
Logistical Challenges and Solutions in Supply Chain Management at Major Indian Ports

Mansi Shrivastava
Research Scholar
Management

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Abstract

At large Indian ports, supply chains and logistics must be strategically integrated for maximum efficiency. However, there are obstacles to overcome, including obsolete infrastructure, information silos, and inconsistent processes. Indian ports can become powerful nodes in the global supply chain by streamlining cargo flow and increasing data exchange, collaboration, and infrastructural upgrades. Based on the study's backdrop, the study examines how strategic integration affects operational performance and stakeholder satisfaction within the logistics and supply chain management framework at India's main ports. Surveys are used to gather information on stakeholder satisfaction and logistics indicators from a representative sample of the largest ports.

Keywords: *Strategic, Logistics, Supply Chain Management, Operational issues, Ports*

1. INTRODUCTION

A nation's trade growth is a key determinant of its total economic growth. A nation's trade speaks volumes about its economic health. A nation's internal trade not only satisfies the needs of its many areas, but it also encourages balanced regional growth inside the nation. Since ancient times, water transportation has been vital to the Indian economy. It is a simple and affordable way to import and export bulky goods. The significance of ports' role is heightened in this particular situation. A port is a gate that leads from the water onto land. A

port is actually a location along a canal where a ship can halt to load and unload cargo. The hubs for both maritime and terrestrial trade are ports. The largest merchant shipping fleet among developing nations is found in India, which is ranked fifteenth in terms of deadweight tonnes (dwt) and seventeenth in terms of gross registered tonnage (grt) in the world (Mukherjee, 2001). Roughly 90% of the global trade in goods and commodities is said to be carried out by ships. Although the quantities have expanded significantly in the previous two decades, this percentage has stayed relatively consistent throughout the past century. Feenstra (1998)² states that the integration of world trade and the breakdown of production led to this increase in global shipping volumes. Berköz (1999)³ asserts that ports offer two primary benefits. They serve as crucial conduits connecting the hinterlands to international locations first and foremost. However, in order for nations to carry out their functions effectively, they also need internal connections, such as connections to other ports, airports, and train lines. Second, when fuel costs and investment are taken into account, maritime transportation is the most affordable mode of transportation. Road transportation uses ten times as much energy as marine transportation, while railway transit uses twice as much as other modes of transportation. The globe has grown more ecologically conscious in the last few decades, and marine transportation is unquestionably more environmentally friendly than other modes of transportation due to its reduced energy usage. More than 85 percent of India's total seaborne trade is divided among Mumbai, Kolkata, Cochin, Chennai, and Visakhapatnam. India has 35 million tonnes of ship traffic annually on average, while the main ports' combined maximum handling capacity is scarcely greater. Port congestion arises with any growth in trade. Even while ports are becoming more and more important to the nation's trade, the current port infrastructure is insufficient. It cannot stop the time it takes for the ships to finish their voyage or the delays in pre-trade operations. Indian ports are not as productive as other Asian ports in terms of labor and machinery. Due to the lack of indentations in its coastline, India only has a small number of significant ports for trade (Sinha, 2015).⁴ The government authorizes the formation of joint ventures between major ports and foreign ports, major ports and minor ports, and major ports and companies (ies). In order to: (i) attract new technology; (ii) introduce better managerial processes; (iii) expedite the implementation of schemes; (iv) foster strategic alliances with minor ports for the creation of optimal port infrastructure; and (v) increase private sector confidence in funding ports, the measure is intended to facilitate port trusts. When evaluating the port reform process in India, it is important to consider the significant

global shifts in port handling productivity and cargo delivery patterns. Although ports in India were traditionally built primarily to handle bulk and break-bulk cargoes, changes in the maritime trade over the past forty years have resulted in a shift in the way cargo is delivered using containers. The information above must be used to identify solutions for the issues port officials and sheep owners have when operating in this setting. Thus, the researcher chose the current issue for the study after taking the aforementioned relevance into account. The average turn-around time of the vessel, average pre-berthing time, average production per ship berth day, average non-working time at berth, percentage of non-working time to total stay at berth and also at port, and average parcel size are the port's efficiency characteristics, often known as performance indicators. With a few exceptions, the majority of these performance metrics centre on productivity.

