"A study of Hinterland Connectivity of Major Ports on the East Coast in India – A case study of KPL & CPA"

Project Report submitted in partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Port and shipping Management

by

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Under the guidance of

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Assistant Professor

SCHOOL OF MARITIME MANAGEMENT

INDIAN MARITIME UNIVERSITY

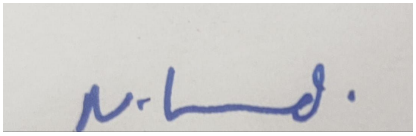
(A Central University under the Ministry of Ports, Shipping and Waterways, Govt of India)

MAY 2024

DECLARATION

I, **N. LEONARD BERNARD** bearing Register Number: **2203304014**, student of MBA – Port and shipping Management, at School of Maritime Management, Indian Maritime University, Chennai Campus, hereby declare that the project report titled **"A study of Hinterland Connectivity of Major Ports on the East Coast in India – A case study of KPL & CPA"** is my original work. This report is being submitted in partial fulfillment of the requirement for the award of the degree of Master of Business Administration (MBA) In Port and shipping Management (PSM)The project report is an output of my learning and observations of my research under the guidance of Dr.Lekha Ravi. Assistant Professor, School of Maritime Management, Indian Maritime University, Chennai Campus.

I declare that the information submitted is true and original to the best of my knowledge.

Signature: 

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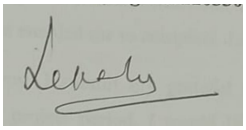
CERTIFICATE

This is to certify that this project report entitled **"A study of Hinterland Connectivity of Major Ports on the East Coast in India – A case study of KPL & CPA"**- submitted to the School of Maritime Management, Indian Maritime University, Chennai Campus in partial fulfillment of the requirement for awarding the degree, MBA in Port and shipping Management (PSM) is a genuine work of **N. LEONARD BERNARD (Reg No. 2203304014)**.

Project Guide 

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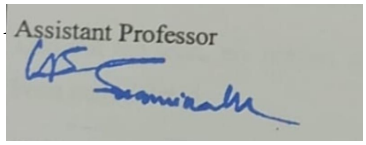

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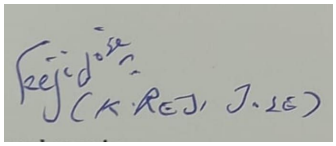

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Place: Chennai

Date: 10/05/2024

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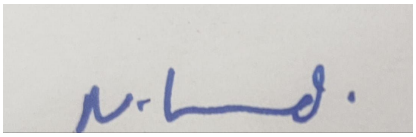
In a special way, I submit my grateful thanks to my family who motivated and encouraged me throughout the project period. I would like to profoundly thank all respondents who helped me in collecting the necessary information for the completion of this project.

Last but the least, my prayers and thanks to the "almighty" without whom the work would not have been materialized.



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EXECUTIVE SUMMARY

The study aims to examine the critical role of hinterland connectivity in enhancing the competitiveness of Chennai Port and Kamarajar Port (KPL) within the Indian bulk cargo handling sector. Recognizing the importance of efficient cargo movement for both ports, the study delves into a comparative analysis of their respective hinterland networks.

The research begins with a comprehensive review of existing literature on hinterland connectivity for ports, analysing factors such as transportation modes, industrial clusters, and policy frameworks. This review provides a foundation for understanding the broader context and identifying key considerations relevant to the specific case of Chennai Port and KPL.

Through in-depth analysis, the project examines the existing transportation infrastructure connecting each port to its hinterland, including road networks, railway connectivity, and potential for coastal shipping integration. Additionally, the research identifies key industries within each port's hinterland and analyses their cargo demands. The impact of government policies and infrastructure development initiatives on hinterland connectivity for both ports is also critically evaluated.

By comparing the strengths and limitations of hinterland connectivity for Chennai Port and KPL, the research identifies potential areas for improvement. This includes recommendations for infrastructure development, logistics enhancements, and strategic policy changes. The potential impact and feasibility of these recommendations are assessed to provide a realistic perspective on their potential to enhance competitiveness.

The project concludes by summarizing the key findings and highlighting the significance of optimizing hinterland connectivity for both ports. By drawing insights from the comparative analysis, the research offers valuable recommendations for strategic development initiatives that can propel Chennai Port and KPL towards achieving greater competitiveness within the Indian bulk cargo handling landscape as well as catering to future container trade.

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CHAPTER 1

INTRODUCTION

1.1: India Hinterland Connectivity

Unlocking the Trade Potential of India Major ports handle more than 95% of India's total trade volume, making them vital entry points for the nation's international trade. These ports serve as economic centres, drawing investments, creating jobs, and fostering regional growth. However, strong hinterland connectivity a system of effective transportation infrastructure linking ports to the large geographic areas they serve is necessary for them to reach their full potential. But major ports' real potential is revealed by their effective link to the hinterland, the large geographic region they service. The port and the surrounding areas can move goods with ease thanks to this connectivity, which is mainly made up of inland waterways, railroads, and roads. Faster transit times, reduced logistics costs, and ultimately increased port competitiveness in the world trade arena are all guaranteed by a well-developed hinterland network.

1.2: The Hinterland Connectivity's Critical Importance for Major Indian Ports

1.2.1: Gateway to Growth: India's principal ports are essential drivers of economic growth due to the country's extensive coastline and advantageous location. Along the whole value chain, they promote foreign investment, ease international trade, and generate job opportunities. However, robust hinterland connectivity is necessary to realize their full potential.

1.2.2: Bridging the Gap: The effective transportation of goods between ports and their inland centres of production and consumption is referred to as "inland connectivity." This includes networks of inland waterways, railways, and roadways as well as regulatory frameworks and logistics services. Movement that is efficient reduces time and cost of transportation, enabling imports and exports to be competitive. Potential

1.2.3: Diversification: By drawing in a variety of industries and cargo kinds, improved accessibility lessens reliance on a single commodity and boosts overall trade resilience. Producing Competitiveness Faster turnaround times along with lower logistics costs make Indian manufacturers more competitive in international markets.

1.2.4: Regional Development: By promoting economic growth and job creation in hinterland regions, improved connectivity helps to strengthen local economies. Opportunities and Challenges: There are a number of hinterland connectivity issues that India's main ports must deal with. Increased expenses and delays are a result of inadequate infrastructure, clogged roads, a lack of inland waterways, and dispersed logistics services. On the other hand, there are encouraging prospects provided by programs like Sagarmala, specific freight corridors, and port modernization projects.

1.2.5: Research Focus: analysing the two major east coast ports' hinterland connectivity will provide significant findings.

1.2.6: Comparative Analysis: By contrasting government policies, trade patterns, infrastructure, and logistics, best practices and areas for development can be found. Impact Assessment: Future plans and investments can be influenced by assessing how hinterland connectivity affects port competitiveness, regional development, and economic growth.

1.2.7: Policy Recommendations: Enhancing the competitiveness of ports and India's overall trade landscape can be achieved by making specific recommendations for infrastructure development, logistics improvements, and policy changes.

1.3: Two major Indian Ports selected as Case in Studies

For the purpose of studying hinterland connectivity, two major ports in Chennai region were chosen both the ports have common hinterland.

1.3.1: Chennai Port and Kamarajar Port (KPL)

On the dynamic eastern coast of India, two major ports stand as pivotal gateways to international trade and economic activity for South India: Chennai Port and Kamarajar Port (KPL). While Chennai Port boasts a rich legacy dating back to the 17th century, KPL, established in 2009, has emerged as a rising star in the maritime landscape. Together, they present a fascinating study in contrast and collaboration, each playing a distinct yet crucial role in the region's economic growth.

1.3.2: Chennai Port

Steeped in history, Chennai Port, the second-largest container handling port in India, thrives on its well-established infrastructure and diverse cargo handling capabilities. Nestled within the bustling city of Chennai, it serves as a vital trade artery, catering to a wide spectrum of industries like automobiles, textiles, and pharmaceuticals. Its network of berths, terminals, and specialized facilities efficiently manage containerized cargo, breakbulk, liquid cargo, and even cars. Notably, Chennai Port has also carved a niche in cruise tourism, offering a gateway for international travellers to explore India's cultural tapestry.

1.3.3: Kamarajar Port limited (KPL)

Approximately 30 km south of Chennai, KPL, formerly known as Ennore Port, has swiftly carved a niche as a prominent handler of bulk cargo, primarily focusing on coal, iron ore, and fertilizers. Its deep-water infrastructure allows for the navigation of larger vessels, contributing to efficient import and export operations. KPL's strategic location and ongoing expansion plans hold immense potential to attract investments and solidify its position within India's maritime trade ecosystem.

1.3.4: Collaboration and Competition

While both ports serve distinct cargo needs, they are not isolated entities. Chennai Port and KPL operate within a symbiotic relationship, complementing each other's strengths and addressing regional trade demands collaboratively. Chennai Port's established network and diverse cargo handling expertise benefit KPL by attracting feeder traffic and facilitating value-added services. Conversely, KPL's deep-water capabilities and focus on bulk cargo ease congestion at Chennai Port and cater to specific industrial requirements. This collaborative approach fosters the overall maritime trade ecosystem of South India.

1.3.5: A Shared Vision for Growth

Both Chennai Port and KPL face individual challenges, including infrastructure limitations, logistical complexities, and the ever-evolving global trade landscape. However, their shared commitment to modernization, technological advancements, and strategic partnerships positions them for continued success. Through ongoing investments in infrastructure, streamlined logistics operations, and

collaborative initiatives, these two ports are poised to remain vital pillars of South India's maritime trade, propelling the region towards a brighter economic future.

1.4: Objectives of the study:

The rapid growth of maritime trade on India's East Coast necessitates a thorough examination of the hinterland connectivity landscape for key ports like Chennai Port and Kamarajar Port (KPL). This research delves into this crucial aspect, aiming to gain a comprehensive understanding of their strengths, weaknesses, and potential for improvement. By analyzing infrastructure networks, logistics efficiency, trade patterns, and the impact of government policies, the research seeks to:

- To critically evaluate the hinterland connectivity of two major ports on the Eastern coast of India
- Analyzing the cargo movement from various regions to the Ports for export – connectivity by road, rail and air.
- Study the challenges of the Port Infrastructure in improving connectivity

1.5: Scope:

This research will focus on the following aspects of hinterland connectivity:

Infrastructure: Examine the quality, capacity, and connectivity levels of the inland waterway, rail, and road networks that link each port to its hinterland.

Logistics Services: Examine the cost, availability, and effectiveness of logistics services, such as freight forwarding, warehousing, and multimodal transport choices, at both ports.

Trade Patterns: Examine the kinds of cargo, the origin and destination locations, and the volume of trade that each port handles. Note any notable distinctions and parallels between these trade patterns.

Government Initiatives: Evaluate how government programs, such as infrastructure development projects, trade facilitation measures, and regulatory frameworks, will affect hinterland connectivity for both ports.

1.6: Research Methodology

1.6.1. Data Collection:

- **Secondary data:**
    - **Government reports:** Sagarmala Project documents, Ministry of Ports, Shipping & Waterways reports, Dedicated Freight Corridor Corporation of India reports.
    - **Port statistics:** Chennai Port Trust annual reports, KPL website data on cargo movement and infrastructure.
    - **Research publications:** Academic studies, journal articles on hinterland connectivity, port development, and trade logistics.
    - **Case studies:** Analysing specific challenges and solutions related to hinterland connectivity for Chennai Port and KPL.
    - **Site visits:** to both ports to observe infrastructure, logistics operations, and hinterland connections firsthand.

1.6.2. Data Analysis:

- **Qualitative analysis:**
    - Analyse interview transcripts, case studies, and reports to identify key themes, challenges, and opportunities related to hinterland connectivity.
    - Use content analysis techniques to categorize and interpret qualitative data.

1.6.3. Limitations and Scope:

- Limitations of data availability and access.
- Geographical scope of the hinterland analysis for both ports.

1.7: Chapter Scheme

1.7.1: Chapter 1: Introduction

- Briefly introduce the significance of bulk cargo handling in India.
- Highlight the roles of Chennai Port and KPL within the sector.
- State the research objective: Analyze and compare the hinterland connectivity of Chennai Port and KPL.

