ANALYSING THE CAUSES AND CONSEQUENCES OF INCREASED LOGISTICS COSTS IN DEVELOPING COUNTRIES LIKE INDIA

Submitted to the School of Maritime Management, Indian Maritime University in partial fulfilment for the award of degree in MBA International Transportation and Logistics Management

Submitted

By

AJITH S NAIR
Reg.No. 2303305004

Under the supervision of

Dr. B. SWAMINATHAN
Associate Professor & Head

SCHOOL OF MARITIME MANAGEMENT

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

CHENNAI CAMPUS

MAY 2025

DECLARATION

I, **Ajith S Nair (Reg.No.2303305004)**, student of School of Maritime Management, Indian Maritime University- Chennai Campus, hereby declare that this project report titled **Analysing the Causes and Consequences of Increased Logistics Costs in Developing Countries like India** submitted in partial fulfilment of the requirement for the degree of Master of Business Administration (MBA) in International Transportation and Logistics Management is my original work carried under the guidance of my project guide. It has not formed the basis for the award of any Degree/Diploma of any University/Institution. The information submitted is true and original to the best of my knowledge.

Ajith S Nair
(Reg. No.2303305004)

Place: Chennai
Date: 12th May 2025

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CERTIFICATE

This is to certify that the project report titled **'Analysing the Causes and Consequences of Increased Logistics Costs in Developing Countries like India'** submitted to School of Maritime Management, Indian Maritime University, Chennai Campus, in partial fulfilment for the award of the degree of Master of Business Administration (MBA) in International Transportation and Logistics Management, is a record work carried out entirely by **Ajith S Nair,** Reg.No.**2303305004.**

Dr. B. Swaminathan

(Associate Professor)

Project Guide

26.5.25

External

Examiner:

Place: Chennai

Date: 26/05/25

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ACKNOWLEDEMENTS

It gives me immense pleasure to express my gratitude to all those who helped in the successful completion of this project. First & foremost, I thank the God Almighty for his gracious blessings throughout the project work.

I'd like to express my heartfelt gratitude to **Dr. B. Swaminathan, Associate Professor, Head School of Maritime Management, Indian Maritime University,** who has been a constant pillar of support behind this project, without his guidance and support this project would not have materialized. His constant encouragement has truly helped me to complete this project

I'd also like to express my gratitude to the faculties of SMM who provided me with valuable resources and guidance as well as my fellow colleagues who provided me with all sorts of cooperation and support throughout the period which helped me a lot in the completion of my project work

Most importantly I also express my heartfelt love and gratitude towards my parents without whom none of this would have been possible

ABSTRACT

The Indian logistics industry plays a pivotal role in the nation's economic growth, serving as the backbone for key sectors such as agriculture, manufacturing, e-commerce, and infrastructure. As one of the fastest-growing logistics markets globally which is currently valued at over $250 billion and is expected to grow at a CAGR of 10–12% in the coming years this industry is of vital importance in boosting our economy to the next milestone. However, India's logistics costs estimated at 13–14% of GDP are significantly higher than the global average of 8–9%, the goal of this research is to investigate the factors behind this as well as analyse the complexities that makes reducing the cost a challenge

Reducing logistics costs is essential for improving national competitiveness, boosting exports, and supporting the domestic value chain. Lower logistics expenses directly enhance operational efficiency, reduce delivery lead times, and improve service quality across industries. The main objective behind this study is to find out the critical factors behind this problem, understand the root cause and put forward actionable strategies that when implemented efficiently can bring down logistics costs to acceptable levels

The project is divided into several chapters where each focus on a different area, the initial chapters provide a detailed overview of the current logistics landscape in India and the chapters that follow provides a deep dive into the causes and consequences of increased logistics costs in India, the concluding chapter suggests actionable strategies that can be implemented in various sectors which is required to transform India' logistics ecosystem. A more efficient, integrated, and tech-driven logistics sector will be critical in achieving India's vision of becoming a $5 trillion economy.

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
GDP	Gross Domestic Product
LPI	Logistics Performance Index
TMS	Transport management systems
WMS	Warehouse management systems
CAGR	Compound Annual Growth Rate
MSME	Micro Small and Medium Enterprises
JIT	Just in Time
ROI	Return on Investment
3PL	Third Party Logistics
EXIM	Export Import
NCR	National Capital Region
EODB	Ease of doing business
FDI	Foreign Direct Investment
TTF	Trade and Transport Facilitation
PFT	Private Freight Terminals
PPP	Public Private Partnership
RSV	River Sea Vehicle
IV	Inland Vehicle
FICCI	Federation of Indian Chamber of Commerce
DMAIC	Define Measure Analyse Improve Control
ITS	Intelligent Transport Systems
SIP	Smart Industrial Parks
MMLP	Multi Modal Logistics Parks
PGA	Participating Government Agencies
FTL	Full Truck Load
LTL	Less Than Truck Load
MT	Million Tonnes
CHA	Custom House Agents
SWIFT	Single Window Interface for Facilitating Trade
PLI	Productivity Linked Incentives
RTO	Road Transport Organisation
JNPT	Jawahar Lal Nehru Port Trust
ICD	Inland Container Depot
CFS	Container Freight Station
MoRTH	Ministry of Road Transport and Highways
NHAI	National Highways Authority of India
MoPSW	Ministry of Ports, Shipping and Waterways
MoHUA	Ministry of Housing and Urban Affairs
CBIC	Central Board of Indirect Taxes and Customs
GST	Goods and Services Tax
OPEX	Operating Expenditure
HSN	Harmonized System of Nomenclature
ASRS	Automated Storage and Retrieval System
IOT	Internet of Things