1.1.Overview of Logistics and Supply Chain Management

In terms of a conventional "hard and tangible goods" organization's final bottom line, logistics is typically considered as a differentiator that either enables a lower cost or provides more value. High value enters the picture much later and can be either real or intangible in the early stages of a good, whereas lower cost is mostly a one-time feel-good component and has been the typical focal area in logistics. Therefore, even though a company like Zappos could appear pricey at first, the exceptional customer service provided by their strong policies more than makes up for the slightly higher cost. The flow of information as well as materials is a problem of logistics. Information flows the opposite way around, while commodities move from source to consumer. Logistics encompasses more than just inventory management and resource use; it also includes customer responsiveness.

Simply said, logistics is the connection between a company's marketing and manufacturing processes. Because of their interdependence and feedback channel, traditional organizations used to think of them independently, but there is a clear value addition in merging the two. As the number of partners in a supply chain increases, the level of coordination needed to minimize the overall cost for the end customer becomes more difficult to achieve since optimization requires an incredibly efficient movement of materials and information. The broad functional areas of network design, transportation, and inventory management are all included in logistics.

Facilities such as manufacturing plants, warehouses, retail establishments, etc. are essential elements of the network architecture. Transportation: the kind and mode of moving goods is determined by the cost and consistency (reliability) expected from the transportation network, which also has an impact on inventories. The reserve stock known as buffer (or safety) stock is kept on hand to protect against shortages or an unanticipated spike in demand, so preventing "stock-outs." Reduced stock-outs and lower stocks are signs of a well-functioning logistical system.

1.2.Challenges in Strategic Integration at Major Ports

Challenges in strategic integration at major ports encompass a range of complex issues stemming from the intricate nature of port operations, stakeholder dynamics, and external factors. One primary challenge is the coordination among various stakeholders involved in port operations, including port authorities, shipping companies, customs officials, and logistics providers. These entities often have diverse interests and objectives, leading to coordination difficulties in aligning strategies and processes. Misalignment can result in inefficiencies, delays, and suboptimal utilization of resources, hindering the overall effectiveness of strategic integration efforts.

Another challenge relates to information sharing and transparency within the port ecosystem. Effective strategic integration requires timely and accurate exchange of information among stakeholders to facilitate coordinated decision-making and seamless operations. However, information silos, outdated systems, and data security concerns can impede the flow of information, leading to inefficiencies and communication breakdowns. Establishing robust information-sharing mechanisms and promoting a culture of transparency are essential steps in overcoming this challenge.

Port congestion management poses a significant challenge to strategic integration efforts. As ports become increasingly congested due to growing trade volumes and limited infrastructure capacity, delays in vessel berthing, cargo handling, and customs clearance become more prevalent. Addressing congestion requires coordinated efforts from port authorities, terminal operators, and shipping lines to optimize resource allocation, improve operational processes, and invest in infrastructure upgrades. Failure to effectively manage congestion can result in increased costs, longer lead times, and diminished competitiveness for ports.

Risk management and security represent critical challenges in strategic integration at major ports. Ports are vulnerable to various security threats, including terrorism, smuggling, and cyber-attacks, which can disrupt operations and compromise the safety of personnel and cargo. Implementing robust security measures while balancing the need for efficiency and trade facilitation is a delicate balancing act. Moreover, ports must navigate evolving regulatory requirements and international standards to ensure compliance and mitigate risks effectively.

2. LITERATURE REVIEW

Shi, Y. (2020) Drives in the supply chain that have been wanted to offer the most elevated conceivable benefit to clients at the least conceivable expense are significantly affected by various variables, including institutional prerequisites, an absence of figuring out with respect to partners, and port-driven supply chain reconciliation. An absence of development culture and the shortfall of benchmarking principles are two extra critical deterrents that should be survived. There is a clarification of the consequences for both management and strategy.

Srivastava, S. K. (2006) The exploration depends on both essential and auxiliary information, as in the field perceptions. Joint effort and associations inside the supply chain, the construction of the supply chain, the plan of offices organizations, transportation and logistics, and the place of data and correspondences innovations (ICT) are the essential points that are talked about by the creators. The exploration comprises of directing meetings, casual conversations, and on location perceptions with center and upper supervisors from a determination of 25 unique organizations. These affirmations are upheld by measurements and data got from sources like writing and other optional sources. An examination and assessment of the acts of logistics and supply chain management is completed by the creators to recognize huge subjects like creating patterns and areas of concern. Likewise, they uncover and answer worries that are related with Indian approach producers, supply chain administrators, and different partners.