1.7.2: Chapter 2: Literature Review

- Review existing research on hinterland connectivity for ports, focusing on factors like:
    - Transportation modes (road, rail, coastal shipping)
    - Industrial clusters and cargo demand
    - Policy frameworks and infrastructure development initiatives
- Analyze studies specifically related to hinterland connectivity of Indian ports.

1.7.3: Chapter 3: Hinterland Connectivity Analysis of Chennai Port

- Analyze the existing transportation network connecting Chennai Port to its hinterland, including:
    - Road network infrastructure and connectivity to key industrial clusters
    - Rail network connectivity and potential for improvement
    - Coastal shipping potential for efficient cargo movement within the region
- Identify key industries within Chennai Port's hinterland and their cargo demands.
- Discuss the impact of government policies and infrastructure development initiatives on Chennai Port's hinterland connectivity.

1.7.4: Chapter 4: Hinterland Connectivity Analysis of Kamarajar Port (KPL)

- Analyze the existing transportation network connecting KPL to its hinterland, including:
    - Road network infrastructure and connectivity to key industrial clusters in South India
    - Dedicated railway network within the port complex and potential for expansion
    - Coastal shipping potential for specific cargo types
- Identify key industries within KPL's hinterland and their cargo demands.
- Discuss the impact of government policies and infrastructure development initiatives on KPL's hinterland connectivity.

1.7.5: Chapter 5: Comparative Analysis

- Compare the strengths and limitations of hinterland connectivity for both Chennai Port and KPL, considering:
    - Diversification of transportation modes

    - Geographical reach and coverage of key industrial clusters
    - Efficiency and cost-effectiveness of cargo movement
- Analyze the potential impact of hinterland connectivity on the overall competitiveness of each port.

1.7.6: Chapter 6: Conclusion

- Summarize the key findings from the comparative analysis of hinterland connectivity for Chennai Port and KPL.
- Highlight the distinct advantages and challenges faced by each port in terms of hinterland reach and cargo movement efficiency.
- Draw an overall conclusion about the relative effectiveness of hinterland connectivity strategies for both ports within the Indian bulk cargo handling sector.

CHAPTER 2

Literature review

2 .1: Introduction:

This research project delves into the crucial topic of hinterland connectivity for Chennai Port and Kamarajar Port (KPL). Before diving into our analysis, it's essential to examine what existing research has established on this subject. This review of literature will explore the various studies and reports that have investigated hinterland connectivity for ports in general, with a specific focus on those analyzing Indian ports. By examining the findings of previous research, we gain a deeper understanding of the key factors influencing hinterland connectivity, including transportation modes, industrial clusters, and policy frameworks. This comprehensive review will serve as a foundation for our own analysis, allowing us to identify potential research gaps and tailor our investigation to address the specific context of Chennai Port and KPL within the Indian bulk cargo handling sector.

2.2: Review of Literature:

2.2.1: A STUDY ON THE INFRASTRUCTURAL FACILITIES OF THE SEAPORTS IN CHENNAI CLUSTER

Authors: **Rajasekar and Dr. J. Rengamani.**

Research Objectives: The paper aims to identify and compare the opinions of the seaport users about the infrastructural facilities and port connectivity of three seaports in Chennai Cluster: Chennai Port, Kamarajar Port and Kattupalli Port

Research Methodology: The paper uses a questionnaire survey with a sample size of 150 port users, selected by multistage random sampling method. The infrastructural facilities and port connectivity are measured on a five-point Likert scale. The data are analysed using descriptive statistics and one-way analysis of variance (ANOVA).

Research Findings: The paper finds that there is a significant difference in the opinion of the port users about the infrastructural facilities and port connectivity of the three seaports. The paper identifies the lack of availability of the required infrastructure in all the three seaports as compared to the international seaports. The paper also discusses the future prospects and challenges of the seaports in Chennai Cluster.

2.2.2: Modeling challenges affecting the performance of major ports of India

Authors: Neeraj Kumar Jha and V.P.S.N Nanyam

Research Objectives

The paper aims to analyze the operational, service quality, and financial performance of 12 major ports of India from 2013 to 2020. It also seeks to identify the critical challenges that affect their performance.

Research Methodology

The paper uses data envelopment analysis and interpretive structural modeling techniques to measure the performance of the ports and identify the challenges. The performance is measured based on three dimensions: operational (output per ship berth day), service quality (inverse of turnaround time), and financial (profit). The challenges are identified and classified into four categories: autonomous, dependent, linkage, and independent variables.

Research Findings

The paper finds that there is a significant variation in the performance of the ports, with some ports performin[1]g well in all dimensions and others performing poorly. The paper identifies 19 challenges that affect the performance of the ports, such as inadequate mechanization, tariff issues, environmental issues, etc. The paper also constructs a hierarchy model of the challenges to show their causal relationships and influences. The paper concludes that addressing these challenges is crucial for [2]improving the performance of the ports.

[111] https://iaeme.com/MasterAdmin/Journal_uploads/IJCIET/VOLUME_8_ISSUE_11/IJCIET_08_11_062.pdf

https://www.researchgate.net/publication/371911200_Modeling_challenges_affecting_the_performance_of_major_ports_of_India

[2]

2.2.3: A Study on the Port Hinterland Connectivity of Chennai Port Sector

Authors: **Rajasekar and Dr. J. Rengamani.**

Port Hinterland Connectivity

The paper studies the factors affecting the port hinterland connectivity of Chennai Port, which is a major seaport in India that faces congestion and competition from other ports.

Literature Review

The paper reviews the existing literature on port congestion, port competitiveness, port infrastructure, port logistics, and port IT systems, and identifies the gaps and challenges in the field.

Research O[3]bjectives and Hypotheses

The paper aims to examine the opinion of the port users on the port hinterland connectivity and IT logistics factors of Chennai Port, and tests the hypotheses using one-way ANOVA.

Methodology and Data Analysis

The paper uses a questionnaire survey to collect data from 150 port users of Chennai Port, and applies descriptive statistics and one-way ANOVA to analyze the data.

Conclusion

The paper finds that there is a significant difference in the opinion of the port users on various port hinterland connectivity and IT logistics factors of Chennai Port, and suggests some recommendations to improve the port performance and competitiveness

[3] https://www.ijitee.org/wp-content/uploads/papers/v8i4/D2853028419.pdf

2.2.4: Port Connectivity in India

The article discusses the importance of enhancing t[4]he connectivity of major and non-major ports in India with the hinterland, as it affects the port efficiency and trade competitiveness.

Comprehensive Port Connectivity Plan: The article mentions a plan prepared by the DPIIT in consultation with other ministries and state boards, which incorporates 298 connectivity projects, both road and rail, to improve the last mile and hinterland connectivity of ports.

Current Status of Port Connectivity: The article reports that all major ports are connected by rail and by four-lane road or national highways, and that 13 out of 66 non-major ports handling cargo are connected by rail, while 24 are connected by four-lane roads or national highways.

Future Prospects of Port Connectivity The article states that smooth connectivity to ports is crucial for meeting the projected increase in traffic and for leveraging the potential of domestic waterways (coastal shipping and inland waterways) as an alternative mode of transport.

The Comprehensive Port Connectivity Plan (CPCP) is a significant initiative by the Department for Promotion of Industry and Internal Trade (DPIIT) in India. It was prepared in consultation with the Ministry of Ports, Shipping and Waterways, Ministry of Railways, Ministry of Road Transport & Highways, and State Maritime Boards.

The CPCP includes 298 connectivity projects, both road and rail, which are currently enhancing the last mile and hinterland connectivity of ports. These projects are aimed at improving port efficiency, enabling the ports to handle more cargo.

The plan is part of a broader effort to improve infrastructure and logistics in India, which will in turn boost trade and economic growth[1]. The projects under the CPCP are primarily undertaken by the Ministry of Railways and Ministry of Road Transport & Highways on a priority basis.

[4] https://www.maritimegateway.com/connectivity-to-ports-in-india-has-significantly-improved/

2.2.5: Malaysian Container Seaport-Hinterland Connectivity: Status, Challenges and Strategies

Authors: Shu-Ling chena , Jagan jeevanb , Stephen cahoonc

***Introduction*:**

The Malaysian container seaport-hinterland connectivity plays a crucial role in facilitating trade and improving market access. The availability of efficient transport infrastructure, modal options, and reliable services connecting seaports and hinterlands are essential for a well-connected seaport). However, the existing literature on this topic is limited, and there is no international standard for measuring hinterland connectivity

Challenges in Hinterland Connectivity

The Malaysian container seaports are primarily connected to their hinterlands through road transport, leading to an imbalanced modal split. Insufficient rail capacity and limited train services further hinder the development of efficient hinterland connectivity Additionally, road congestion and space restrictions in inland facilities pose challenges to the seamless movement of goods

Stra[5]tegies for Improving Hinterland Connectivity

To enhance the quality of hinterland connectivity in Malaysian container seaports, several strategies can be i[6]mplemented. These include:

1. Modal Shift: Encouraging a shift from road to rail transport can help alleviate road congestion and reduce the dependence on a single mode of transportation
2. Rail Capacity Enhancement: Increasing rail capacity and improving train services can enhance the efficiency of hinterland connectivity, providing a viable alternative to road transport
3. Inland Freight Facilities: Strengthening the capacity and capabilities of inland facilities such as dry ports and ICDs can facilitate seamless connections between exporters, importers, and seaports, promoting regional and cross-border trades

Measurement of Hinterland Connectivity

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https://www.sciencedirect.com/science/article/pii/S2092521216300438#:~:text=This%20paper%20suggests%20that%20the,train%20services%2C%20increasing%20road%20congestion

Measuring the performance of seaport-hinterland connectivity is a complex task. Existing indices such as the Logistics Performance Indices (LPI) and Trading Across Borders Indices provide some measures related to hinterland transport, including cost efficiency, time efficiency, and transport infrastructure (UNECE, 2010). However, there is a need for an integrated methodology to accurately measure seaport connectivity, considering both foreland and hinterland connections

Conclusion

The Malaysian container seaport-hinterland connectivity faces challenges such as an imbalanced modal split, insufficient rail capacity, road congestion, and space restrictions in inland facilities. To overcome these challenges, strategies such as modal shift, rail capacity enhancement, and strengthening inland freight facilities can be implemented. However, there is a need for an integrated methodology to accurately measure the performance of seaport-hinterland connectivity

2.2.6: Infrastructure and connectivity in India getting the basics right

(Purva Singh and Rajat Kathuria, 2016)

This research report defines the importance of infrastructure and connectivity of ports for India's overall economic development. This report first provides the insights on how the transportation and logistics process are currently running in India. Inadequacies of physical infrastructure and equipment coupled with cumbersome administrative procedures have burdened India's logistics network. These deficiencies manifest themselves in higher transport times and costs, reduced reliability, lower availability of quality services, and a higher risk of damage or pilferage. This report compares how Chinese investment proves effective and gives a comparison with that of Indian Investments. India's ports desperately need to ramp up capacity and efficiency to meet the swelling. Demand. Port efficiency is critical to the success of any strategy to integrate a country with. The global trade system. Ports' turnaround time in India remains slow by world and regional. Standards and the connections between the wharf and inland transport need to be improved. Next it goes to how the investment in India is currently happening in the trends and challenges Strengthening of bond markets and mobilizing domestic savings to infrastructure. The need for developing the domestic corporate bond market is inevitable. Long-term bonds form a. Major share of infrastructure finance in developed nations. The Indian corporate bond. Market is less than 5% of GDP. The 12th FYP report states that the market for infrastructure. debt generically belongs to the

corporate bond market and without the latter, movement in The former is unlikely. Next the report focussed on the infrastructure development and role of public-private partnerships. The reasons are plain. Many PPP projects in India have suffered from large time and cost overruns and could not meet expectations regarding transparency and accountability. An evaluation of the impact of the PPP infrastructure projects reveals that the major benefit of PPPs has been to speed up infrastructure deployment, provide possible short-term release of fiscal pressures and for India, these partnerships have often offered better value-for-money.[7]

2.2.7: Challenges and Strategies of Abidjan Port-Hinterland Connectivity

Authors: Pascal Kany Prud'ome Gamassa and Yan Chen

Abidjan port-hinterland is composed of three countries which include Ivory Coast, Mali and Burkina Faso. The fast economic growth of the above countries resulted to a greater demand for the foreign goods from their population, causing a congestion problem at Abidjan port. Because of this problem, the connectivity movement between the port and its hinterland has considerably slowed down. In this article a qualitative methodology is used to analyse the Abidjan port-hinterland connectivity. The constant delays of the train services, the road congestion and the lack of coordination and communication between Abidjan port and its hinterland customers are the main presented challenges. The results of this research demonstrate that the poor-quality roads and railways and the lack of a new dry port in Ivory Coast greatly affects the fluidity of the Abidjan port-hinterland connectivity. This article suggests some strategies on how to solve the current challenges and will be helpful in deciding on how the Abidjan port should be developed better and improve its connectivity with its hinterland.

