechanized Iron-Ore plant for handling Iron Ore in 1974.The year 1983 heralded commissioning of the country's first dedicated Container Terminal facility at Bharathi Dock, witnessing a phenomenal growth in Container handling year after year, the Port commissioned its second Container Terminal in 2009 at the former East Quay and South Quay III berths. Not restricting itself only to cargo handling, the Port also promotes Cruise Tourism with a modern Cruise Cum Passenger Terminal developed at West Quay. With several Car manufacturing companies emerging around Chennai, the potential exists for large-scale car exports through Pure Car Carriers (PCC) shipment. The long term vision of Chennai Port envisages handling of 4 Cs-Containers, Cars, Cruise and Clean Cargo.

Chennai Port acquired Kamarajar Port Ltd. in March 2020 and is leveraging its operational and financial synergies to enhance services and strengthening its regional dominance.

With the commissioning of Coastal Berth (2 berths) during year 2019 and Bunker Berth (1 berth) in the year 2022, the number of berths increased to 27 now. Port Profile

Chennai Port, the third oldest port among the 12 major ports, is an emerging hub port in the East Coast of India.

This gateway port for all cargo has completed 147 years of glorious service to the nation's maritime trade. Maritime trade started way back in 1639 on the sea shore Chennai. It was an open road-stead and exposed sandy coast till 1815. The initial piers were built in 1861, but the storms of 1868 and 1872 made them inoperative. So an artificial harbour was built and the operations were started in 1881. The cargo operations were carried out on the northern pier, located on the northeastern side of Fort St. George in Chennai. In the first couple of years, the port registered traffic of 3 lakh tonnes of

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cargo handling 600 ships. Being an artificial harbour, the port was vulnerable to the cyclones, accretion of sand inside the basin due to underwater currents, which reduced the draft. Sir Francis Spring, a visionary, skillfully drew a long-term plan to charter the course of the port in a scientific manner, overcoming both man-made and natural challenges. The shifting of the entrance of the port from the eastern side to the northeastern side protected the port to a large extent from the natural vulnerabilities. By the end of 1920, the port was equipped with a dock consisting of four berths in the West Quays, one each in the East & South Quay along with the transit sheds, warehouses, and a marshalling yard to facilitate the transfer of cargo from land to sea and vice versa. Additional berths were added with a berth at South Quay and another between WQ2 & WQ3 in the forties. India's Independence saw the port gathering development, momentum.

INTRODUCTION

Globalization has transformed the nature of trade and logistics, necessitating smarter, faster, and more sustainable transportation systems. In this context, **multimodal transportation** has emerged as a strategic solution. It allows goods to move across various regions and countries through interconnected transport modes under a single system or contract.

Chennai Port, located on India's southeastern coast, is a vital gateway for cargo movement, especially for the states of Tamil Nadu, Andhra Pradesh, and Karnataka. However, the port currently faces serious logistical challenges due to an overdependence on road transport, leading to:

- Traffic congestion in urban areas.
- Higher transportation costs.
- Delays in cargo movement.
- Increased carbon emissions and fuel consumption.

The integration of multimodal transport offers a pathway toward overcoming these issues by ensuring a more balanced use of road, rail, and sea transport modes. This not only improves operational efficiency but also aligns with India's broader goals of reducing carbon emissions and enhancing trade competitiveness.

Statement of the Problem

Chennai Port is currently hindered by fragmented and inefficient logistics systems. Key problems include:

- **Over-reliance on road transport**, which causes urban congestion and delays.
- **Limited rail connectivity** to hinterlands.
- **Underutilization of inland waterways** due to infrastructure and policy gaps.
- **Poor integration between transport modes**, which delays cargo transfers.
- **Lack of digital coordination tools** like real-time cargo tracking or unified communication platforms.
- **Resistance to change** from logistics operators used to traditional methods.

As a result, cargo throughput is affected, customer satisfaction drops, and the region's export-import businesses face rising costs and uncertainties. Without strategic improvements, Chennai Port risks falling behind in the increasingly competitive logistics and port sector.

OBJECTIVES OF THE STUDY

Primary Objectives

1. To analyze the current state of multimodal transportation infrastructure at Chennai Port.
2. To evaluate how well different transport modes (road, rail, sea, air) are integrated in cargo operations.
3. To study how multimodal systems can help reduce congestion and turnaround time.
4. To assess cost savings, carbon reduction, and economic advantages offered by multimodal systems.
5. To identify the challenges in implementing multimodal transport systems.