GPS	Global Positioning System
RFID	Radio Frequency Identification
HDV	Heavy-Duty Vehicle
ERP	Enterprise Resource Planning
PAAR	Pre-Arrival Assessment Report
SCM	Supply Chain Management
COD	Cash on Delivery
SLA	Service Level Agreement
ATF	Aviation Turbine Fuel
GHG	Greenhouse Gas
CLP	Certified Logistics Professional
NLP	National Logistics Policy
NMP	National Master Plan
LDB	Logistics Data Bank
ULIP	Unified Logistics Interface Platform
DFC	Dedicated Freight Corridor
LEEP	Logistics Efficiency Enhancement Program
PMGSY	Pradhan Mantri Gram Sadak Yojana
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
NW	National Waterway
KPI	Key Performance Indicator
WIM	Weigh-In-Motion
ISO	International Organization for Standardization
NATRIP	National Automotive Testing and R&D Infrastructure Project

CHAPTER I
INTRODUCTION

1.1 Background of the Study

Logistics forms the backbone of trade setting up linkages between producers and markets at both domestic and international levels. Good logistics in developing countries are important for economic development, poverty reduction, and global competitiveness. They affect GDP, creation of jobs, industrial growth, and integration into international value chain. By allowing a smooth flow of goods, services, and information, logistics helps in accelerating economic growth, reducing costs, and enhancing competitiveness. Well-established logistic networks reduce transit times and make goods more accessible and cheaper. Good logistics infrastructure is the backbone for cross-border trade in trade agreements and globalization. Such a logistics system enables supply chains to operate through disruptions caused by events such as the outbreak of pandemics, natural disasters, or geopolitical tensions.

It follows that a well-functioning logistics system provides competitive differentiation to businesses through faster delivery and better service. Countries with highly sophisticated logistics networks would have better chances of attracting foreign investments and export opportunities for economic development. An improvement in logistics performance will give developing countries the opportunity to actively take part in international trade, a crucial engine for economic growth and poverty alleviation. In essence, additional benefits to logistics in terms of cost, safe transport, efficiency, and service quality have consistently played a significant role in boosting competitiveness. The management of the logistics system, from sourcing materials to distributing semi-finished products and delivering final goods to consumers, can be a critical factor in achieving competitive superiority. When viewed as an integrated system, logistics comprises a comprehensive framework of information, packaging, storage, and transportation that fulfils the demands of time, quality, quantity, and cost.

Logistics costs is a crucial component of trade, it refers to all the expenses involved in moving goods from the point of origin to the end customer. It covers a wide range of activities, including:

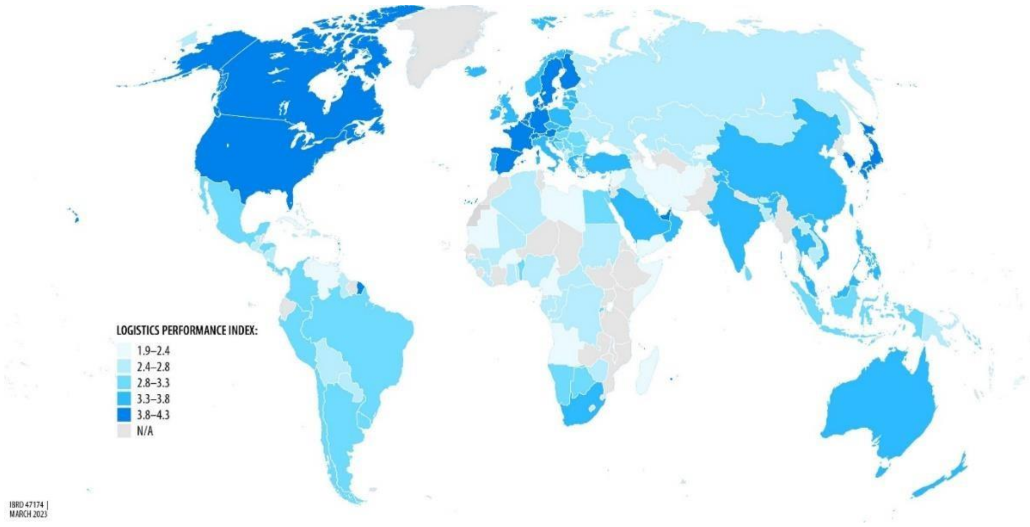
- Transportation costs: involves all kinds of costs that is needed to move the cargo from point A to point B through various modes of transportation which includes road, rail, air, sea, pipelines etc
- Warehousing costs: includes all those costs which is involved in the storage and handling of cargo once it reaches the warehouse.
- Inventory holding costs: refers to all the costs that is involved in maintaining a certain level of inventory, it includes the cost of ordering, opportunity costs, working capital that is tied up, cost of obsolescence etc
- Packaging and labelling: involves all those costs that is incurred in the packaging and labelling of cargo before it moves out of the facility
- Administrative costs: refers to all those costs that is incurred in handling a particular movement from ensuring the documentation and paperwork, permits and clearances, legal compliance etc
- Technology costs: involves the cost of implementing and maintaining the technology used in the logistical systems which includes software like tracking systems, warehouse management software etc
- Labor costs: refers to all those costs that is incurred in managing the payments of the human resources along the various stages of the logistical process. It includes drivers, warehouse staff, logistics managers etc

Currently, logistics costs can be analysed from various angles. At the micro level, the total logistics expenses incurred by different entities vary regionally due to operational and situational factors, The other operational method for logistics costs is considered as a proportion of-GDP. This methodology is most used to evaluate logistical efficiency or competitiveness at a global level.

