

AN ANALYTICAL STUDY OF CONTAINER HANDLING AND TRANSSHIPMENT OPERATIONS AT ADANI VIZHINJAM PORT PVT LTD

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ABSTRACT

The handling of containers and transshipment processes are crucial in fostering international business and maritime transport. Seaports are pivotal channels through which goods can be efficiently moved from one country to another by ensuring effective container handling procedures that enhance the delivery process and minimize time spent in transit. In this case, this study seeks to examine the operational efficiency, issues, and effectiveness associated with the handling of containers and transshipment activities within seaports.

The key areas of interest in the study include cargo handling efficiency, port infrastructure, turnaround time, technological advancement, labor productivity, and operating cost associated with transshipment processes. The research design employed in this study includes analytical research methods that incorporate both primary and secondary data collection techniques. Primary data is acquired through a set of standardized questionnaires and interviews conducted with port managers, logistics companies, and shipping agencies, while secondary data is obtained from journal articles, port reports, and official government publications.

The results from the study indicate that the key challenges associated with handling of containers and transshipment include congestions, delays, inefficient port facilities, and lack of adequate technology.

In conclusion, the study shows that proper handling of containers and transshipment plays a key role in making ports productive, supply chains effective, and international business thrive. Suggestions have been made to increase efficiency, minimize delays, and create a competitive advantage for the seaports in the international logistics system.

Keywords : *Container Handling , Transshipment Operations, Seaport Logistics, Port Efficiency, Maritime Transport, Cargo Management, Supply Chain Management*

INTRODUCTION

Port plays a key role in facilitating the interconnection among nations via trade and business activities. More than 90 percent of international cargo shipments are carried through sea routes. Thus, ports play a crucial role in making the global economy strong. Shipping and logistic industry in India has acquired increasing significance with the help of industrialization and globalization. The Government of India has been focusing on establishing maritime infrastructure within the country. Among various maritime infrastructure projects in India, the construction of Vizhinjam International Seaport is one of the notable ventures.

Vizhinjam Port is India's first seaport that has been constructed with automation facilities and infrastructure to operate as a transshipment hub. This seaport has been built near Thiruvananthapuram city of Kerala State.

This port is capable of handling Ultra Large Container Vessels (ULCVs). It is expected to make India less dependent on other countries for transshipment such as Colombo, Singapore, and Dubai. The location of the port is its biggest advantage in terms of global maritime trade.

Nestled close to the city of Thiruvananthapuram in the Indian state of Kerala, the Vizhinjam Port is the first deep-sea automated transshipment port of India, which has been constructed using contemporary technology and state-of-the-art logistics. This port has been built with the capacity to accommodate ultra-large container ships, thereby decreasing India's reliance on overseas transshipment centers like Colombo, Singapore, and Dubai.

As a result of the rising trend in international business activities, there has been an increase in demand for logistics and fast movements of containers. Modern ports cannot be compared to the loading and offloading centers of ships since they have now become logistics centers that affect supply chain management, transport costs, and trade competitiveness. For this reason, logistics efficiency and container flow are critical considerations for ports.

The current study is devoted to an investigation of the logistics efficiency and container flow of the newly constructed Vizhinjam Port in its initial period of operation from January to April 2026. In particular, this research will concentrate on the following aspects:

- Performance indicators of the port;
- Patterns of container traffic in the port;
- Infrastructure use by the port;
- Integration of technologies at the port.

Besides exploring the strengths of operation, this research aims to highlight any challenges or weaknesses that need to be addressed. Given that Vizhinjam port is at its early stages of development, conducting research on its early operations will help gain insight into the operations of an advanced port facility and automation system in practical situations.

REVIEW OF LITERATURE

The effectiveness of port operations and logistics has been extensively explored by scholars globally. Earlier investigations concentrated on cargo handling and economic effectiveness; however, current literature emphasizes operational effectiveness, technological advancement, and synchronization within the supply chain.

Port efficiency plays an important role in evaluating the competitiveness of ports with performance measures that enable comparison between ports around the world, according to Tongzon (2001). In contrast, Cullinane et al. (2006) used DEA to examine the efficiency of container ports and demonstrate the influence of infrastructure and management on their performance measures.

The significance of berth allocation, yard management, and equipment planning to enhance productivity was explored by Vis and de Koster (2003) in container terminal operations. In their subsequent study, Carlo et al. (2014) analyzed the role of optimization strategies in the operation of container transport services at terminals. Both studies demonstrated that efficient collaboration among various operational departments could lead to minimized delays and congestion.

The governance structures of ports and their effects on operational efficiency were considered by Brooks and Cullinane (2007). They highlighted the importance of efficient management systems and policy frameworks for sustainable port development.