2.2.8: Tianjin Port-Hinterland Connectivity to Mongolia: Challenges and Strategies

Authors:khailiun nasanjargal, pascalkany prudome gamassa, yan chen

Background: The authors introduce the topic of port-hinterland connectivity and its importance for international trade and economic development. They explain the challenges and opportunities of

[7] (PDF) Infrastructure Development in India (researchgate.net)

connecting Tianjin port, a major gateway in China, to Mongolia, a landlocked country with abundant mineral resources.

Literature Review: The authors review the existing literature on port-hinterland connectivity, focusing on four aspects: the relationship between port competition and hinterland connections, the harmonious operation of logistics finance management of supply chain in ports-hinterland, the mode selection for developing port logistics, and the [8]improvement of rail-sea multimodal transport with dry port construction. They identify the main theories, methods, and findings of previous studies, as well as the gaps and lim[9]itations in the current knowledge.

Research Questions: The authors formulate two research questions based on the l[10]iterature review:

1) What are the main challenges of Tianjin port-hinterland connectivity to Mongolia?

(2) What are the possible strategies to overcome these challenges and improve the efficiency and effectiveness of the connectivity?

Research Methodology: The authors describe the research methodology they use to answer the research questions. They adopt a qualitative approach, using interviews with various stakeholders involved in the port-hinterland connectivity, such as port authorities, customs officers, logistics companies, railway companies, and customers. They also use secondary data from official statistics and websites to supplement the primary data. They analyze the data using thematic analysis and SWOT analysis.

2.2.9: HINTERLAND CONNECTIVITY OF MALAYSIAN CONTAINER SEAPORTS: CHALLENGES AND SOLUTIONS

[8]https://www.researchgate.net/publication/320102883_Challenges_and_Strategies_of_Abidjan_Port-Hinterland_Connectivity

https://www.researchgate.net/publication/297518794_HINTERLAND_CONNECTIVITY_OF_MALAYSIAN_CONTAINER_SEAPORTS_CHALLENGES_AND_SOLUTIONS

https://www.researchgate.net/publication/297518794_HINTERLAND_CONNECTIVITY_OF_MALAYSIAN_CONTAINER_SEAPORTS_CHALLENGES_AND_SOLUTIONS

[10]

Authors: Shu-Ling chena , Jagan jeevanb , Stephen

Hinterland Connectivity of Malaysian Container Seaports: This paper evaluates the physical infrastructure and services that link the major container seaports in Malaysia with their hinterlands, such as road and rail transport, and inland freight facilities.

Challenges and Strategies: This paper identifies the existing challenges of seaport-hinterland connectivity, such as imbalanced modal share, insufficient rail capacity and services, road congestion and space constraints of inland facilities. It also suggests some strategies to improve the quality and efficiency of hinterland connectivity, such as enhancing rail services, developing new dry ports, and fostering collaboration among stakeholders.

Methodology and Data: This paper adopts a qualitative methodology based on relevant literature, government data, and interviews with seaport operators, authorities, rail operator and intermodal terminal operators in Malaysia.

Implications and Future Research: This paper contributes to the understanding of seaport-hinterland connectivity in Malaysia and its impact on seaport competitiveness and regional economic development. It also highlights the need for further research on the institutional and people dimensions of seaport-hinterland connectivity.

2.2.10: Hinterland Connectivity Analysis of a Binary Port System: Case of Paradip and Dhamra Ports

Authors :Triveni nanda

This thesis examines the hinterland-port connectivity in Odisha, India, focusing on the Paradip and Dhamra ports. Despite coastal shipping being a significant part of India's international shipments, the state of Odisha, with its long coastline and booming steel industry, has faced challenges due to having only one operational port, Paradip. The recent operation of Dhamra port has posed competition for Paradip. The thesis identifies issues in the connectivity of these ports with their hinterlands and assesses the regional logistics imbalance. Using authenticated data, fuzzy matching algorithms, and GIS-based maps, the study performs a demand-supply interaction analysis at a regional level. The Herfindahl-Hirschman Index and Shift-Share analysis are used to measure the impact of these ports on the region

and each other. The findings propose interventions like new highway routes and railway lines, a crude regional plan involving both ports and the integrated hinterland, and a logistics hub at Chandikhole.

2.2.11: Port Hinterland Connectivity, the Role of Inland Waterways a Bangladesh Perspective

Authors : K.R. Hasan, M.R.H. Khondoker

Bangladesh is becoming more and more a trading nation. The latest data of World Bank shows the share of import-export is 40% of the GDP. As international trade has a strong linkage with maritime trade, the same is observed here is Bangladesh as well. Sharp increase in the figure of cargo handling both bulk and containers in the maritime ports indicates the adequacy of the significance of international trade in economic development. In order to keep pace with the incremental trend of international trade in parallel to the maritime port development its hinterland connectivity is also necessary to establish requiring huge investment in different modes of transports like road, rail and inland waterways. A country with high population density as well as the largest delta of the world would be more cost and environment effective to diverse more and more cargo to inland waterways. This paper has been structured by reviewing the importance of hinterland connectivity in relation to port operation, port efficiency as a whole port development followed by a brief discussion of the international trade pattern of Bangladesh. Later on a comparative analysis of the performance of different modes of surface transport in facilitating the hinterland services of the Maritime Ports has been highlighted here. Finally comparative advantages of inland waterways to compliments other modes of transport as well as a logistical approach of overcoming the drawbacks it possesses.

2.2.12: ASSESSING [11]THE HINTERLAND OF MARITIME PORTS IN THE EUROPEAN NORTHERN RANGE

Authors: Ralf elbert, Michael gleser, frank van der laan.

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https://www.researchgate.net/publication/321835855_Port_Hinterland_Connectivity_the_Role_of_Inland_Waterways_a_Bangladesh_Perspective

https://www.researchgate.net/publication/321835855_Port_Hinterland_Connectivity_the_Role_of_Inland_Waterways_a_Bangladesh_Perspective

Research Objective: The paper aims to assess the impact of additional hinterland connections on the inter-port competition among the major ports in the European Northern Range, especially for the region of North Rhine-Westphalia (NRW) in Germany.

Simulation Model: The paper develops an agent-based simulation model that recreates the intermodal connectivity to all relevant ports from NRW, based on data from port information systems, vessel call positions, container creation frequencies, and utility scores for different transport options.

Experimental Assessment: The paper uses the simulation model to experimentally evaluate the changes in port and mode choice for different regions in NRW, by adding or modifying the frequencies of intermodal connections, such as train services.

Managerial Insights: The paper provides some managerial insights for port authorities and hinterland operators, such as the po[12]tential modal shift from truck to intermodal transport, the need for further calibration and validation of the model, and the importance of qualitative studies to complement the simulation results.

2.2.13: An extended notion of hinterland connectivity to analyze multimodal integration in European hinterland service networks

Authors: camil harter , otto koppius , rod zuidwijk

In this research paper, the authors discuss the concept of hinterland connectivity in the context of port development. They provide empirical data to substantiate existing qualitative findings and highlight the role of extended gates in port development. The authors also introduce an extended notion of connectivity, which sheds light on the changing dynamics of the European hinterland transport network as it evolves into a multimodal service network.

The project emphasizes the importance of understanding hinterland connectivity beyond the number and frequency of sea port-to-hinterland connections. It explores the impact of increasing competition for hinterlands between sea ports and the role of (inland) ports in the evolving transport system. The authors suggest that this

12 https://www.researchgate.net/publication/357174593_ASSESSING_THE_HINTERLAND_OF_MARITIME_PORTS_IN_THE_EUROPEAN_NORTHERN_RANGE

extended notion of connectivity is applicable beyond the European hinterland network and can be useful for intermodal infrastructure and corridor planning.

The project provides a comprehensive review of relevant literature on hinterland transport and network connectivity. It discusses various definitions and levels of port connectivity, including local, network-wide, and multimodal connectivity. The authors analyze the extent to which the existing literature covers these levels of connectivity and highlight the contribution of their progressive level of connectivity in providing more comprehensive insights.

The dataset used and the methodology employed for the analysis are introduced in the project. The results of the analysis serve as a basis for the subsequent discussion on hinterland connectivity and port positioning. The project concludes with an outlook for future research in this area.

Overall, this project offers valuable insights into the concept of hinterland connectivity in port development. It provides empirical evidence to support existing qualitative findings and introduces an extended notion of connectivity that contributes to a better understanding of the evolving transport system. The literature review presented in the project lays the foundation for further research in this field.

2.2.14: Evaluating Determinants of Effective Port-Hinterland Connectivity in Shanghai

Authors: Hee-Yong Leea , Shuangshuang Kongb , Young-Joon Seoc

The research paper, "Evaluating Determinants of Effective Port-Hinterland Connectivity in Shanghai Ports," focuses on the significance of port-hinterland connectivity in the context of global logistics supply chains, particularly with regard to the Shanghai container ports. The study aims to identify the main factors influencing port-hinterland connectivity and to analyze the current situation of hinterland accessibility in Shanghai container ports. The research uses primary data collected through a questionnaire to understand the perceptions of stakeholders regarding the importance of various factors and their current performance levels.

The research paper emphasizes the pivotal role of port-hinterland connectivity in the global logistics supply chain, highlighting the close connection between hinterland accessibility and a port's supply chain. It identifies factors such as punctuality of shipping services, port capacity, port infrastructure, handling operations, safety and securi[13]ty, and regional accessibility as crucial determinants of effective port-hinterland connectivity. Moreover,

[13] https://www.researchgate.net/publication/321835855_Port_Hinterland_Connectivity_the_Role_of_Inland_Waterways_a_Bangladesh_Perspective

https://www.researchgate.net/publication/322207147_Evaluating_Determinants_of_Effective_Port-Hinterland_Connectivity_in_Shanghai_Ports

the study employs the Importance-Performance Analysis (IPA) to evaluate the importance and performance of these factors, revealing the existing gap between importance and performance levels for certain factors, such as punctuality of transport connections and regional accessibility.

Furthermore, the research paper underscores the significance of government assistance in supporting logistics policies and financing, indicating that this factor is considered highly important and relatively satisfying in terms of current performance. The analysis also emphasizes the role of intermodal transportation and the development of dry ports as potential solutions to improve punctuality of hinterland transportation and regional accessibility, respectively. Additionally, the study suggests fostering information sharing and channel integration across port supply chains to enhance port-hinterland connectivity.

In conclusion, the research sheds light on the critical determinants of effective port-hinterland connectivity in Shanghai ports and provides insights into areas requiring improvement. It emphasizes the importance of addressing the identified gaps between the perceived importance and current performance levels of key factors to optimize port-hinterland logistics. The findings underscore the significance of punctuality in hinterland transportation and regional accessibility, and highlight the need for collaborative efforts and infrastructure development to enhance port-hinterland connectivity in the context of global logistics supply chains.

2.2.15: Port Connectivity Model in The Perspective of Multimodal Transport: A Conceptual Framework

Authors: F Indriastiwi , sigit pranowo hadiwardoyo , nahry yusuf

Introduction:

The paper proposes a conceptual framework for port connectivity in the multimodal perspective, which considers three aspects: maritime, hinterland, and port connectivity.The paper uses generalized transport cost as a common measurement for different aspects of port connectivity.The paper aims to fill the gap in the literature on port connectivity, which is mostly analysed only on one aspect.

Port Connectivity Model: The paper proposes a conceptual framework to measure port connectivity from a multimodal perspective, using generalized transport cost as a common variable.

Three Aspects of Connectivity: The paper considers three aspects of port connectivity: maritime connectivity, hinterland connectivity, and connectivity at the port. Each aspect has different variables and measurements that affect the generalized transport cost.

Accessibility Analysis: The paper u[14]ses accessibility analysis based on the generalized transport cost to assess the port connectivity. The paper adapts the accessibility matrix and the relative accessibility function from previous studies to calculate the port connectivity index.