Hall, P. V. (2007) Kindly ask about the components that impact the supply chain strategies utilized by port entertainers. Our speculation is that the territorialized institutional system wherein the prevailing entertainers in a port work is a huge consider deciding the essential supply chain decisions that a port power or administrator makes. A contextual investigation of the rebuilding of Dubai Port Power and the formation of Dubai Ports World (DPW) is the means by which we set these thoughts up as a regular occurrence.

Zagloel, T. Y. (2019) The motivation behind this study is to explore the effect that incorporated worldwide supply chains and port qualities have on the development of vital coalitions, as well as the effect that essential collusions have on port techniques, including sea availability, actual port foundation, coordinated data innovation framework, and terminal taking care of charge, as well as the essential effect of port procedures on port execution. We got information from 210 people in Indonesia who took part in the study, which was led both on the web and straightforwardly. These people were port specialists and professionals. To approve the model, underlying condition demonstrating was used with Lisrel 8.8 as the assessment device. In view of the discoveries, it tends to be reasoned that the qualities of the coordinated worldwide supply chain and ports impact key collusions. These coalitions, thus, affect the improvement of sea openness, actual port foundation, incorporated data innovation framework, and terminal dealing with charge.

Khanapuri, V. B. (2010) Utilizing information envelopment examination on a determination of info and result factors, this exploration assesses the viability of the significant seaports in India. Among the variables that were considered for input were the quantity of births, the quantity of storerooms, and how much cargo dealing with hardware. The typical by and large time required to circle back and the normal result per transport birth day were the two varieties of result that were thought about. It was resolved that six out of the twelve ports were productive terminals. Moreover, an endeavor is made to recognize different regions for expanding the productivity of the port in view of meetings with port chiefs from a chose port in India, where the specialists had the potential chance to do an examination project. This is finished to work on the usefulness of the port. A progression of subjective discussions with port chiefs about the viability of ports filled in as the reason for the meetings that were led following those discussions. Along these lines, the review can act as an establishment whereupon extra changes can be made to all the more likely meet their singular prerequisites.

3. RESEARCH METHODOLOGY

For this study, a lot of primary and secondary data were used. Considering the volume of data collected and presented in this research report, "descriptive research" is deemed to be the methodology most appropriate for the current study. It has been concluded that the study is analytical and descriptive as a result. The research problem and interview schedules have been

designed in accordance with this. The conclusions drawn from a sample of registered Indian freight forwarders are the basis for the study's recommendations.

3.1. Research Design

Using the study's context as a guide, the research methodology seeks to determine how strategic integration affects operational performance and stakeholder satisfaction in supply chain management and logistics at major Indian ports. The process entails choosing a representative sample of significant ports, obtaining logistical metrics data from port authorities, and surveying stakeholders to gauge their degree of satisfaction. Infrastructure, labor efficiency, security measures, and stakeholder satisfaction will all be rated on a scale of 1 to 10. To investigate the relationships between the variables, statistical procedures such as regression and correlation will be employed. The results of the survey will be supplemented by qualitative analysis of the responses. Potential lack of generalizability, inconsistent data reliability, and results impacted by outside influences are among the limitations. Major Indian ports will get recommendations for improving stakeholder satisfaction, operational effectiveness, and strategic integration.

3.2. Sampling Design

To gather primary data, a survey was conducted in the research region between November 2023 and December 2024, focusing on various aspects of logistics operations. The Freight Forwarders Association of India and the Freight Forwarder, which were the subject of the study, had 640 registered members as of December 31, 2024. EXLM Shipping Times, the official publication of the several Freight Forwarders Associations in India that were selected, provided the addresses of the sample respondents. The researcher collected all of the interview dates and personally contacted 300 respondents.