However, the logistics industry in developing countries faces many challenges, which pose a direct threat to national development. The total logistics cost in developed countries as a percentage of GDP usually varies between 7-8%, whereas developing countries usually have it in double digits, sometimes reaching anything between 15 and 30%. Other infrastructural shortcomings-i.e., poor roads, ports, rail, and airports-poorly influence longer inert transit times and chain of custody costs. The inefficiency in the logistics sectors of developing countries is also the result of the fragmented nature of the industry; low uptake of technology and innovation; regulatory barriers; and restrictions on the availability of skilled manpower and quality service providers, these are the other reasons that contribute to inefficient logistics landscape in developing countries

The World Bank instituted the Logistics Performance Index to identify changes required in the logistics arrangements of economies. Fundamentally, firm supply chain trust is the basis for logistic performances. The LPI measures how easy it is to put in place reliable supply chain linkages and the structural factors that support this including the quality of logistics services, trade- and transport-related infrastructure, and border controls. Global performance has shown considerable resilience following three years of unprecedented supply chain disruptions caused by the COVID-19 pandemic, with advanced economies dominating the rankings, led by Singapore and Finland, which scored 4.3 and 4.2 on a 5-point scale, respectively. Promisingly enough, large emerging economies such as India and South Africa have achieved a mid-tier rating of 3-3.5

Figure 1.1 Countries and their respective LPI



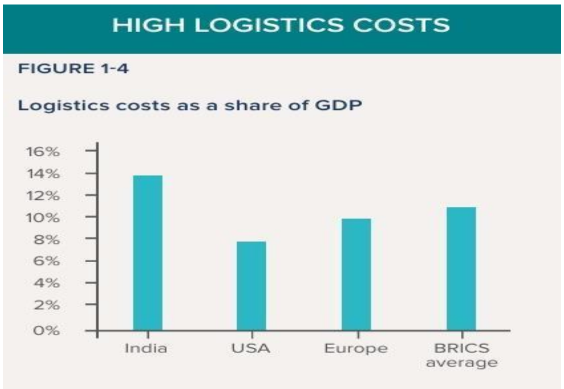
Source: WorldBank.org

An overview of the logistical landscape in certain developing countries like Thailand reveals strong infrastructure with Laem Chabang Port and Map Ta Phut ports, developing aviation and rail connectivity, smart logistic parks, heavy investment in Eastern Economic Corridor yet inefficiencies exist in the form of congestion around Bangkok and port cities as well as regional disparities with logistics costs as high as 15%.

Vietnam has a rapidly improving infrastructure fueled by FDI and manufacturing growth, key hubs include Ho Chi Minh City, Hai Phong Port, and Da Nang but port congestion around Ho Chi Minh City, weak inland connectivity and high logistic costs around 16-18% affect its logistic competitiveness. Bangladesh another emerging economy and a booming garment and textiles hub is also facing similar issues with Chittagong port which is one of the slowest container handling ports and logistic cost as high as 20-22%. African nations like Nigeria, Egypt, Kenya offer immense potential and possibilities with its strategic location, natural resources availability and emerging manufacturing capabilities but are affected by issues like bureaucratic inefficiencies, infrastructural gaps and high logistics costs

As far as India is concerned the Indian logistics industry is growing, due to a flourishing e-commerce market and technological advancement. The logistics sector in India is predicted to account for 14.4% of the GDP. The industry has progressed from a transportation and storage-focused activity to a specialised function that now encompasses end-to-end product planning and management, value-added services for last-mile delivery, predictive planning, and analytics, among other things. This sector employs 22 million people directly and indirectly and serves as the backbone for various businesses. The logistics sector in India was valued at US$ 250 billion in 2021, with the market predicted to increase to an astounding US$ 380 billion by 2025, at a healthy 10%-12% year-on-year growth rate. Moreover, the government is planning to reduce the logistics and supply chain cost in India from 13-14% to 10% of the GDP as per global industry standards.

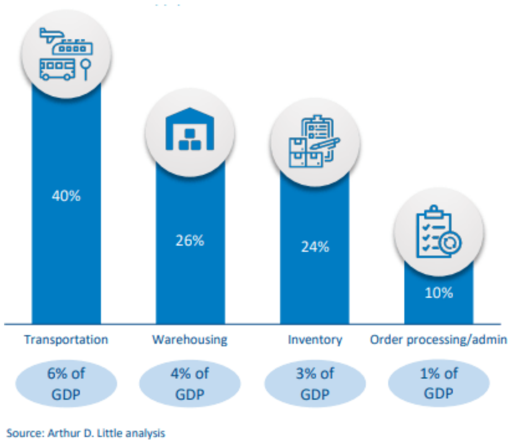
Figure 1.2 Logistics Costs as a Percentage of GDP of given nations



Source: NITI AAYOG

The logistics business is highly fragmented and has thousands of active participants, including major local players, worldwide industry leaders, the express division of the government postal service, and rising start-ups that focus on e-commerce delivery. The industry includes transportation, warehousing, and value-added services like packaging, labelling, and inventory management. With the advent of technology-driven solutions such as transportation management systems (TMS) and warehouse management systems, India's logistics industry has witnessed tremendous development in recent years (WMS). These solutions have assisted logistics firms in increasing operational efficiency, lowering costs, and improving customer service.