Policy Scenarios: The paper suggests that the port connectivity model can be used to evaluate different policy scenarios that aim to improve the port connectivity, such as developing port infrastructure, enhancing shipping services, or reducing transport costs.

[14] https://iopscience.iop.org/article/10.1088/1757-899X/1052/1/012008/meta

Chapter 3

Hinterland Analysis of Chennai Port

3.1: Introduction of Chennai port:

Chennai Port, a vital gateway for South India's maritime trade, boasts a robust infrastructure catering to diverse cargo needs. Spread across three docks - Dr. Ambedkar, Satguru Ramaswamy (formerly Jawahar), and Bharathi Dock - its core strength lies in a well-developed road, rail, and container terminal network.

India's economic growth is intricately linked to its thriving maritime trade sector. As a nation with a vast coastline, strategic ports play a crucial role in facilitating international trade, promoting industrial development, and generating employment opportunities. Among these key ports, Chennai Port stands tall as a prominent gateway to South India.

3.1.1: A Legacy of Maritime Excellence:

Chennai Port (formerly Madras Port) boasts a rich history dating back centuries. Established during the British Raj in the 17th century, it has evolved into a modern, multi-cargo port handling a diverse range of cargo types. Today, Chennai Port serves as a vital economic engine for the region, contributing significantly to the growth of Tamil Nadu and surrounding states.

3.1.2: Focus on Multi-Cargo Capabilities:

Unlike its neighbour, Kamarajar Port (KPL) which specializes in bulk cargo, Chennai Port caters to a wider spectrum of cargo needs. It boasts dedicated facilities for:

- **Containerized Cargo:** This dominant category includes manufactured goods, electronics, textiles, and pharmaceuticals. Chennai Port serves as a key hub for containerized cargo movement, facilitating India's integration with global trade networks.
- **Bulk Cargo:** Coal, iron ore, and fertilizers form a significant portion of cargo handled. These cater to domestic consumption and international trade.
- **Liquid Cargo:** Petroleum products, edible oils, and chemicals contribute a smaller yet important share.
- **Other Cargo:** Automobiles, project cargo, and agricultural products also find their way through Chennai Port, highlighting its diverse capabilities.

3.1.3: Strategic Location and Hinterland Reach:

Chennai Port enjoys a strategic location on the Bay of Bengal, offering easy access to major shipping lanes and international markets. Its well-developed hinterland network connects it to industrial clusters in Tamil Nadu, Andhra Pradesh, and Karnataka. This extensive reach empowers Chennai Port to act as a vital link between these regions and global trade.

Understanding Chennai Port's functionalities and challenges is crucial for:

- **Optimizing port operations:** This knowledge can guide investments in infrastructure upgrades, technology adoption, and operational efficiency improvements.
- **Informing policy decisions:** Insights gained can influence the formulation of trade facilitation measures, hinterland development strategies, and overall port development policies.
- **Promoting regional development:** Chennai Port's growth can create a positive ripple effect on surrounding regions, fostering industrial development and employment opportunities

3.1.4: Road Network:

Roadway traffic:

Fig. No:3.1.4 Chennai-Bangalore Highway (NH 4)

[15] 3.1https://images.app.goo.gl/gppq5o9HPGALTkCK8

The Chennai-Bangalore Highway (NH 4) sees 50,000–100,000 daily vehicles, with 30–40% of those being freight traffic.

Fig. No:3.1.4 Chennai-Kolkata Highway (NH 5)

NH 5 (Chennai-Kolkata Highway): 20–30% of traffic is freight,[16] with 30,000–50,000 vehicles per day.

Fig. No:3.1.4 Chennai-Trichy Highway (NH 45)

3.2:https://images.app.goo.gl/V2GShB7Q5m997Tbc7
3.3:https://images.app.goo.gl/yCQRxQVqyVNycebEA

NH 45 (Chennai-Trichy Highway): 20–25% of traffic is freight, with 20,000–30,000 vehicles per day.

3.1.5: Other Roadways:

The Chennai Outer Ring Road (ORR): sees an increase in freight traffic with 20,000–40,000 vehicles per day.

State Highways and District Roads: These vital routes facilitate local freight movement by linking Chennai with neighboring towns and villages.

3.1.6: Railways:

- Southern Railway: Chennai Egmore and Chennai Central divisions handle rail cargo movement to and from the port.
- Dedicated Freight Corridors: The Chennai-Bangalore and Chennai-Kolkata corridors are under construction, aiming to improve efficiency and capacity.
- Frequency and Capacity: Over 80 freight trains operate daily on existing lines, transporting commodities like automobiles, textiles, leather goods, engineering goods, and agricultural products.

- Connectivity: Southern Railway connects Chennai to major industrial and agricultural hubs across India, including Bengaluru, Hyderabad, Kolkata, and Mumbai.

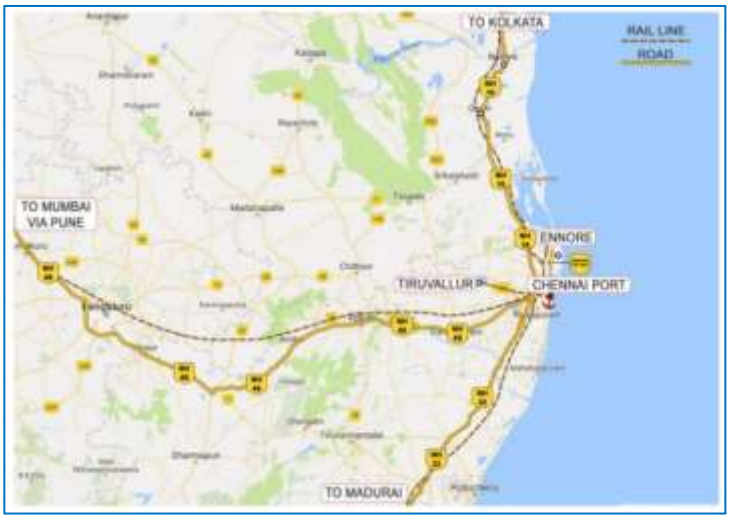

Fig. No:3.1.6: Railway connectivity

3.1.7: CFS (Container Freight Station):

A CFS is a secure, designated area outside the port where import and export containers are temporarily stored and handled. They offer various services, including:

- De-stuffing and stuffing of containers[17]
- Customs clearance procedures
- Inspection and fumigation
- Consolidation and deconsolidation of cargo
- Storage facilities

3.4:https://www.google.com/imgres?imgurl=x-raw-image%3A%2F%2F%2Fcda8fba759e3ff585ef581f5f0c9cacfd7a9b515f3c9383f0749ef0825000668&tbnid=WP_jWaf7qM20kM&vet=1&imgrefurl=https%3A%2F%2Fwww.chennaiport.gov.in%2Fsites%2Fall%2Fthemes%2Fnexus%2Ffiles%2Fpdf%2Fmasterplan1.pdf&docid=iWUDxjFBqz8Q3M&w=967&h=676&hl=en-IN&gl=IN&source=sh%2Fx%2Fim%2Fm1%2F2&kgs=a35b0a3d18d38fc1&shem=abme%2Ctrie

Chennai Port: Due to its larger size and cargo volume, Chennai Port boasts a wider network of CFS facilities. These are strategically located near the port terminals, often within a 10-20 km radius, in areas like:

- Manali
- Ambattur
- Thiruvanmiyu

Fig.No:3.1.7: CFS near to Chennai port

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3.5:https://www.google.com/maps

3.1.8: Hinterland Air Connectivity:

While Chennai does have an international airport, air cargo typically plays a smaller role in hinterland connectivity for Chennai Port compared to road, rail, and waterways. This is because airfreight is generally more expensive and suited for high-value, time-sensitive cargo.

[19]Table 3.1.8: Hinterland Air Connectivity:

Port	Nearby Airports	Distance (km)	Cargo Handling Facilities
Chennai Port	Chennai International Airport	20	Dedicated air cargo terminal with capacity for 300,000 tonnes annually

3.1.9: Average Daily Traffic (ADT) & Freight Traffic Percentage:

Data on the exact Average Daily Traffic (ADT) for various transportation modes like railways might not be readily available on the Chennai Port Trust website. However, reports might provide insights into the overall freight traffic distribution between road, rail, and potentially coastal shipping.

Table 3.1.9: Average Daily Traffic (ADT) and Freight Traffic Percentage:

Port	Highway	ADT (Vehicles per day)	Freight Traffic Percentage
Chennai Port	NH 45 (Chennai-Trichy Highway)	30,000-40,000	35-40%

[19] https://www.ennoreport.gov.in/content/

Chennai Port	NH 16 (Chennai-Kolkata Highway)	20,000-30,000	25-30%

3.1.10: Railways:

Chennai Port has a well-established railway network connecting it to major industrial clusters and cities within its hinterland. This allows for efficient and cost-effective transportation of bulk cargo over long distances. The exact percentage of freight traffic handled by railways would require examining Chennai Port Trust reports or data from Indian port authorities.

[20]Table 3.1.10: Railways:

Port	Railway Network	Freight Trains per day	Key Cargo
Chennai Port	Southern Railway	80+	Containers, automobiles, petroleum products, coal

3.1.11: Commodity Breakdown:

Chennai Port handles a diverse range of commodities. Key import categories include mineral oils (petroleum), fertilizers, chemicals, and vegetable oils. Iron ore, machinery, vehicles, and containerized cargo (electronics, etc.) are significant export categories. The specific percentages can vary depending on the data source and time period analyzed. You can find more details on commodity breakdowns in Chennai Port Trust reports or maritime data platforms.

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[20] https://www.chennaiport.gov.in/home
[21] https://www.chennaiport.gov.in/home

Table 3.1.11: Commodity Breakdown:

Category	Imports (%)	Exports (%)
Mineral Oils & Other POL (Petroleum, Oil, and Lubricants)	50%+	-
Fertilizers (Including Phosphate)	10-15%	-
Chemicals (Including Phosphoric Acid, Soda, and Sulphur)	5-10%	-
Vegetable Oils	5-8%	-
Iron Ore	-	20-30%
Machinery, Mechanical Appliances, etc.	-	10-15%
Vehicles (Other Than Railway or Tramway)	-	5-10%
Containerized Cargo (Diverse Goods)	10-15%	-
Other Manufactured Goods	Variable	Variable

3.2: Logistics Services:

3.2.1: Accessibility:

3.2.1.1: Freight forwarding:

Analyze the existence and competencies of the main freight forwarding businesses in Chennai and the surrounding areas. List the services they provide, such as: Services for Full Container Load (FCL) and Less than Container Load (LCL) Handling documentation and clearing customs solutions for multimodal transportation (road, rail, sea) services with extra value, such as tracking, packing, and cargo insurance

3.2.1.2: Storage:

Analyze the port's and its hinterland's warehouse availability and capacity. Sort them according to types:Bonded storage facilities for duty-free merchandise Container Freight Stations (CFS) for the purposes of consolidation and de-consolidation specialized storage facilities for particular kinds of cargo, such as hazardous materials and perishables Examine how much automation and technological integration are present in warehouses.

3.2.1.3: Containerization:

Evaluate the effectiveness and capacity of the port's container handling infrastructure. Take into account: The availability of equipment (cranes, reach stackers) and space for container yards. Container dwell times and how they affect the cost of logistics Existence of vacant container depots and ease of access to them

3.2.1.4: Multimodal Transport:

Analyze the availability and efficiency of multimodal transport options connecting Chennai Port to its hinterland. Evaluate: Intermodal connectivity involving inland waterways, rail, and roads Existence of specific freight corridors and how they affect travel times Combining multimodal transportation services with additional logistics offerings

3.2.2Efficiency:

Handling of Cargo: Examine how long cargo typically stays in the port and important hinterland hubs. Determine which cargo movement bottlenecks and delays exist. Documentation Clearance: Assess the effectiveness of automation and electronic data interchange (EDI) in the customs clearance process. Information Technology: Evaluate logistics service providers' use of technology, taking into account their online presence, track-and-trace capabilities, and system integration with government and port systems.

3.2.3:Costs:

Examine the prices of different logistics services at Chennai Port in comparison to other significant Indian ports or national standards. Add the following expenses: Inland transportation (by rail, road, and inland waterways)

- Warehousing and storage
- Container handling charges
- Customs clearance fees
- Value-added services

3.3: Examining Trade Patterns of Chennai Port:

Chennai Port, a vital maritime gateway for South India, boasts diverse trade patterns encompassing various cargo types, origins, destinations, and hinterland reach. Analyzing these patterns provides valuable insights into its economic significance and potential for growth.