Table 1: Selected ports

Name of the selected ports	Total Registered Freight Forwarders	Sample Respondents
Visakhapatnam port	247	100
Gangavaram port	213	100

Krishnapatnam port	180	100
Total	640	300

The study used the Area Sampling Method with an emphasis on the chosen ports, namely Visakhapatnam port, Gangavaram port, and Krishnapatnam port, where freight forwarders, customs house agents, and liners are accessible. The researcher selected 300 (47%) out of the 640 registered members for the study. Each of the four regions provided a sample of respondents for the study. The researcher got in touch with 47% of the respondents from the three Andhra Pradesh ports that were chosen. As a result, a sample of 300 respondents who were engaged in logistics operations were called from three Andhra Pradesh ports that had been chosen.

4. DATA ANALYSIS AND INTREPRETATION

Table 1: Ports Logistics and Supply Chain Management Metrics

Port Name	Total Cargo Handled	Avg. Turnaroun d Time	Infrastructur e Rating	Customs Clearanc e Time	Labor Efficienc y Rating	Security Measure s Rating
Krishnapatnam	50,000	2 days	8	6 hrs	9	8
Visakhapatna m	80,000	3 days	9	4 hrs	8	9
Gangavaram	65,000	2.5 days	7	5 hrs	7	8

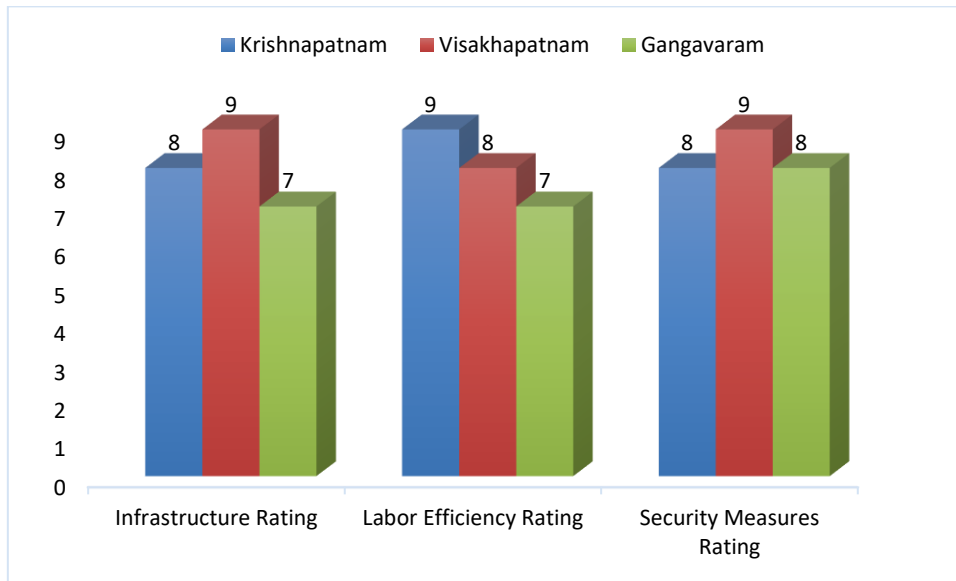


Figure 1: Infrastructure, Labor Efficiency and Security Measures Rating

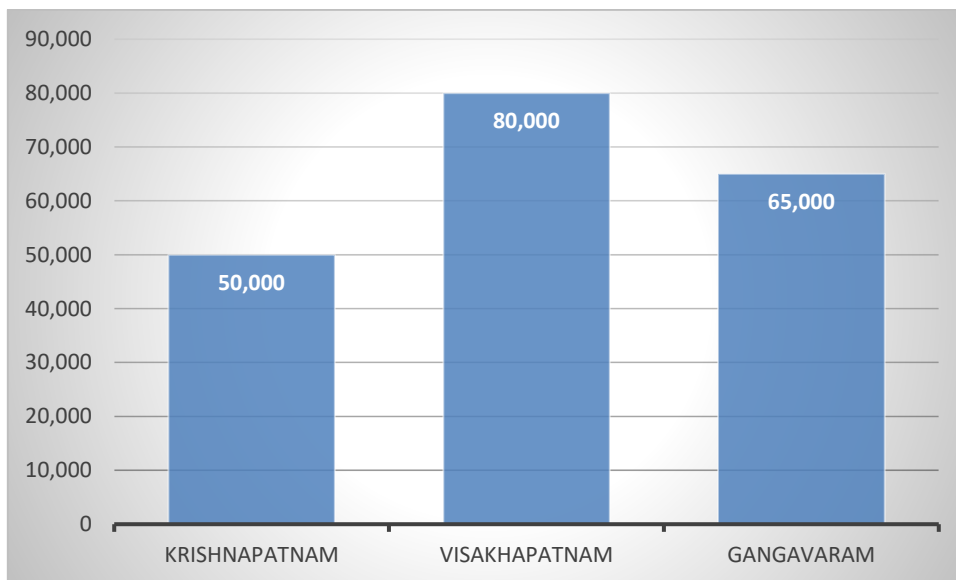


Figure 2: Total Cargo Handled

Key logistics and supply chain management parameters for the three main Indian ports of Krishnapatnam, Visakhapatnam, and Gangavaram are compared in Table 1. Krishnapatnam has an average turnaround time of two days for handling fifty thousand units of cargo. It has