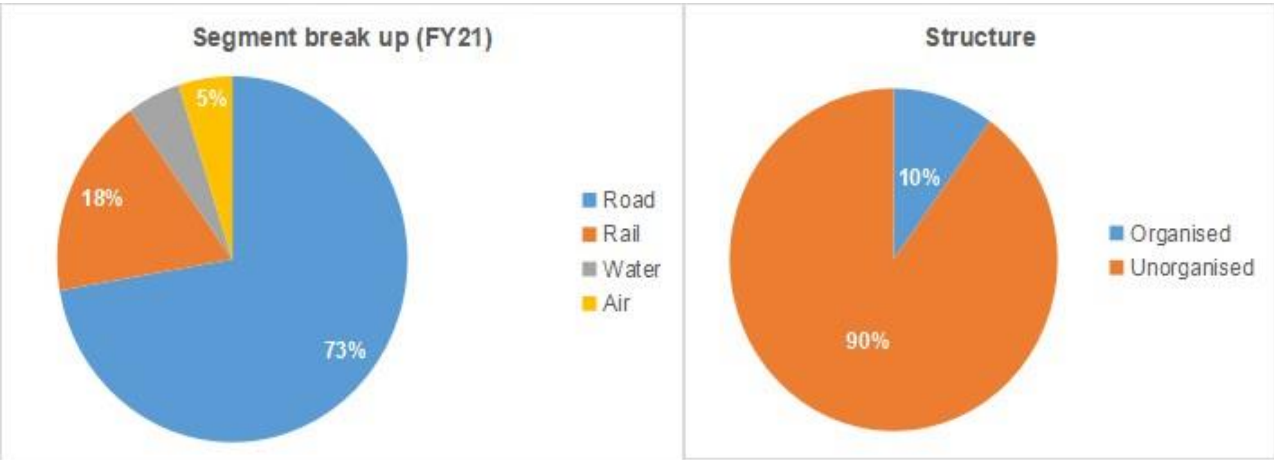
Figure 1.3 Logistics Costs breakdown in India



An essential pillar of economic development, the logistics sector is responsible for the smooth and uninterrupted flow of goods and services across the supply chain. As per job statistics, it contributes nearly 13-14% to the GDP and employs approximately 22 million people. Timely deliveries, reduced costs, and increased competitiveness remain the building blocks of any successful business-the logistics land on these pillars. By creating connectivity infrastructure and integrating new technologies into its system, logistics assist economic growth through productivity and trade enhancement. It also promotes investment in the sector and supports various industries, thereby giving a significant push to GDP growth. Being a standard trade and commerce system, the logistics sector is indispensable for the advancement of the economy, which will allow countries like India to open their full potential and enrich themselves with sustainable growth. According to an EY report, entitled 'India@100', the GDP of India is projected to reach a market exchange rate of about US$ 26 trillion by 2047-48. Transport and logistics shall stand tall as pillars to make the ambitious objectives a reality for the country.

Over the next 25 years, transport and logistics would enable the fruition of this goal pursued by India, and this is a somewhat encouraging factor, considering the fact that logistics costs, as a percentage of India's GDP, are quite high. These high costs are largely attributed to the dependency on road transportation for freight movement in India, wherein road transport accounts for 66% of cargo in ton-kilometres. Rail transportation follows with a 31% share, while shipping and air transport make up only 3% and 1%, respectively. However, the distribution of freight transportation varies by sector. Organised players currently represent only about 9-10% of the logistics market segments, which include road transportation, warehousing, and supply chain services. Nevertheless, organised players are projected to experience a substantial compound annual growth rate (CAGR) of approximately 32% from 2022 to 2027, leading to an expected market share of 18-20% by FY27. This shift in the structural organisation of the industry depends on the capacity of the organised players to provide integrated services, achieve scale-driven efficiencies, and make substantial investments in technology and engineering.

Figure 1.4 Indian Logistics Industry Structure



Source: KPMG Report

1.2 Statement of Problem

Effective logistics systems are key enablers of economic growth, trade facilitation and supply chain competitiveness. The logistics is increasingly crucial for the Indian economy, especially in developing countries, which depend heavily on logistics for their agriculture, industry, services, and retail sectors. It is interesting that though the costs have been falling, India still has the burden of an expensive logistic pricing system with estimates today to be in the region of 13-14% of GDP against an average of 8-10% in developed countries like Germany, Japan and the US.

This high-cost structure is indicative of inherent inefficiencies and infrastructure gaps along the logistics value chain. Among the critical causes pushing the cost structure upwards are: excessive reliance on roads (which carry approximately 70% of the total freight), fragmentation and informalization of trucking industry, poor integration of multimodal logistics (road-rail-interior water transport, coastal shipping, etc.), inordinate lack of warehouse capacity and poor usage of the existing (some five lakh) warehousing capacity or warehouses; inefficient working of ports, inordinate delay in customs and bureaucratic procedures, and super-slow rate of technology adoption by the logistics sector. In addition to structural constraints, operational pinches like congestion, last-mile delivery challenges, rural connectivity, limited cold chain infrastructure, and variable fuel costs only make it worse. There are also policy and regulatory differences across states, complicated tax structures (including post-GST impacts on some segments), and bureaucratic barriers that still obstruct smooth logistics transactions.

The consequences of these high logistics costs are widespread and profound:

- For manufacturers and exporters, it leads to reduced competitiveness, higher input costs, and difficulty integrating into global value chains.
- For MSMEs and farmers, it erodes profitability, constrains market access, and discourages participation in national and international markets.
- For consumers, it results in higher retail prices and limited product availability, particularly for perishable goods.
- For the overall economy, it dampens industrialization efforts, inflates inflationary pressures, widens regional inequalities, and ultimately slows GDP growth.

While acknowledging these problems, the Government of India introduces several steps including National Logistics Policy (2022), PM Gati Shakti National Master Plan, and investment in roadways, port, railway and airport programmes. But to achieve success in these efforts, a clear understanding of the origins of inefficiencies and how they ripple through the economy is necessary.