3.3.1: Cargo Types:

- **Containerized cargo:** Dominant category, including manufactured goods, electronics, textiles, and pharmaceuticals. Originates from industrial clusters in Tamil Nadu, Karnataka, and Andhra Pradesh. Destined for global markets, particularly Europe, North America, and Southeast Asia.
- **Bulk cargo:** Coal, iron ore, and fertilizers form a significant portion. Sourced from domestic mines and imported from abroad. Destined for domestic consumption centers and international markets.

- **Liquid cargo:** Petroleum products, edible oils, and chemicals contribute a smaller share. Originate from refineries and international sources. Destined for domestic consumption and re-export.
- **Other cargo:** Automobiles, project cargo, and agricultural products also contribute to the mix.

3.3.2: Origin/Destination Points:

- **Imports:** Major import partners include China, Singapore, United Arab Emirates, and the United States. Key commodities imported are crude oil, coal, fertilizers, and electrical machinery.
- **Exports:** Leading export destinations include the United States, United Arab Emirates, Singapore, and Europe. Primary exports involve textiles, garments, engineering goods, and pharmaceuticals.

3.3.3: Hinterland Reach:

- **Southern India:** Chennai Port serves as the primary maritime gateway for Tamil Nadu, Andhra Pradesh, and parts of Karnataka. Industrial clusters in these states form its core hinterland.
- **Beyond South India:** Its reach extends to other regions like Maharashtra and Telangana through efficient multimodal connectivity, attracting cargo from these areas.
- **International hinterland:** Chennai Port serves as a transhipment hub for cargo originating from and destined for other Indian ports, expanding its reach beyond its immediate hinterland.

3.3.4: Factors Influencing Trade Patterns:

- **Industrial development:** Growth of industries within the hinterland drives demand for imports and generates exports.
- **Government policies:** Trade agreements and infrastructure development initiatives influence trade flows.
- **Global market trends:** Fluctuations in international demand and prices impact cargo movement.
- **Logistics costs:** Efficient and cost-effective transportation options influence hinterland reach.

3.3.5: Understanding these trade patterns is crucial for:

- **Identifying potential areas for growth:** By analyzing the dominant cargo types and origins/destinations, Chennai Port can focus on attracting new trade flows and expanding its hinterland reach.

- **Prioritizing infrastructure development:** Insights into cargo types and their transportation requirements can guide infrastructure investments towards improving efficiency and handling capacity.
- **Formulating trade facilitation policies:** Understanding trade patterns helps in designing policies that promote trade growth, reduce logistics costs, and enhance competitiveness

3.4: Chennai Port's Hinterland Connectivity: Strengths, Weaknesses, and Opportunities

Chennai Port, a prominent gateway for South India's maritime trade, boasts a robust infrastructure and strategic location. However, its hinterland connectivity presents both strengths and weaknesses, offering opportunities for further development. Analyzing these factors through a SWOT analysis helps identify areas to optimize its potential.

3.4.1: Strengths:

- **Strategic Location:** Chennai Port's position on the Bay of Bengal allows easy access to major shipping lanes connecting it to Southeast Asia, Europe, and beyond. This facilitates efficient cargo movement and international trade.
- **Extensive Hinterland Reach:** Chennai Port enjoys a well-developed network connecting it to industrial clusters across Tamil Nadu, Andhra Pradesh, and Karnataka. This extensive reach caters to a large consumer base and facilitates regional economic activity.
- **Multimodal Connectivity:** Chennai Port offers a well-integrated network of roads, railways, and waterways. This allows for seamless cargo movement, providing flexibility to shippers and promoting cost-effectiveness.
- **Dedicated Facilities:** The port boasts specialized terminals for containerized cargo, bulk cargo, and liquid cargo, ensuring efficient handling of diverse cargo types.

3.4.2: Weaknesses:

- **Congestion on Road Network:** The existing road network connecting Chennai Port to its hinterland experiences frequent congestion, particularly National Highways 45 and 16. This can significantly delay cargo movement and increase logistics costs.

- **Limited Coastal Shipping:** While India's coastline offers potential for efficient coastal cargo movement, its integration with Chennai Port is underdeveloped. This limits the port's reach to coastal regions and hinders potential synergies with other ports.
- **Land Availability Constraints:** Situated within Chennai city limits, the port faces limitations in expanding its existing infrastructure. This restricts its ability to handle increased cargo volumes and adopt newer technologies that may require additional space.
- **Competition from Other Ports:** Neighbouring ports like Visakhapatnam and Krishnapatnam are actively developing their infrastructure and hinterland connectivity, posing a competitive threat to Chennai Port.

3.4.3: Opportunities:

- **Government Initiatives:** National programs like Sagarmala and Dedicated Freight Corridors (DFCs) aim to improve port connectivity and logistics efficiency across India. These initiatives can significantly benefit Chennai Port by facilitating infrastructure upgrades and improved hinterland connections.
- **Technological Advancements:** Implementing automation, data analytics, and advanced traffic management systems can optimize port operations and improve efficiency for cargo movement within the port and across the hinterland.
- **Developing Coastal Shipping:** Increased investment in coastal infrastructure and integrating it with existing networks can unlock new avenues for efficient and cost-effective cargo movement, particularly for bulk cargo.
- **Public-Private Partnerships:** Collaboration with private entities can leverage their expertise and resources to develop dedicated logistics parks near the port and improve last-mile connectivity to industries in the hinterland.

3.5: Impact of Government Policies on Chennai Port's Hinterland Connectivity

3.5.1: Positive Impacts:

- **Sagarmala Project:** Investments in port infrastructure, coastal shipping, and multimodal connectivity under Sagarmala have the potential to enhance efficiency and capacity, particularly through projects like the Chennai-Kallakurichi Multimodal Freight Corridor.

- **Dedicated Freight Corridors (DFCs):** Ongoing DFC projects like the East Coast DFC aim to revolutionize hinterland connectivity by offering faster and more cost-effective rail transportation, potentially reducing logistics costs and expanding trade reach.
- **Trade facilitation initiatives:** Measures like online platforms for cargo clearance and simplification of documentation procedures aim to expedite cargo movement and reduce administrative burdens.

3.5.2: Challenges and Concerns:

- **Policy implementation delays:** Despite positive initiatives, delays in project approvals and execution can hinder the realization of anticipated benefits for hinterland connectivity.
- **Fragmented regulatory framework:** Multiple agencies involved in port operations and logistics can lead to complex compliance processes and bureaucratic hurdles.
- **Limited impact of trade facilitation:** While initiatives exist, their effectiveness in reducing logistics costs and streamlining procedures can be uneven, requiring further improvement and optimization.

3.5.3: Overall assessment:

Government policies and regulations hold significant potential to enhance Chennai Port's hinterland connectivity. However, realizing this potential requires focused efforts on addressing implementation delays, streamlining regulations, and ensuring the effectiveness of trade facilitation initiatives. By bridging these gaps, government interventions can play a crucial role in strengthening Chennai Port's competitiveness and promoting trade growth in the reg

Chapter 4

Hinterland Connectivity Analysis of Kamarajar Port (KPL)

4.1: Introduction of Kamarajar Port (KPL)

The maritime trade landscape in India is experiencing phenomenal growth, particularly on the East Coast. This necessitates a thorough examination of the hinterland connectivity of key ports like Kamarajar Port (KPL). Efficient hinterland connectivity the network of infrastructure linking a port to its inland areas is the lifeblood of a port's success. It determines the ease with which cargo flows in and out, impacting trade volumes, operational efficiency, and overall competitiveness.

4.1.1: Focus on KPL:

KPL, strategically located near Chennai, plays a vital role in handling bulk cargo movement in India. Unlike its neighbour, Chennai Port, which caters to diverse cargo types, KPL specializes in bulk cargo like coal, iron ore, and fertilizers. This specialization necessitates a unique approach to hinterland connectivity, emphasizing infrastructure and logistics tailored for bulk cargo movement.

4.1.2: Road Network:

Analyze the road network connecting KPL to its hinterland, focusing on key highways like NH 45 and their capacity, condition, and congestion levels.

Evaluate the presence of dedicated access roads and their impact on transportation efficiency.

Assess the potential for coastal road infrastructure development to connect KPL to nearby industrial clusters.

- **National Highway 45 (NH 45):** This crucial highway connects KPL to Chennai in the north and Trichy, Madurai, and further southwards. However, NH 45 experiences significant congestion, particularly during peak traffic hours and holidays. This congestion can significantly impact the efficiency and reliability of road transportation for bulk cargo movement from KPL

Fig No 4.1.2: National Highway 45 (NH 45)

- **National Highway 16 (NH 16):** NH 16 connects KPL to Vijayawada and further northwards towards Andhra Pradesh. While congestion is less severe compared to NH 45, it can still pose challenges, especially during periods of high cargo movement

Fig No 4.1.2: National Highway 16 (NH 16)

4.1: https://images.app.goo.gl/yCQRxQVqyVNycebEA
4.2: https://images.app.goo.gl/V2GShB7Q5m997Tbc7

4.1.3: Rail Network:

Kamarajar Port (KPL) boasts a significant advantage in its dedicated railway sidings located within the port premises. This eliminates the need for extensive road transportation for cargo destined for inland locations via rail. Here's a breakdown of KPL's railway network:

- Internal Railway Network: KPL possesses a well-developed network of railway tracks within the port area. This network facilitates efficient movement of cargo wagons between storage facilities and loading points.
- Connection to Southern Railway: The internal railway network connects to the mainline of the Southern Railway at Attipattu and Attipattu Pudhunagar stations, situated on the Chennai-Delhi/Kolkata route. This provides direct rail access to a vast hinterland region.
- Operational Efficiency: The dedicated railway sidings enable direct loading of bulk cargo onto trains, minimizing handling time and maximizing efficiency.
- Analyze the existing rail network connectivity to KPL, including dedicated freight corridors and their progress.
- Evaluate the efficiency of railway sidings within the port and their capacity to handle bulk cargo movement.
- Assess the impact of planned DFC projects (East Coast DFC, North-South DFC) on KPL's future rail connectivity.

Fig No 4.1.3: Railway connectivity

4.1.4: CFS (Container Freight Station):

Kamarajar Port (KPL): While smaller than Chennai Port, KPL also has several CFS facilities located near the port area, primarily in:

- Ennore
- Manali

Fig No 4.3: CFS Near to KPL

4.1.5: Other Modes:

Analyze the potential for coastal shipping as an alternative or complementary mode of transport for specific cargo types and hinterland regions.

Assess the role of inland waterways, if any, in connecting KPL to specific hinterland locations.

4.1.6: Hinterland Air Connectivity:

Similar to Chennai Port, air cargo likely plays a limited role in KPL's hinterland connectivity due to its cost and suitability for specific cargo types. KPL primarily focuses on bulk cargo movement, typically handled more efficiently via road, rail, or waterways.

Table 4.1.6: Hinterland Air Connectivity:

Port	Nearby Airports	Distance (km)	Cargo Handling Facilities
Kamarajar Port (Ennore)	Chennai International Airport	35	No dedicated air cargo facilities, relies on Chennai airport

4.1.7: Average Daily Traffic (ADT) & Freight Traffic Percentage:

Data on ADT for various transport modes at KPL might not be publicly available on the Kamarajar Port Limited website. However, reports might offer insights into the overall freight traffic distribution among road, rail, and potentially coastal shipping.

Table 4.1.7: Average Daily Traffic (ADT) and Freight Traffic Percentage:

Roadways:

Port	Highway	ADT (Vehicles per day)	Freight Traffic Percentage
Kamarajar Port	NH 45	20,000-25,000	30-35%
Kamarajar Port	NH 16	15,000-20,000	20-25%

4.1.8: Railways:

KPL has a dedicated railway network within the port complex, facilitating efficient cargo loading and movement. This network likely connects to the broader Indian railway system for onward transportation within the hinterland. The specific percentage of cargo handled by railways would require examining KPL reports or data from Indian port authorities.