Secondary Objectives

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- To benchmark Chennai Port's performance against other Indian and international ports.
- To learn from successful case studies such as JNPT (Mumbai), Mundra Port, or Rotterdam (Netherlands).
- To suggest policy and infrastructure improvements.
- To promote digital innovation like Port Community Systems (PCS), RFID, and AI-based logistics planning.

REVIEW OF LITERATURE

Quality of multimodal freight transportation: a systematic literature review Aman, Dua and Deepankar Sinha Published Online, 29 Mar 2019: Firms, especially in global trade, have been experiencing movement of goods and products through different modes of transportation interfacing at different nodes (or terminals). Yet the major focus has been on the sea or air leg of transportation. Efforts are made to reduce cost and time, but there are other dimensions of multimodal transportation as well. In this paper authors has analysed literature with a focus on quality perspective multimodal transportation using systematic literature review method. The research in area of multimodal transportation is in nascent stage. This work has been concluded with analysis of gaps in research done and providing a future direction of research targeted for improvement in multimodal transportation

A review of multimodal transportation optimization model Published in:s
ISBN Information: Publisher: IEEE 2018 5th International Conference on business Industrial Research (ICBIR) The major component of logistic system is multimodal transportation. This paper presents the various alternative methodologies available to multimodal transportation planning. There is an application need for network modelling approach the optimization of people and freight transportation with different techniques. In the process of selecting the most efficient transportation modes, a multimodal transport cost model is used to demonstrate and clarify multimodal transport routing alternatives. Risk factors are also considered for each route, transport modes and nodal links. The goal of this paper is to review literature concerning a generic multi transportation network model based on implementation of computational techniques to increase efficiency.

A Literature Review On Multimodal Freight Transportation Planning Under Disruption BY E E Rosyida, B Santosa and I N PujawanPublished under licence by IOP Publishing Ltd This paper reviews publication that focuses on multimodal freight transportation planning under disruptions. In this paper, disruptions are specified by the level of the disruptions occurs and the scope of its effect. This becomes an important distinction since the cause and effect that may occur at different levels. The failure to make this

SCOPE OF THE STUDY

The scope extends to:

- Analyzing all major transport modes (road, rail, sea, inland waterways) connected to Chennai Port.
- Reviewing government policies like **Sagarmala**, **Bharatmala**, and **National Logistics Policy**.
- Understanding the impact on **costs, time, emissions**, and **stakeholder satisfaction**.
- Including **urban planning and socio-economic** aspects like local congestion and job creation.
- Providing a **replicable model** for other Indian ports and logistics hubs.

RESEARCH METHODOLOGY

A **mixed-method research approach** was adopted:

- **Quantitative data** was collected via structured questionnaires answered by 30 respondents.
- **Qualitative insights** were obtained from interviews with port officials, logistics companies, and transport workers.

The research design is **descriptive and exploratory**, aiming to highlight existing practices, gaps, and areas for improvement.

Data was analyzed using:

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- **Statistical tools** for quantitative data (e.g., averages, frequency, Likert scales).
- **Thematic analysis** for qualitative data using coding to identify common themes and stakeholder concerns.

Sampling Technique

The study used **Simple Random Sampling** to select 30 participants from:

- Chennai Port Authority.
- Private logistics operators.
- Truck/rail cargo operators.
- Freight forwarders.
- Exporters/importers.
- Local residents affected by port traffic.

Each respondent had an equal chance of selection, ensuring a fair representation of the port's ecosystem.

Key Findings

- Majority of stakeholders felt **integration between modes is poor**.
- **Road transport dominates**, but it's **less cost-effective** and **more polluting**.
- **Rail and coastal shipping** are underutilized despite being cheaper and greener.
- **Digital tracking and coordination** systems are either outdated or not used effectively.
- **Port congestion and delays** have a **high impact** on customer satisfaction and operating costs.

LIMITATIONS OF THE STUDY

- Sample size is relatively small (30 participants).
- Limited by geographical scope—focused solely on Chennai Port.
- Time constraints prevented a deeper analysis of other competing ports.
- Some stakeholders were hesitant to share sensitive data or opinion

CONCLUSION

Chennai Port stands at a crossroads. It has immense potential to become a model for efficient, green, and globally competitive port logistics. However, to realize this, it must:

- Invest in **better infrastructure** (dedicated rail lines, inland terminals, digital systems).
- **Promote coastal shipping** and **develop river transport** networks.
- Align with **national logistics policies** and sustainability goals.
- Foster **public-private partnerships** to build and operate integrated logistics hubs.
- Use **data-driven decision-making** tools to enhance real-time coordination.

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