Therefore, this study seeks to systematically analyse the underlying causes and wide-ranging consequences of increased logistics costs in India, assess existing policy interventions, and propose actionable strategies to enhance the efficiency, reliability, and cost-effectiveness of India's logistics ecosystem.

The Indian logistics sector, an important ingredient to economic progress, has experienced impressive growth. But even as it grows, it does not come without challenges. The primary challenge is the lack of infrastructure such as roads, ports, airports, and rail heads which have under capacity, unorganised supply chain with many small independent players operating across the supply chain segments, complex regulation, last mile connectivity, security, skills, and skill sets.

1.3 Objective of the Study

- Identify the primary factors responsible for increased logistics costs in India and other developing countries
- To assess the economic, industrial, and social impacts of elevated logistics costs across sectors such as manufacturing, agriculture, and retail.
- To assess the role of government policies and infrastructure in influencing or reducing the logistics costs and evaluating the effectiveness of recent government initiatives
- To suggest various actionable strategies to reduce the expenses along the supply chain and bring down the overall logistics costs

1.4 Methodology

- Review of Literature: Conduct a comprehensive review of existing literature on Indian logistics industry with reference to total logistics costs and operational inefficiencies existing in the industry
- Descriptive and Analytical Approach: The study is descriptive in identifying logistics cost components and analytical in evaluating the effects and root causes.
- Secondary Data Collection through Government Reports published by agencies like Ministry of Commerce, NITI Aayog, National Logistics Policy (2022), Gati Shakti, Industry white papers by FICCI, CII, KPMG, McKinsey, Deloitte, etc, academic journals, published case studies, and research papers.
- Qualitative Analysis of data which includes thematic analysis of sectors and policy documents, and case studies illustrating challenges and reforms in select regions or sectors.

1.5 Scope of the study

- Geographical scope: Primarily focused on India, with comparative references to other emerging economies (such as Vietnam, Thailand, and South Africa) where relevant.
- Sectoral Scope: Covers manufacturing, agriculture, e-commerce, and MSME sectors, where logistics plays a critical role.
- Temporal Scope: Focuses on trends and developments over the past decade (2010–2025), including the impact of recent policy initiatives.
- Analytical scope: Policy analysis, cost data, efficiency indices will be utilized

1.6 Significance of the study

The study is significant as it seeks to answer several questions that arise as a part of the research process such as

- What are the major factors causing elevated logistics costs in India?
- How do high logistics costs impact the competitiveness of industries, exporters, and small businesses?
- What are the broader economic and social consequences of inefficient logistics systems?

- How effective are recent policy measures and infrastructure projects in mitigating logistics inefficiencies
- What strategies can be adopted to bring India's logistics costs in line with global standards

The study can be of substantial significance as it can provide critical insights for policymakers striving to make India a global manufacturing and export hub under initiatives like Make in India and Atmanirbhar Bharat helping policymakers fine-tune national initiatives. The data gathered can help initiate reforms in customs, interstate transport rules, and multimodal integration boosting India’s Ease of Doing Business and global competitiveness which will weigh down the overall logistics costs. By highlighting specific bottlenecks (e.g., poor warehousing in Tier-2 cities, port delays), it can help prioritize public infrastructure spending.

As far as businesses and stakeholders are concerned significant benefit can be cost optimization, sectors like manufacturing, retail and agriculture can identify avoidable logistical expenses and improve their supply chain design. It can highlight specific pain points faced by MSMEs and agricultural producers, thus informing targeted policy interventions. The study will also discuss the benefits of adopting latest technologies and digitization like TMS, WMS, Just in Time methods, warehouse automation etc at the sectoral level which will have a positive impact from ROI point of view and ultimately help to bring down the total cost of logistics

It can also contribute to academic literature on emerging market logistics, providing a nuanced analysis of India's unique infrastructural, regulatory, and operational landscape. Ultimately, it supports the broader national objective of reducing logistics costs to 8–9% of GDP and enhancing India's global competitiveness.

CHAPTER II
REVIEW OF LITERATURE

2.1 Introduction to Literature Review

This chapter provides a review of literature that consists of expert insights on topic related to increasing logistics costs in India. To understand the impact of logistics costs on supply chain performance, it is imperative to first understand the concept of logistics costs, its constituents and the key drivers. Therefore, this chapter focuses on the review of literature on the concept of logistics costs and its implications.

2.2 Logistics Costs

Logistics, in simple terms, is the distribution of products and services from the point of origin to the point of consumption Hence, a unified and reliable way to measure logistics costs is crucial. Equally important is to identify the factors where there is scope to reduce costs. At the outset, it is important to understand the elements that determine logistics costs which can be broadly classified into

- Warehousing Costs
- Transportation Costs
- Inventory holding costs
- Order Processing Costs
- Material Handling Costs
- Information Services Costs
- Insurance and Administration costs

As per the **"India Logistics Industry Research report"** by **N Vishvanadham and M Puvaneshwari** [1] The authors believe that India's infrastructure poses a significant obstacle to the logistics industry. Although India is a vast nation covering 3.29 million square kilometres, its infrastructure, which includes roads, railways, seaports, and airports, is deemed inferior when compared to both developed and developing nations. This inadequate infrastructure and subpar transport services lead to ineffective freight movement and delays, resulting in substantial time and financial losses. Consequently, the unreliable transport and logistics systems diminish the competitiveness of the

[1] Viswanadham, N., & Puvaneswari, M. (2004). India Logistics Industry.

country's exports. Additionally, the fragmentation and overlapping responsibilities among various government agencies create confusion and hinder accountability, thereby impacting the performance pressure on these agencies. Furthermore, resource mobilization in India is insufficient, with public investment in transport remaining stagnant and declining in relation to GDP, while private financial contributions are still very limited. Lastly, poor asset and system management represents a third challenge affecting the transportation infrastructure sector in India.