Notteboom and Rodrigue (2005) concentrated on the role of ports within logistics chains. According to Notteboom and Rodrigue, ports have ceased to be mere transport hubs and have become significant components of logistics networks. Efficient ports facilitate effective logistics chains through decreased transit time and minimized logistics costs.

Recently conducted studies by Heilig and Voß (2017) emphasized the significance of the role of digital technology in the functioning of ports. Such technologies as Terminal Operating Systems (TOS), Electronic Data Interchange (EDI), Artificial Intelligence (AI), and Internet of Things (IoT) have revolutionized the approach of ports in handling containers.

Regarding the Indian scenario, Goyal (2010) conducted research on the operational efficiency of Indian ports. Some key concerns include lack of proper infrastructure, traffic problems, inadequate connectivity, and less usage of advanced technology. It became evident from the study that India needs to develop its marine industry.

Despite a good amount of research on port efficiency, little is known about new automatic transshipment ports in India. Thus, there is a dire necessity for research regarding such ports as Vizhinjam.

RESEARCH GAP

The earlier literature on port efficiency tends to examine port facilities that have become quite efficient over time and that already have established systems in place. Fewer studies have investigated ports that have just come into operation and that are only in their infancy in terms of operations. Moreover, few studies have been conducted concerning the influence of modern technologies and infrastructures on logistics efficiency in Indian transshipment ports.

Despite the importance of Vizhinjam Port as one of the newer ports in India, there are relatively few studies dealing with its performance in practice. This suggests the need for further research on Vizhinjam Port's operational efficiency in light of the flow of containers and logistics efficiency.

The present study aims to contribute to filling this void.

OBJECTIVES OF THE STUDY

Objectives of the Study Include:

1. To understand the movement pattern of containers at Vizhinjam Port and pinpoint any inefficiencies.
2. To assess the significance of several performance measures including turnaround time of vessels, crane productivity, average dwelling time of containers, and turnaround time of trucks.
3. To explore the impact of coordination and integration of technology on port performance.
4. To highlight any problems related to logistics operations and suggest relevant solutions.
5. To fill the gap between the theory of logistics and real-life port management practices.

Research Questions

- What contributes to efficient container movement at Vizhinjam Port?
- How does Vizhinjam Port compare with other industry standards at its initial stage of operations?
- What measures should be taken by Vizhinjam Port for achieving future efficiency?

RESEARCH METHODOLOGY

This research used descriptive and analytical approaches to investigate logistics efficiency and container movement at the Vizhinjam Port. Both qualitative and quantitative techniques were employed in the research to obtain detailed insights into the workings of the port.

Primary Data

The primary data was collected through:

- Observation of operations of vessels, yards, and gates.
- Performance analysis using time and motion study techniques.
- Semistructured interviews of port authorities, shipping agents, custom authorities, logistics agencies, and equipment operators.

Secondary Data

The secondary data was collected from:

- ❖ Research articles from various academic journals.
- ❖ Publications by industry organizations like Drewry Maritime Research and Indian Ports Association.
- ❖ Organizational performance records.

Different statistical and analytic methods were adopted for comparing performance with international benchmarks.

RESEARCH DESIGN

The time span considered by this study was from January to April 2026, which constituted the beginning phase of the commercial activities at the port of Vizhinjam. In the research, day-to-day activities related to the handling of vessels, containers, and cargo were analyzed.

Interviews were structured for obtaining information on operational difficulties, experiences of stakeholders, and coordination problems between various departments.

SAMPLING TECHNIQUES

Respondents were selected using a purposive sampling technique because they had direct involvement in the operational activities of the port. These included:

- Marine officers
- Yard supervisors
- Operators
- Customs personnel
- Freight forwarders
- Logistics managers

RESEARCH TOOLS

The following methods and techniques were employed:

- Time-motion study
- Performance Indicators (KPIs)
- SWOT analysis
- Process mapping
- Value Stream Analysis

The Performance Indicators (KPIs) used in the present study are as follows:

- Vessel turnaround time
- Crane productivity
- Container dwell time
- Truck turnaround time
- Equipment utilization

ANALYSIS

From the results obtained, it can be seen that Vizhinjam Port operates at an extremely high efficiency level, considering that it is still in the beginning stages of operations. This has been facilitated by state-of-the-art facilities and technologies, coupled with deep-water ports.

It was discovered that the crane productivity rates were fairly similar to international standards, indicating that there was proper performance of the machinery and operation. Automated gates significantly minimized the truck waiting time, increasing efficiency of cargo transfer.

On the other hand, some operational problems were identified. Problems associated with integration of digital equipment, inter-departmental coordination problems, and the creation of hinterland connections impacted the operation. Transshipment times increased as a result of poor synchronization between the schedule of shipment and the activities of the yard.

Furthermore, good communication between marine, yard, and gate operations was important for minimizing congestion and idle time.