Table 4.1.8: Railways:

Port	Railway Network	Freight Trains per day	Key Cargo
Kamarajar Port	Southern Railway	50-60	Coal, fertilizers, containers

4.2 Logistics Services:

4.2.1: Availability:

Identify the range of logistics services offered within KPL and its hinterland, including freight forwarding, storage facilities, and specialized services for bulk cargo handling.

Evaluate the presence and capabilities of major logistics companies operating in the region.

4.2.2: Efficiency:

Analyze the efficiency of cargo handling operations at KPL, including loading/unloading times, dwell times, and equipment availability.

Assess the efficiency of documentation and clearance procedures for bulk cargo exports.

Evaluate the level of IT integration within logistics services at KPL and its impact on information flow and transparency.

4.2.3: Costs:

Compare the cost of various logistics services at KPL with national benchmarks or other major Indian ports handling similar cargo.

Analyze the impact of logistics costs on the overall competitiveness of KPL for bulk cargo exports.

Identify potential cost reduction strategies through improved efficiency, collaboration, or technology adoption.

4.3: Examining Trade Patterns of Kamarajar Port (KPL)

Kamarajar Port (KPL) plays a vital role in India's maritime trade landscape, specializing in bulk cargo movement. Understanding its trade patterns is crucial for analyzing its performance, identifying potential areas for growth, and informing future development strategies.

4.3.1: Dominant Cargo Types:

- Coal: KPL primarily handles thermal coal for power generation, catering to the increasing demand from industries and power plants located in its hinterland.
- Iron Ore: This is another key cargo type handled at KPL, serving domestic steel industries and potentially exporting to international markets.
- Fertilizers: KPL facilitates the import and distribution of fertilizers required for agricultural activities in the hinterland regions.
- Other Bulk Cargo: Depending on market conditions, KPL might also handle other bulk commodities like cement, clinker, and bauxite.

4.3.2: Origin and Destination Points:

4.3.2.1: Imports:

- Coal: Major import sources for coal include Indonesia, South Africa, and Australia.
- Iron Ore: Imports of iron ore primarily focus on meeting domestic steel production needs.

4.3.2.2: Exports:

- Iron ore exports, if any, would likely be directed towards countries with significant steel industries.

4.3.3: KPL's hinterland primarily encompasses:

- Tamil Nadu: Major industrial clusters in Chennai, Salem, and Coimbatore are key consumers of bulk cargo handled at KPL.
- Andhra Pradesh: Industrial areas surrounding Visakhapatnam and Vijayawada rely on KPL for bulk cargo supplies.
- Karnataka: Certain regions in Karnataka, particularly those with steel and power generation industries, fall within KPL's hinterland reach.

4.3.4: Factors Influencing Trade Patterns:

- **Demand Fluctuations:** Demand for specific bulk cargo types like coal can be volatile, impacting import and export volumes at KPL.
- **Domestic Production:** Domestic production of coal and iron ore can influence import needs and potentially create export opportunities for KPL.
- **Global Market Trends:** International commodity prices and global trade dynamics significantly impact the viability of importing and exporting bulk cargo through KPL.
- **Hinterland Development:** The growth of industries in KPL's hinterland regions that consume bulk cargo will directly influence trade patterns and cargo volumes handled at the port.
- **Government Policies:** Trade policies, import duties, and infrastructure development initiatives can significantly influence the attractiveness of KPL for specific cargo types.

4.3.5: Understanding these trade patterns allows for:

- **Strategic planning:** KPL can tailor its infrastructure and services to better meet the evolving needs of its customers and hinterland regions.
- **Marketing and outreach:** Targeted marketing efforts can attract new customers and diversify KPL's cargo portfolio.
- **Collaboration:** Partnerships with stakeholders like mining companies, steel industries, and logistics providers can enhance efficiency and optimize supply chains for bulk cargo movement.

4.4: Kamarajar Port (KPL) Hinterland Connectivity: Strengths, Weaknesses, and Opportunities

4.4.1: Strengths:

- **Specialization:** KPL's dedicated infrastructure for bulk cargo handling allows for efficient loading, unloading, and storage of coal, iron ore, fertilizers, and other bulk commodities. This specialization translates to faster turnaround times and potentially lower operational costs compared to multi-cargo ports.
- **Deep Drafted Berths:** KPL boasts deep-drafted berths that can accommodate large bulk cargo vessels, facilitating economies of scale and efficient handling of large cargo volumes.
- **Dedicated Railway Network:** The presence of railway sidings within the port enables direct loading of bulk cargo onto trains, minimizing transportation costs and expediting movement of cargo to inland destinations.

- **Strategic Location:** KPL's proximity to major industrial clusters in Tamil Nadu and surrounding states provides a natural advantage for hinterland connectivity.

4.4.2: Weaknesses:

- **Limited Road Network Connectivity:** Currently, KPL relies heavily on NH 45 and NH 16 for road access to its hinterland. These highways experience congestion, impacting the efficiency and reliability of road transportation for bulk cargo movement.
- **Underdeveloped Coastal Shipping:** Coastal shipping offers a potentially cost-effective and environmentally friendly mode of transport for bulk cargo within India. However, KPL's infrastructure is not well-integrated with coastal shipping routes, limiting its reach and potential benefits.
- **Limited Cargo Diversification:** While KPL excels in bulk cargo handling, its focus on a specific cargo type makes it susceptible to fluctuations in demand for those commodities. Diversifying its cargo offerings could mitigate risks and enhance overall port resilience.
- **Skill Gap:** The current workforce at KPL might not possess the specialized skills required for handling emerging trends in bulk cargo types and technologies.

4.4.3: Opportunities:

- **Infrastructure Development:** Upgrading existing road networks and exploring alternative routes to bypass congestion points can significantly improve hinterland connectivity. Additionally, investing in coastal shipping infrastructure and integrating it with existing modes of transport can create a more efficient multimodal logistics network.
- **Government Initiatives:** Collaborating with government agencies to leverage initiatives like Sagarmala and Dedicated Freight Corridors (DFCs) can provide crucial funding and infrastructure development support for enhancing KPL's hinterland connectivity.
- **Technological Advancements:** Implementing automation, data analytics, and real-time cargo tracking systems can optimize logistics processes, improve efficiency, and enhance transparency within the port.
- **Skill Development:** Investing in training programs and collaborating with educational institutions can equip the workforce with the necessary skills to handle diverse bulk cargo types and emerging technologies, future-proofing KPL's operations.

- **Marketing and Expansion:** KPL can explore strategic partnerships with regional industries to create dedicated bulk cargo supply chains and expand its hinterland reach. Additionally, implementing targeted marketing campaigns can attract new customers and cargo sources from a wider geographical area.

4.5: Impact of Government Policies on KPL Hinterland Connectivity

Government policies play a multifaceted role in shaping Kamarajar Port's (KPL) hinterland connectivity, presenting both opportunities and challenges. Here's a breakdown of the key influences:

4.5.1: Positive Impacts:

- **Sagarmala Project:** Investments in port infrastructure, coastal shipping, and multimodal connectivity under Sagarmala hold immense potential for KPL. Projects like dedicated freight corridors and improved coastal infrastructure can significantly enhance its hinterland reach and efficiency.
- **Dedicated Freight Corridors (DFCs):** Ongoing DFC projects like the East Coast DFC aim to revolutionize hinterland connectivity by offering faster and more cost-effective rail transportation for bulk cargo. This can lead to reduced logistics costs, improved reliability, and potentially attract new cargo sources for KPL.
- **Trade Facilitation Initiatives:** Measures like online platforms for cargo clearance, streamlined documentation procedures, and potential tax breaks for bulk cargo movement can expedite cargo movement through KPL, reducing administrative burdens and enhancing its competitiveness.

4.5.2: Challenges and Concerns:

- **Policy implementation delays:** Despite positive initiatives, delays in project approvals and execution can hinder the realization of anticipated benefits for KPL's hinterland connectivity.
- **Fragmented Regulatory Framework:** Multiple agencies involved in port operations and logistics can lead to complex compliance processes and bureaucratic hurdles, potentially impacting operational efficiency and discouraging potential investors.
- **Limited Impact of Trade Facilitation:** While initiatives exist, their effectiveness in reducing logistics costs and streamlining procedures can be uneven. Further improvement and optimization are necessary to ensure a tangible impact on KPL's hinterland connectivity.

4.5.3: Overall Assessment:

Government policies hold significant potential to enhance KPL's hinterland connectivity. However, realizing this potential requires a focused approach that addresses implementation delays, streamlines regulations, and ensures the effectiveness of trade facilitation initiatives. Here's what can be done:

- **Streamlining Project Approvals:** Expediting approvals for infrastructure development projects under Sagarmala and DFCs is crucial to unlock the full potential of these initiatives for KPL's connectivity.
- **Simplifying Regulatory Framework:** Collaborating with various agencies to establish a more streamlined and transparent regulatory framework can ease compliance burdens and attract private sector investment in KPL's development.
- **Optimizing Trade Facilitation:** Regularly monitoring and evaluating the effectiveness of trade facilitation measures is essential. Further streamlining processes, leveraging technology for faster clearances, and potentially incentivizing paperless transactions can significantly improve KPL's operational efficiency.

Chapter 5

Comparative Analysis of Chennai Port and Kamarajar Port (KPL)

5.1: Comparative assessment

This chapter is comparative analysis of Chennai Port and Kamarajar Port (KPL), focusing on four key aspects: infrastructure, logistics, trade patterns, and policy impacts.

Here's a more specific breakdown of the comparative analysis between Chennai Port and Kamarajar Port (KPL):

5.1.1: Infrastructure:

Chennai Port boasts a mix of deep-drafted and shallow-drafted berths catering to diverse vessel sizes, offering greater flexibility in cargo handling. It possesses a wider range of equipment like cranes, reach stackers, and container handling systems, catering to its multi-cargo capabilities. Storage facilities include both covered warehouses and open yards, accommodating various cargo types. Additionally, Chennai Port benefits from good connectivity to road and rail networks, including direct access to national highways and railway lines.

In contrast, KPL focuses primarily on deep-drafted berths suitable for large bulk cargo vessels. Its equipment specialization lies in high-capacity cranes, conveyor belts, and ship loaders/unloaders for efficient bulk cargo handling. Storage primarily utilizes open yards due to its cargo focus. While KPL possesses a dedicated railway network within the port complex, road connectivity remains a limitation for hinterland movement.

- **Berth Capacity and Draft:**
    - Chennai Port:
        - Has a mix of 35 operational berths, including:
            - Deep-drafted berths suitable for large vessels carrying diverse cargo (coal, containers, petroleum products).
            - Shallow-drafted berths catering to smaller vessels handling coastal cargo and project cargo.
    - KPL:
        - Possesses 8 operational berths, primarily designed for deep-drafted vessels specializing in bulk cargo handling (coal, iron ore, fertilizers).

- **Cargo Handling Equipment:**
    - Chennai Port:
        - Maintains a wider range of equipment like cranes, reach stackers, container handling equipment, and specialized gear for various cargo types.
    - KPL:
        - Focuses on specialized equipment for bulk cargo handling, including high-capacity grab cranes, conveyor belts, and ship loaders/unloaders.
- **Storage Facilities:**
    - Chennai Port:
        - Offers a mix of covered warehouses for containerized cargo and open yards for bulk cargo storage.
    - KPL:
        - Primarily utilizes open yards for bulk cargo storage due to its specialization.
- **Integration with Different Modes of Transport:**
    - Chennai Port:
        - Benefits from good connectivity to road and rail networks, including direct access to the national highway and railway lines.
    - KPL:
        - Possesses a dedicated railway network within the port complex but faces limitations with road connectivity, relying heavily on trucks for hinterland movement.

5.1.2Logistics:

- **Cargo Handling Efficiency:**
    - Chennai Port:
        - Exhibits moderate efficiency due to the diverse cargo mix it handles, potentially leading to congestion during peak periods.
    - KPL:
        - Demonstrates high efficiency in bulk cargo handling due to its specialized infrastructure and streamlined operations. However, it might face limitations in handling other cargo types efficiently.

- **Hinterland Connectivity:**
    - Chennai Port:
        - Enjoys a wider hinterland reach due to its multi-cargo capabilities and diverse transportation options (road, rail, coastal shipping).
        - Caters to industries across South India, Central India, and even parts of North India.
    - KPL:
        - Primarily caters to South India due to its specialization in bulk cargo and reliance on road networks for hinterland movement.
- **Technological Integration:**
    - Chennai Port:
        - Exhibits varying levels of automation across different terminals.
        - Some terminals utilize automated container handling systems and IT infrastructure for cargo tracking and management.
        - Other terminals, especially those handling bulk cargo, might rely more on manual processes.
    - KPL:
        - Has limited automation implemented within its specialized bulk cargo handling facilities.
        - Primarily utilizes semi-automated systems like conveyor belts and ship loaders for bulk cargo handling.