In the paper **"Study of Indian Logistics Industry in Changing Global Scenario** by **Dr Gyanesh Kumar Sinha[2],** The author highlights several factors contributing to the rising logistics costs within the Indian logistics sector, primarily attributing these issues to inadequate infrastructure and administrative hurdles. There is a particular concern regarding the rail network, which is largely overburdened. Since independence, there has been minimal enhancement in track infrastructure, with route kilometers expanding at a compound annual growth rate (CAGR) of only 3%, while the addition of new lines on existing routes has seen a modest CAGR of 6.6%. In contrast, freight and passenger traffic has surged at a CAGR of nearly 55%, resulting in the oversaturation of many high-density corridors. Furthermore, the author notes that the Indian railways implement a policy of subsidizing passenger fares through freight charges, leading to elevated rail freight tariffs that have escalated sharply, while passenger tariff rates have seen only slight increases. Consequently, Indian rail freight rates have become among the highest globally. Regarding the road network, freight transportation in India heavily relies on national highways, which, despite comprising only about 2% of the total road network, accommodate 40% of all traffic. This reliance has led to severe congestion on these highways, causing freight to travel only one-third the distance compared to developed nations. Although the quality of roads, including national highways, is improving, it remains inadequate in many areas, with estimates indicating that motorable roads constitute less than 10% of the entire road network. In the port sector, high turnaround times for ships due to berth congestion and slow cargo evacuation significantly elevate both time and costs. Additionally, coastal shipping has not gained traction due to insufficient port and land-side infrastructure, which limits its large-scale application for freight transport.

[2] Sinha, G. K. (2016). Study of Indian Logistics Industry in Changing Global Scenario. In *International Conference at GD Goenka University, Gurgaon*.

The paper "**A roadmap for internal reforms and other actions required to enhance exports in logistical services from India"** by **Samir K Srivastava and Saurabh Chandra**[3] provides much deeper perspective into the causes, the authors suggest that the main factors that drive up the logistics costs consists of Poor-quality Infrastructure, A complex tax system both at State and Central level. Low acceptance of logistics requirement outsourcing like 3PL and 4PL, Highly Fragmented market with large number of small players, Lack of integrated players across different modes and geographies, Lack of IT Infrastructure and Complexity of International trade documentation process

As per NCAER Research report on "**Analysis of India's Logistics Costs**" by **Devendra B Gupta, Sanjib Pohit**[4]**,** regional imbalances in India have led to the establishment of production facilities only in a few regions in India. This, in turn, has resulted in an imbalance of cargo loads across India. More often than not, after delivering their cargo, especially in the North-east, transporters have to bring back their trucks completely or partially empty. This leads to higher logistics costs on some of the routes where one of the nodes of transportation lies in eastern/north-eastern India.

Unionisation is another important factor leading to an escalation in logistics costs in some states like Himachal Pradesh, Kerala, and West Bengal. This is one of the reasons why exporters located in Tirupur do not send their export consignments through the nearest port, namely, Kochi.

The transportation cost, on an average, contributes to nearly 50 per cent of the total logistics costs across all domestic/EXIM routes. This holds true for both transportation by road as well as by rail. Thus, high fuel costs in India have a significant impact on the logistics costs.

It may also be noted that the NCR-Guwahati route also faces other serious challenges like leakage of consignments and the need to pay bribes to allow for smooth movement of the cargo along the route thus again contributing to rising costs.

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[3] Srivastav, S. K., & Chandra, S. (2013). A road map for internal reforms and other actions required to enhance exports in logistic services from India. *Invited Concept Paper at Services Conclave on "Promoting Services Export from India—Challenges, Opportunities and Issues. Hotel Le Meridien, New Delhi*

[4] NCAER Research report on Analysis of India's Logistics Costs, Devendra B Gupta, Sanjib Pohit, Ministry of Commerce, New Delhi, September 2019

In the article "**A Framework for assessing logistic costs"** by **M Andrejić, N Bojović, M Kilibarda, S Nikoličić** [5] author provides us with a deeper understanding of the logistical costs and its various constituent, Logistics costs as a percentage of GDP vary between 5% and 20%, influenced by the development levels of individual national economies. These costs account for 25% to 45% of total expenses, and can represent up to 20% of product prices, depending on the industry and business type. Within logistics costs, transportation and warehousing are the most significant components. Transportation costs, which can range from 25% to 50% of total logistics expenses, are particularly affected by the company's size, business type, economic development, and various other factors. Following transportation, warehousing costs contribute between 15% and 40%. A considerable portion of logistics costs remains obscured, referred to as 'hidden' logistics costs. Consequently, there is an increasing interest in both the literature and practical applications aimed at establishing and minimizing logistics costs.

In the paper **"Research on the Analysis of the Cost of Logistics Enterprises"** by **Yongming Pan, Ziwei Li**[6]**,** The authors highlight macroeconomic factors influencing logistics pricing, such as labour and fuel costs. The paper also identifies additional drivers of logistics expenses, noting that rising labour costs, due to fluctuations in labour supply and demand, directly elevate the operational costs for logistics companies. Given that many current logistics operations rely heavily on manual labour, the costs for these enterprises have risen sharply. Furthermore, increasing material costs are another contributing factor; the logistics sector is closely tied to oil, with significant fuel consumption across shipping, air transport, and road transport. The recent volatility in oil prices, characterized by more frequent increases than decreases, has substantially raised the raw material costs for logistics companies.

Improving logistics performance through investments and policy intervention: a causal loop model" by **Amrita Jhawar, S.K Garg, Shikha N Khera**[7]

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[5] Andrejić, M., Bojović, N., Kilibarda, M., & Nikoličić, S. (2018). A framework for assessing logistics costs. *Int. J. Logist. Manag*, *27*, 770-794.