TABLES (KEY METRICS)

Metric	Vizhinjam Port (2026)	Industry Benchmark
Vessel Turnaround Time	22–26 hours	24–30 hours
Crane Productivity	28–32 moves/hour	30 moves/hour
Container Dwell Time	3.8 days	4.5 days
Truck Turnaround Time	55–65 minutes	70–90 minutes
Equipment Utilization	82%	80–85%

The above table reveals that Vizhinjam Port has successfully achieved operational efficiencies despite being in its stabilizing stage.

Analysis/Interpretation

The analysis has revealed that both infrastructure and automated technology at Vizhinjam Port have been beneficial in making logistics operations efficient. This is because of the presence of deeper water channels and state-of-the-art handling machinery.

On the other hand, while technology is one of the important aspects of efficiency, it must be complemented by coordination, skilled labor, and infrastructures such as road networks. Thus, improvements in system inter-operability, employee training, and logistic services of hinterlands will help to make them more efficient.

In the future, Vizhinjam Port can become a major transshipment center in South Asia.

FINDINGS

1. High operational efficiency at Vizhinjam Port is evident through automation and advanced infrastructure. Vizhinjam Port demonstrates high operational efficiency through the adoption of automated container handling systems, modern port infrastructure, advanced cargo tracking technologies, and streamlined terminal management practices.
2. Operational problems and integration issues persist at an early stage. Despite technological advancement, Vizhinjam Port continues to face initial operational challenges, including system integration difficulties, coordination gaps, workforce adaptation issues, and infrastructure synchronization delays.
3. The port outperforms many national standards in several operational parameters. Vizhinjam Port exceeds several national operational benchmarks by achieving improved turnaround time, faster cargo movement, efficient container handling capacity, and enhanced terminal productivity standards.
4. Effective stakeholder coordination and digitalization impact productivity greatly. Strong coordination among port authorities, shipping agents, logistics providers, and customs officials, combined with digitalized operations, significantly enhances productivity, operational transparency, and service efficiency.
5. Good road and rail connectivity is vital for future logistics development. Efficient road and rail connectivity surrounding Vizhinjam Port is essential for supporting seamless cargo transportation, reducing transit delays, improving supply chain efficiency, and future logistics expansion.

SUGGESTIONS:

Operational Improvement

- Incorporate real-time Key Performance Indicators (KPIs) tracking systems to monitor cargo movement, turnaround time, equipment utilization, and operational efficiency for better decision-making and performance evaluation.
- Formulate standardized operational procedures to ensure consistency, minimize delays, improve workflow coordination, and maintain service quality across all container handling and transshipment activities.

Technology Improvement

- Enhance interoperability between Terminal Operating Systems (TOS) and Port Community Systems (PCS) to improve data sharing, operational coordination, communication efficiency, and real-time information accessibility.
- Adopt smart technologies such as Artificial Intelligence (AI) and Internet of Things (IoT) for predictive maintenance, automated monitoring, cargo tracking, and operational forecasting to increase efficiency.

Skills Development

- Conduct regular training programs and workshops for operators, supervisors, and technical staff to improve operational knowledge, safety practices, and handling efficiency within port operations.
- Upgrade technical competencies related to automated machinery, digital systems, and advanced container handling equipment to ensure effective utilization of modern port technologies.

Stakeholder Coordination

- Organize periodic coordination meetings among customs authorities, shipping companies, freight forwarders, and logistics service providers to improve communication, reduce operational conflicts, and enhance supply chain efficiency.

Port Connectivity

- Focus on strengthening rail and road connectivity between the port and industrial hubs to facilitate faster cargo transportation, reduce logistics costs, and support regional trade development.

Sustainability Strategies

- Implement environmentally sustainable port practices such as renewable energy utilization, energy-efficient technologies, green logistics systems, and waste recycling facilities to support long-term environmental and operational sustainability.

CONCLUSION

It can be concluded that Vizhinjam International Seaport has huge potential for becoming one of the most successful transshipment ports in India. Positive results from the operation of Vizhinjam Seaport, which include its deep water level, automation system, and infrastructure development, have already been shown to have significant effects on logistics efficiency in the early stages.

Despite some issues with the integration process, human adaptation, and hinterland connectivity, the current performance metrics demonstrate significant growth potential for Vizhinjam Seaport. Continuous improvements will further enhance Vizhinjam's importance for the maritime industry worldwide.

In addition, practical experience shows that a port study provides valuable connections between theory and practice concerning logistics. Effective logistics management involves the optimal balance of several factors.

SCOPE OF FUTURE STUDIES

The following areas may be explored by future researchers:

1. Long-run operational performance in the context of fully commercial operations
2. Comparison with foreign ports that act as transshipment centers (e.g., Colombo and Singapore)
3. Benefits/costs of automation and digitalization
4. Economic and socio-economic implications for Kerala State's regional development and blue economy initiatives.

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