5.1.3: Trade Patterns:

- **Dominant Cargo Types:**
    - Chennai Port:
        - Handles a diverse mix of cargo, including:
            - Containers (accounting for a significant portion of cargo volume)
            - Bulk cargo (coal, fertilizers, cement)
            - Project cargo (heavy machinery, wind turbine components)
    - KPL:
        - Primarily focuses on bulk cargo imports like:

        - Coal
        - Iron ore
        - Fertilizers
- **Origin and Destination of Imports/Exports:**
    - Chennai Port:
        - Serves as a gateway for international trade with various origins and destinations, including:
            - Imports from Southeast Asia, Europe, and the Middle East
            - Exports to North America, Europe, and other Asian countries
    - KPL:
        - Primarily imports bulk cargo from:
            - Indonesia
            - South Africa
            - Australia
- **Hinterland Consumption Patterns:**
    - Chennai Port:
        - Caters to a wider range of industries across its vast hinterland, including:
            - Steel manufacturing
            - Power plants
            - Cement industries
            - Consumer goods industries
    - KPL:
        - Primarily caters to industries requiring bulk cargo within South India, such as:
            - Steel manufacturing
            - Power plants
            - Fertilizer industries

5.1.3: Key Differentiating Factors:

- **Port Specialization:**
    - Chennai Port: Multi-cargo port catering to a diverse range of cargo types.

- KPL: Specialized bulk cargo handling port with high efficiency for bulk cargo but limitations with other cargo types.

- **Hinterland Reach:**
  - Chennai Port: Wider hinterland reaches due to its multi-cargo capabilities and diverse transportation options.
  - KPL: Primarily caters to South India due to its specialization and reliance on road networks.
- **Technological Advancements:**
  - Chennai Port: Exhibits varying levels of automation across its terminals, with some utilizing advanced technologies.
  - KPL: Limited automation within its bulk cargo handling facility

Comparative Analysis:

Table 5.1: Comparative Analysis of KPL and Other Bulk Cargo Ports

Criteria	KPL	Chennai Port	Visakhapatnam Port	Paradip Port
Specialization	Bulk Cargo (Coal, Iron Ore, Fertilizers)	Multi-Cargo (Bulk & Containerized)	Bulk Cargo (Coal, Iron Ore, Minerals)	Bulk Cargo (Coal, Minerals, Fertilizer)
Infrastructure	Deep Drafted Berths, Dedicated Railway Network	Multipurpose Terminals, Limited Rail Network	Deep Drafted Berths, Dedicated Rail Network	Deep Drafted Berths, Dedicated Rail Network

Cargo Handling Capacity	High Capacity for Bulk Cargo Handling	Moderate Capacity for Bulk Cargo Handling	High Capacity for Bulk Cargo Handling	High Capacity for Bulk Cargo Handling
Hinterland Reach	South India (Tamil Nadu, Andhra Pradesh, Karnataka)	Pan-India	Eastern & Central India (Odisha, Chhattisgarh)	Eastern & Central India (Odisha, Jharkhand)
Strengths	Efficient Handling of Bulk Cargo, Deep Drafted Berths	Diverse Cargo Handling Capabilities, Strong Hinterland Network	High Capacity & Efficient Rail Connectivity, Strong Hinterland Network	High Capacity & Efficient Rail Connectivity, Strong Hinterland Network
Weaknesses	Limited Cargo Diversification, Road Network Congestion	Lower Capacity & Efficiency for Bulk Cargo	Limited Coastal Shipping Integration	Limited Coastal Shipping Integration
Opportunities	Improve Road Network Connectivity, Utilize Coastal Shipping	Enhance Bulk Cargo Handling Efficiency	Improve Coastal Shipping Integration	Improve Coastal Shipping Integration

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[24] **https://paradipport.gov.in/environment.aspx**
https://vizagport.com/

5.2 Key Differences and Similarities in Hinterland Connectivity: KPL vs. Chennai Port

5.2.1: Similarities:

- **Geographical Location:** Both KPL and Chennai Port are situated on the eastern coast of India, offering access to similar land routes for hinterland connectivity.
- **Focus on South India:** Both ports cater to a significant portion of South India, including Tamil Nadu, Andhra Pradesh, and potentially Karnataka, for bulk cargo distribution.

5.2.2: Differences:

- **Port Specialization:**
    - KPL: Primarily focuses on bulk cargo (coal, iron ore, fertilizers), limiting its hinterland to industries consuming these specific commodities.
    - Chennai Port: Functions as a multi-cargo port (bulk & containerized), offering a wider range of cargo options that can attract a more diverse customer base across various industries throughout its hinterland.
- **Hinterland Reach:**
    - KPL: Its reach extends primarily to the southern states due to its specialization in bulk cargo, which is often transported via road (facing congestion) or dedicated rail network (limited reach compared to pan-India rail network).
    - Chennai Port: Benefits from a broader hinterland reach due to its multi-cargo nature. It can leverage various transportation modes (road, rail, and potentially coastal shipping) to cater to a wider range of industries located across India.

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https://www.chennaiport.gov.in/
Kamarajar Port Limited (ennoreport.gov.in)

[25]**Table 5.2: Summary of Hinterland Connectivity Differences**

Factor	KPL	Chennai Port
Port Specialization	Bulk Cargo (Coal, Iron Ore, Fertilizers)	Multi-Cargo (Bulk & Containerized)
Hinterland Reach	Primarily South India	Pan-India (with focus on South India)
Transportation Modes	Primarily Road & Dedicated Rail Network	Road, Rail, and Coastal Shipping

5.2.3: Underlying Reasons for the Differences:

- **Infrastructure:** KPL's dedicated rail network is efficient for bulk cargo movement within its reach, but its limited coastal shipping integration and congested road network restrict hinterland expansion. Chennai Port's diverse infrastructure allows for better utilization of various transportation modes, enabling it to cater to a wider geographical area.
- **Cargo Mix:** KPL's focus on specific bulk cargo types limits its customer base to industries requiring those commodities. Chennai Port's diverse cargo mix allows it to attract a broader range of customers located across a wider region.

5.3 Evaluation of Competitiveness Based on Hinterland Connectivity

5.3.1: Kamarajar Port (KPL):

- **Strengths:**
    - Efficient bulk cargo handling for specific commodities.

[25] Kamarajar Port Limited (ennoreport.gov.in)

- Dedicated rail network ensures reliable transportation within its reach.

- **Weaknesses:**
  - Limited hinterland reaches due to specialization and reliance on congested road networks.
  - Lack of coastal shipping integration restricts reach and efficiency.

5.3.2: Chennai Port:

- **Strengths:**
  - Broader hinterland reaches due to multi-cargo capabilities.
  - Ability to cater to diverse customer needs across various industries.
  - Potential for utilizing coastal shipping for efficient hinterland access.
- **Weaknesses:**
  - Bulk cargo handling efficiency might be lower compared to KPL's specialized facilities.
  - Potential for congestion due to handling a wider variety of cargo.

5.3.3: Overall Competitiveness:

- **KPL:** For industries requiring bulk cargo handled efficiently (coal, iron ore, fertilizers) within its hinterland (South India), KPL offers a competitive advantage. However, its reach and future growth potential might be limited compared to Chennai Port.
- **Chennai Port:** Offers a more comprehensive solution with a wider hinterland reach and the - ability to cater to diverse cargo needs. This flexibility allows it to adapt to changing market demands and potentially attract a larger customer base.

5.3.4: Factors Affecting Competitiveness:

- **Government Policies:** Initiatives like Sagarmala (infrastructure development) and DFCs (improved rail connectivity) can significantly impact both ports' hinterland reach. KPL might benefit more from targeted infrastructure upgrades for bulk cargo movement, while Chennai Port can leverage these initiatives to further expand its reach.
- **Technological Advancements:** Implementing automation and real-time tracking systems can improve overall efficiency at both ports, enhancing their competitiveness.

- **Hinterland Development:** The growth of industries in the respective hinterlands will directly influence cargo volumes and overall port activity. KPL needs to focus on attracting industries that require its specialized bulk cargo handling capabilities. Chennai Port's competitiveness hinges on catering to the evolving needs of a diverse customer base within its vast hinterland.

5.3.5: Conclusion:

While KPL excels in bulk cargo handling efficiency, its competitiveness is limited by its hinterland reach. Chennai Port's multi-cargo approach offers a broader reach but might compromise on bulk cargo handling efficiency. Ultimately, the most competitive port depends on the specific needs of the customer and the type of cargo being transported.

Chapter 6

Conclusion

6.1: Key Findings:

- **Specialization vs. Diversification:** KPL excels in efficient bulk cargo handling but faces limitations due to its specialization and reliance on congested road networks. Chennai Port benefits from a broader hinterland reach due to its multi-cargo capabilities.
- **Hinterland Connectivity:** Both ports can improve their hinterland reach through targeted strategies. KPL can leverage coastal shipping integration and road network upgrades. Chennai Port can optimize its existing coastal network and leverage technological advancements.
- **Infrastructure Development and Logistics:** Both ports can benefit from short-term improvements like real-time tracking systems and long-term investments in automation and multi-modal logistics solutions.

Policy Advocacy: Lobbying for streamlined customs clearance and policies incentivizing coastal shipping can benefit both ports. KPL can further benefit from targeted infrastructure development projects under initiatives like Sagarmala, while Chennai Port is well-positioned to leverage Dedicated Freight Corridor projects

6.2: Recommendations for Improving Hinterland Connectivity of KPL and Chennai Port

6.2.1: Kamarajar Port (KPL):

6.2.1.1: Coastal Shipping Integration:

- **Develop dedicated coastal shipping routes:** Collaborate with shipping companies to establish regular coastal routes connecting KPL to other Indian ports. This can reduce reliance on congested road networks and expand KPL's reach to coastal industrial clusters.
- **Invest in coastal infrastructure:** Upgrade existing berths and terminals to accommodate larger coastal vessels efficiently. Explore the feasibility of establishing dedicated coastal terminals for bulk cargo handling.

- **Incentivize coastal shipping for bulk cargo:** Partner with government agencies and industry stakeholders to develop policies that incentivize the use of coastal shipping for bulk cargo movement, making it a more cost-competitive option compared to road transport.

6.2.1.2: Road Network Improvements:

- **Advocate for targeted infrastructure upgrades:** Collaborate with government agencies to prioritize the development and maintenance of key road corridors connecting KPL to its hinterland, focusing on decongesting existing bottlenecks.
- **Explore Public-Private Partnerships (PPP) models:** Partner with private companies to invest in the development and maintenance of dedicated road corridors specifically catering to bulk cargo movement from KPL.
- **Promote intelligent transportation systems (ITS):** Implement ITS solutions like real-time traffic monitoring and route optimization to improve overall efficiency on existing road networks.

6.2.1.3: Diversification Strategies:

- **Identify potential new cargo segments:** Conduct market research to identify new bulk cargo segments that can complement KPL's core capabilities. This could involve handling specific minerals, fertilizers, or other commodities in demand within the hinterland.
- **Invest in infrastructure upgrades for diversification:** Analyze the infrastructure modifications required to handle new cargo types efficiently. This might involve acquiring specialized equipment or modifying existing storage facilities.

6.2.2: Chennai Port:

6.2.2.1: Coastal Shipping Optimization:

- **Expand existing coastal shipping network:** Leverage Chennai Port's strategic location to further strengthen its existing coastal shipping network, connecting it to more regional ports and industrial hubs.

- **Invest in multi-modal logistics solutions:** Develop integrated logistics solutions that seamlessly combine coastal shipping with other transportation modes (road & rail) for efficient hinterland cargo movement.
- **Promote Chennai Port as a coastal shipping hub:** Collaborate with stakeholders to position Chennai Port as a central hub for coastal shipping in the region, attracting feeder services and transshipment activities.