an infrastructure rating of eight out of ten, and customs clearance takes about six hours. Security measures and labor efficiency are rated eight and nine, respectively. With 80,000 pieces of cargo, Visakhapatnam has a somewhat longer turnaround time of three days, but it scores highly in terms of infrastructure (rating 9), with customs clearance taking only four hours, and labor efficiency (8) and security measures (9). With a labor efficiency rating of 7 and an infrastructure rating of 8, Gangavaram handles 65,000 units of cargo, placing it in between the other two ports in terms of turnaround time (2.5 days) and infrastructure rating (7). Customs clearance takes 5 hours.

Table 2:Port Satisfaction Levels

Ports	Satisfaction Level
Krishnapatnam	7
Visakhapatnam	6
Gangavaram	8

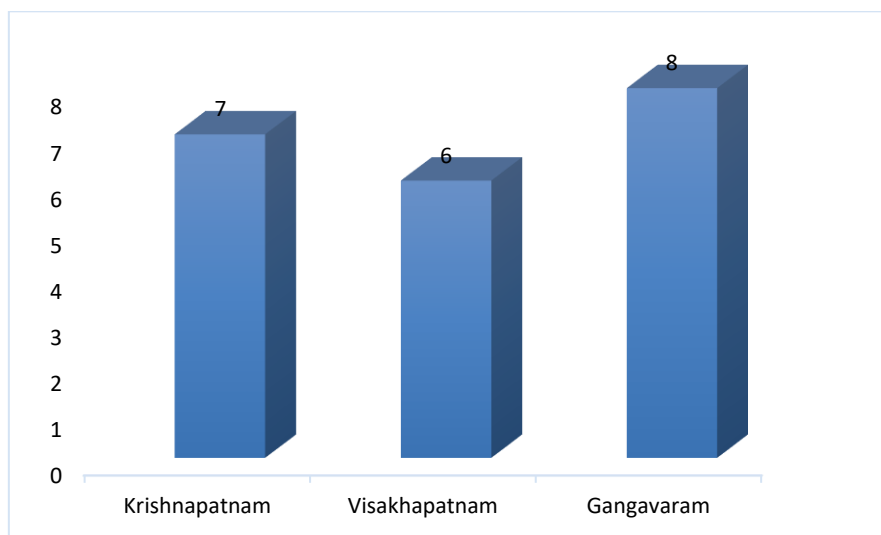


Figure 3: Port Satisfaction Levels

Stakeholder satisfaction at three major Indian ports—Karthapath, Visakhapatnam, and Gangavaram—is seen in Table 2. A rather positive perception among stakeholders is indicated by Krishnapatnam's satisfaction score of 7, which is followed closely by Visakhapatnam with

a level of 6. With the highest satisfaction score of 8, Gangavaram stands out and indicates a particularly high level of satisfaction among the port's stakeholders.

5. CONCLUSION

Although strategic integration in Indian ports offers reduced costs and faster turnaround times, obstacles like clogged roadways and information gaps prevent it from happening. The potential of India's ports to become global trade powerhouses may be realized via investments in infrastructure, standardized data exchange, and cooperation. As a result, this study clarifies the vital role that strategic integration plays in improving operational performance and stakeholder satisfaction in supply chain management and logistics at India's main ports. Important insights into the variables influencing port operations and stakeholder perceptions have been obtained through a thorough study design that included data collecting, stakeholder surveys, and quantitative analysis.

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