[6] Pan, Y., & Li, Z. (2015, March). Research on the Analysis of the Cost of Logistics Enterprises—— Analysis Based on the Financial Statements of 15 Logistics Listing Enterprises. In *2015 International Conference on Education Technology, Management and Humanities Science (ETMHS 2015)* (pp. 52-57). Atlantis Press.

[7] Jhawar, A., Garg, S. K., & Khera, S. N. (2017). Improving logistics performance through investments and policy intervention: a causal loop model. *International Journal of Productivity and Quality Management*, *20*(3), 363-391.

sheds some more light on the logistics environment as well as the drivers of logistics costs in India.

India’s spend on logistics, 13% of its gross domestic product (GDP) (Deloitte, 2012) is much higher than that of the developed economies like the USA (8.3%), Japan (11%) and Germany (8.8%) Although the growth is exponential, it is faced by numerous problems, leading to very high logistics cost A fragmented market increases paperwork, costs and efforts required to channel resources. The poor condition of roads translates directly to higher vehicle turnover, which increases operating costs and reduces efficiency and increases the rate of accidents. These inefficiencies are passed on to the logistics industry, with transportation costs accounting for nearly 41% of logistics costs and the losses due to accidents and mishandling accounting for nearly 14% of logistics costs (Pandey and Sahai, 2012). In addition to increasing the logistics cost, the transit time also gets increased and the useful assets like the driver, labour and truck are deployed for a longer period of time to complete a delivery. One of the barriers to the Indian logistics system is the tax infrastructure. With state owned tax structure, along with other taxes, movement of goods become costly and inflexible also, the movement is hauled by police check posts, tolls etc. which increases the cost, wastes time and fuel. Internationally while truck drivers do an average of greater than 600 km per day, in India the struggle is to get to 400 km per day due to the infrastructural limitations which once again drives the cost up

As per the paper” **National Logistics Costs”** by **Mir Saman Pishvaee, Hadi Basiri, and Mohsen sheikh Sajadieh[8],** certain other factors driving up the logistics costs include geographical situation Usually, countries that are close to ports, airports, economic hubs have better logistics systems with lower logistics costs. Logistics infrastructures -Distribution network and communication network are important components of this part. Human resource, Availability of skilled labour as a strategic source can play an important role in promoting logistics activities and reducing logistics costs. In most methods for estimating national logistics costs, share of administration costs is assumed to be around 1.5-2% of total costs. Technological development makes fundamental changes in logistics activities. In this area information and communications technologies (ICT) are more effective on logistics activities. Political and economic

[8] Pishvaee, M. S., Basiri, H., & Sajadieh, M. S. (2009). National logistics costs. *Supply Chain and Logistics in National, International and Governmental Environment: Concepts and Models*, 57-83.

stability play an important role in attracting investment in national logistics activities. Moreover, instability in this area may result in industrial disputes and work stoppage that both result in an increase in logistics costs. Business legal rules. Customs, taxes and insurance laws are components of this Part. One of the important macroeconomic indicators that can play an important role in logistics costs is rate of interest, Global trend of increasing energy prices is another important factor that affects logistics costs.

High logistics costs can significantly impact businesses by raising product prices, reducing profit margins, hindering competitiveness in the global market, impacting inventory management, and potentially forcing businesses to reduce investment in innovation and expansion due to increased operational costs, ultimately affecting their overall economic viability. The impact of increased logistical costs will be the next area of focus in this literature review

In the research paper **"Identification and Measurement of Logistics Cost Parameters in the Company" by Marcin Stępieńa, Sylwia Łęgowik-Świącikb, Wioletta Skibińskac, Izabela Turekd**[9] the authors suggest that planned logistics costs mainly concern the transportation of supplies, manufacturing, maintenance and expiry of stocks, warehouse and transport management, interest rates on credits, communication and information costs. the authors suggest that planned logistics costs mainly concern the transportation of supplies, manufacturing, maintenance and expiry of stocks, warehouse and transport management, interest rates on credits, communication and information costs. An increase in these costs significantly affects the company margins. Maintenance of excessive stocks (warehousing, service, interest rates on credits), improper transport expenses, losses due to improper materials management, e.g. downtime caused by failure in materials delivery, production shortages caused by inappropriate materials, penalties for improper ordering and deliveries all these are other aspects of logistics cost and increases the operational expenses of the company in a directly proportional manner. Consequently, a significant part of the costs of warehouse management, incurred at the level of the company, disappears from the accounts and this includes: costs of frozen

[9] Stępień, M., Łęgowik-Świącik, S., Skibińska, W., & Turek, I. (2016). Identification and measurement of logistics cost parameters in the company. *Transportation Research Procedia*, *16*, 490-497.

capital in warehouse stocks, costs and the way of storage of materials, costs of the structure of warehouses, the way of their arrangement and operation, costs of losses arising in the course of storing the resources, costs of maintenance of proper inventory level, costs of current functioning of storage cells, costs of loss of profit due to inventory shortages

In the research paper **"Comparative impact of Logistics Performance Index, Ease of doing Business and Logistics Costs on Economic Development: A fuzzy QCA Analysis"** by **Mohan Saini, Denisa HRUŠECKÁ [10]** the authors aims to evaluate the impact of two major institutional indexes logistics performance index (LPI) and ease of doing business (EODB) along with logistics cost (LC) on the economic development (Gross domestic product – GDP per capita). The variables selected for the research study provides the comprehensive impact and forms the core of the economy for any country

In the paper results of correlation analysis have displayed a positive relationship between logistics performance index, ease of doing business and economic development, however negative relationship between logistics costs and economic development. The paper illustrates, that with reduction in LC in percentage to GDP is a sign of reduction in cost of goods and higher purchasing power and thus contributing to growth in GDP per capita. In summary, better infrastructure and policies for improving logistics network to enable reduced logistics cost and improvement in LPI factors results in the higher values of GDP per capita.