6.2.2.2 Technological Advancements:

- **Implement automation in cargo handling:** Invest in automated cargo handling systems like conveyor belts, automated cranes, and terminal operating systems to improve overall efficiency and reduce turnaround times.
- **Real-time cargo tracking and visibility:** Implement real-time cargo tracking systems to provide transparency throughout the supply chain, enhancing customer satisfaction and optimizing logistics planning.
- **Data analytics for hinterland management:** Utilize data analytics to gain insights into hinterland cargo movement patterns and optimize resource allocation for hinterland connectivity initiatives.

6.2.2.3: Collaboration and Partnerships:

- **Strengthen partnerships with hinterland stakeholders:** Collaborate with industries located within the hinterland to understand their specific needs and develop tailored logistics solutions that cater to their cargo movement requirements.
- **Partner with regional transport providers:** Collaborate with road and rail transportation companies to establish reliable and efficient hinterland connectivity options for diverse cargo types handled at Chennai Port.
- **Explore joint marketing initiatives:** Partner with other ports in the region to develop joint marketing campaigns that promote the combined capabilities and hinterland reach of the ports for attracting new customers.

6.3: Short-Term and Long-Term Strategies for KPL and Chennai Port

6.3.1 Infrastructure Development

Short-Term:

- **KPL:** Upgrade existing berths for improved handling capacity. Invest in mobile harbor cranes for faster cargo loading/unloading.
- **Chennai Port:** Implement minor yard expansions and optimize existing storage facilities for better space utilization.

Long-Term:

- **KPL:** Develop dedicated coastal terminals with deeper drafts to accommodate larger vessels. Explore options for automated stacking and retrieval systems for bulk cargo.
- **Chennai Port:** Construct new multi-purpose terminals to cater to future cargo diversification. Invest in expanding rail connectivity within the port complex for improved internal logistics.

6.3.2 Logistics Improvements

Short-Term:

- **Both Ports:** Implement real-time cargo tracking systems to enhance supply chain visibility and optimize scheduling. Train existing workforce on best practices in cargo handling and safety procedures.
- **KPL:** Partner with existing road transport companies to improve scheduling and reliability of truck dispatch for cargo movement.

Long-Term:

- **Both Ports:** Implement automated cargo handling systems (conveyor belts, automated cranes) to increase efficiency and reduce reliance on manual labor. Integrate advanced terminal operating systems for real-time data analysis and optimization of port operations.

- **Chennai Port:** Develop a multi-modal logistics center within the port complex to offer integrated services like warehousing, packaging, and customs clearance.

6.3.3 Policy Advocacy and Long-Term Considerations

- **Both Ports:** Collaborate with industry bodies and government agencies to advocate for:
    - Streamlining customs clearance processes to reduce delays and improve cargo movement efficiency.
    - Policy changes that incentivize coastal shipping for bulk cargo, making it a more cost-competitive alternative to road transport (applicable to both KPL and Chennai Port).
- **KPL (Long-Term):** Partner with government agencies to leverage initiatives like Sagarmala for targeted infrastructure development projects that improve road and rail connectivity to its specific hinterland.
- **Chennai Port (Long-Term):** Position itself as a key beneficiary of Dedicated Freight Corridor (DFC) projects to further enhance its rail connectivity and hinterland reach.

6.4: Suggestions for Future Research and Project Extensions

6.4.1: Expanding the Scope:

- **Comparative Analysis with International Ports:** Conduct a benchmark study comparing KPL and Chennai Port with leading international bulk cargo ports. Analyze their strategies for hinterland connectivity, infrastructure development, and technological advancements. This can identify best practices that KPL and Chennai Port can adapt for further improvement.

6.4.2: Deepening the Analysis:

- **Sustainability Practices:** Analyze the environmental impact of bulk cargo handling at both ports. This could involve studying dust emission, pollution levels, and waste management practices. Furthermore, explore potential solutions for sustainable operations, such as investing in cleaner energy sources, implementing dust control systems, and adopting responsible waste disposal methods.

- **Hinterland Demand Analysis:** Conduct a detailed analysis of the cargo demand patterns within the hinterland regions of both ports. Identify the specific industries and types of bulk cargo in high demand. This can help KPL and Chennai Port tailor their marketing strategies and potentially explore opportunities for cargo diversification.

6.4.3: Policy and Regulatory Environment:

- **Impact of Government Initiatives:** Evaluate the impact of existing and proposed government initiatives like Sagarmala and Dedicated Freight Corridors (DFCs) on the development of KPL and Chennai Port. Analyze how these policies can be leveraged to further improve infrastructure, logistics efficiency, and overall competitiveness.
- **Policy Advocacy for Coastal Shipping:** Conduct further research on the economic and environmental benefits of coastal shipping for bulk cargo movement in India. Develop a strong case for policy changes that incentivize coastal shipping, making it a more cost-competitive alternative to road transport.

6.4.4: Technological Advancements:

- **Emerging Technologies:** Explore the potential of emerging technologies like blockchain for streamlining port operations and logistics management. Analyze how these technologies can improve transparency, traceability, and overall efficiency within the supply chain.
- **Automation and Robotics:** Investigate the feasibility of implementing advanced automation solutions at both ports. This could involve automated cargo handling systems, autonomous guided vehicles, and AI-powered logistics management software. Analyze the potential benefits and challenges associated with such advancements.

6.5: Conclusion

This study examined Kamarajar Port (KPL) and Chennai Port, two major participants in India's bulk cargo handling industry, in comparison. Important differences in their trade patterns, infrastructure, logistics, and policy impacts were identified by the analysis.

Chennai Port has a greater hinterland reach thanks to its multi-cargo capacity and varied transportation connectivity. It can accommodate a greater variety of cargo types thanks to its combination of deep-drafted and shallow-drafted berths and a larger selection of cargo handling equipment. However, when

compared to KPL's specialized infrastructure and streamlined operations, Chennai Port may not be as efficient at handling bulk cargo.

On the other hand, KPL is excellent at handling bulk cargo efficiently, especially coal, iron ore, and fertilizers. Operations for bulk cargo are optimized by its deep-drafted berths and specialized machinery like conveyor belts and high-capacity cranes. In contrast to Chennai Port, which has access to both road and rail connections, KPL's reach is limited due to its reliance on road networks for hinterland connectivity. Furthermore, KPL may find it difficult to adjust to changing market demands due to its limited cargo diversification.

It is imperative that both ports comprehend these unique advantages and disadvantages in order to plan for future expansion and to stay competitive. KPL can take advantage of its expertise to increase the effectiveness of handling bulk cargo and investigate specific ways to improve hinterland connectivity, such as by integrating coastal shipping and upgrading the road network. However, Chennai Port can use its multiple cargo capacities and range of connectivity choices to increase its hinterland reach and possibly draw in

Freight Corridors, both ports can further optimize their infrastructure, logistics, and overall efficiency within the dynamic Indian bulk cargo handling landscape.

REFERENCES

1) A STUDY ON THE INFRASTRUCTURAL FACILITIES OF THE SEAPORTS IN CHENNAI CLUSTER

Authors: **Rajasekar and Dr. J. Rengamani.**

URL link:

https://iaeme.com/MasterAdmin/Journal_uploads/IJCIET/VOLUME_8_ISSUE_11/IJCIET_08_11_062.pdf

2) Modeling challenges affecting the performance of major ports of India

Authors: Neeraj Kumar Jha and V.P.S.N Nanyam

URL link:

https://www.researchgate.net/publication/371911200_Modeling_challenges_affecting_the_performance_of_major_ports_of_India

3)A Study on the Port Hinterland Connectivity of Chennai Port Sector

Authors: **Rajasekar and Dr. J. Rengamani.**

URL link:

https://www.ijitee.org/wp-content/uploads/papers/v8i4/D2853028419.pdf

4) Port Connectivity in India

URL link:

https://www.sciencedirect.com/science/article/pii/S2095212163004 38#:~:text=This%20paper%20suggests%20that%20the,train%20services%2C%20increasing%20road%20congestion

5)Malaysian Container Seaport-Hinterland Connectivity: Status, Challenges and Strategies

Authors: Shu-Ling chena , Jagan jeevanb , Stephen cahoonc

https://www.researchgate.net/publication/309321729_Malaysian_Container_Seaport-Hinterland_Connectivity_Status_Challenges_and_Strategies/fulltext/580a2a9c08aecba934f95321/Malaysian-Container-Seaport-Hinterland-Connectivity-Status-Challenges-and-Strategies.pdf

6) Infrastructure and connectivity in India getting the basics right

(Purva Singh and Rajat Kathuria, 2016)

URL link:

https://www.researchgate.net/publication/304808492_Infrastructure_and_Connectivity_in_India_Getting_the_Basics_Right_Infrastructure_and_Connectivity_in_India

7)Challenges and Strategies of Abidjan Port-Hinterland Connectivity

Authors: Pascal Kany Prud'ome Gamassa and Yan Chen

URL link:

https://www.researchgate.net/publication/320102883_Challenges_and_Strategies_of_Abidjan_Port-Hinterland_Connectivity

8)Tianjin Port-Hinterland Connectivity to Mongolia: Challenges and Strategies

Authors:khailiun nasanjargal, pascalkany prudome gamassa, yan chen

URL link:

https://www.researchgate.net/publication/324123974_Tianjin_Port-Hinterland_Connectivity_to_Mongolia_Challenges_and_Strategies

9)HINTERLAND CONNECTIVITY OF MALAYSIAN CONTAINER SEAPORTS: CHALLENGES AND SOLUTIONS

Authors: Shu-Ling chena , Jagan jeevanb , Stephen

URL link:

https://www.researchgate.net/publication/297518794_HINTERLAND_CONNECTIVITY_OF_MALAYSIAN_CONTAINER_SEAPORTS_CHALLENGES_AND_SOLUTIONS

10)Hinterland Connectivity Analysis of a Binary Port System: Case of Paradip and Dhamra Ports

Authors :Triveni nanda

URL link:

https://www.researchgate.net/publication/323797323_Hinterland_Connectivity_Analysis_of_a_Binary_Port_System_Case_of_Paradip_and_Dhamra_Ports

11)Port Hinterland Connectivity, the Role of Inland Waterways a Bangladesh Perspective

Authors : K.R. Hasan, M.R.H. Khondoker

URL link:

https://www.researchgate.net/publication/321835855_Port_Hinterland_Connectivity_the_Role_of_Inland_Waterways_a_Bangladesh_Perspective

12)ASSESSING THE HINTERLAND OF MARITIME PORTS IN THE EUROPEAN NORTHERN RANGE

Authors: Ralf elbert, Michael gleser, frank van der laan.

URL LINK:

https://www.researchgate.net/publication/357174593_ASSESSING_THE_HINTERLAND_OF_MARITIME_PORTS_IN_THE_EUROPEAN_NORTHERN_RANGE

13)An extended notion of hinterland connectivity to analyze multimodal integration in European hinterland service networks

URL LINK

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4040082

14) Evaluating Determinants of Effective Port-Hinterland Connectivity in Shanghai

Authors: Hee-Yong Leea , Shuangshuang Kongb , Young-Joon Seoc

URL link:

https://www.researchgate.net/publication/322207147_Evaluating_Determinants_of_Effective_Port-Hinterland_Connectivity_in_Shanghai_Ports

15 : Port Connectivity Model in The Perspective of Multimodal Transport: A Conceptual Framework

Authors: F Indriastiwi , sigit pranowo hadiwardoyo , nahry yusuf

URL LINK:

https://www.researchgate.net/publication/349430242_Port_Connectivity_Model_in_The_Perspective_of_Multimodal_Transport_A_Conceptual_Framework

LINKS:

- Shipping Industry: Largest Port in India | IBEF
- Ports & Shipping Industry in India: Navigating the Maritime Se... (investindia.gov.in)
- Kamarajar Port Limited (ennoreport.gov.in)
- Wikipedia, the free encyclopedia
- Ennore Container Terminal, Chennai, Tamil Nadu (adaniports.com)
- https://www.chennaiport.gov.in/
- https://iwai.nic.in/
- https://www.chennaiport.gov.in/sites/all/themes/nexus/files/pdf/dmp2022.pdf?t=1644899158
- **https://paradipport.gov.in/environment.aspx**
- https://vizagport.com/

- https://scholar.google.com/
- https://www.researchgate.net/
- https://www.academia.edu/

REPORTS:

- KPL CORPORATE PLAN 2020-2021
- KPL 20th ANNUAL REPORT 2019-20
- MASTER PLAN – CHENNAI PORT