The article "**The Real impact of high transportation costs"** by **Dawn Russell, John J Coyle, Kusumal Ruamsook, Evelyn A Thomchick[11],** highlights that High transportation costs are driving three main transitions in supply chain strategies. These changes are having a beneficial impact not just on transportation budgets but also on broader supply chain and financial performance.

Transition 1: Offshoring to nearshoring Sourcing How much should we move from an offshoring sourcing to a nearshoring sourcing to minimize the distance of transportation? This shift is causing companies to take a fresh look at the way they

[10] Saini, M., & Hrušecká, D. (2021). Comparative impact of logistics performance index, ease of doing business and logistics cost on economic development: a fuzzy QCA analysis. *Journal of Business Economics and Management, 22*(6), 1577-1592.

[11] Russell, D., Coyle, J. J., Ruamsook, K., & Thomchick, E. A. (2014). The real impact of high transportation costs. *CSCMP's Supply Chain Quarterly*.

source. More and more companies are no longer seeing supply and manufacturing only from a cost perspective, they are aligning their operations as close to their end markets as possible.

Transition 2: Moving from product and packaging designs whose main goals are marketability and production efficiency to designs that also focus on 'shipability.' Many manufacturers are redesigning their products and packaging to reduce weight and increase the density of shipments. For instance, some companies have redesigned products, such as laundry soap, dishwasher liquid, dairy powder and fruit juice, to be denser and more compact.

Transition 3: Evolving from lean inventory strategies to hybrid strategies that integrate lean inventory and transportation. Typical transportation strategies employed by companies adhering to lean principles include just-in-time delivery, small, rapid, and frequent shipments, and the use of dedicated fleets—all of which rely on low transportation costs. However, as the significance of transportation economies of scale (achieved through larger, less frequent shipments) grows, and the trade-offs between inventory and transportation costs become increasingly critical, companies have begun to adopt hybrid strategies that not only emphasize safety-stock and cycle-stock policies but also take into account the advantages of reduced transportation expenses.

Mariusz Iskra[12] in his work "**The importance of logistics costs in enterprises"** talks about the phase flow criterion in logistical performance of a company and how activities in each stage have an impact on the overall logistical cost of the company

phase costs of supply (purchase) - related to the organization and implementation of the supply and maintenance of warehouse. In particular, these are the costs of the physical flow of materials from suppliers to warehouse, transport costs, supply control, planning and management of process supply, maintenance costs of information processes involved in the movement of materials, an increase in any of these aspects can lead to increased overhead costs

costs of the production phase - include company internal flows of materials, semi-finished and finished products. In particular, include the costs of the physical flow of

[12] Iskra, M. (2015, October). The importance of logistics costs in enterprises. In *Conference Proceedings of the 3rd International Scientific Conference* (p. 781).

materials between the seats of production, the cost of information processing that controls the process flow of materials and products within the company

costs of the distribution phase - includes costs of organization and functioning of distribution channels and costs of information processes related to distribution logistical costs of storage and recycling of waste - the cost of the collection, transport and disposal of waste and the costs of information processes aimed at waste management. It can be related to the return or reverse process of the supply chain connected with used products: collection, inspection and separation, re-processing, disposal and re-distribution. Cost variations in these aspects of distribution can significantly amplify the logistical costs of a business

Liu Xianghui[13] in his paper **"The Impact of Logistics Costs on the Economic Development"** points out the impact of high logistics cost on businesses in terms of their bottom line as well as opportunity cost associated with other ventures. From a micro-economic perspective, the cost-effectiveness of logistics can have a major bearing on a firm's decisions about which country to locate in, which suppliers to buy from, and which consumer markets to enter. From a macro-economic perspective, high logistics costs to GDP are a barrier to trade and foreign direct investment (FDI), and thus to economic growth. Countries with higher overall logistics costs are thus more likely to miss the opportunities of globalization. Higher logistics costs result in higher trade costs, which in turn penalize trade and impede the realization of gains from trade liberalization as well as the growth of the economy

Government policies significantly impact logistics costs by regulating aspects like infrastructure development, taxation, customs procedures, and trade regulations, essentially influencing the efficiency and speed of goods movement, thereby directly affecting transportation and storage costs within the supply chain; essentially, supportive policies can lower logistics costs by facilitating smoother operations and encouraging investment in modern logistics infrastructure. Key ways government policies influence logistics costs: Infrastructure development by Investing in roads, ports, airports, and rail

[13] Liu, X. (2016). The impact of logistics costs on the economic development: The case of Thailand. *Business and Public Administration Studies*, *10*(1), 37-42.

networks, implementing favorable tax policies for logistics companies, streamlining customs procedures, simplifying documentation, and implementing digital platforms for customs clearance, negotiating trade agreements that facilitate cross-border movement of goods can lower tariffs.

The discussion paper "**Measurement of National level logistic cost and performance"** by **Karri Rantasila, Prof Lauri Ojala**[14] highlights the role govt policies plays in shaping the logistical performance of a nation, understanding logistics performance at the national level is essential for effectively assessing and directing Trade and Transport Facilitation (TTF) policy initiatives over time and among different countries. Reduced logistics costs lead to lower product delivery expenses, which in turn stimulates sales, enhances trade, opens new markets, and generally promotes business growth. A robust and comprehensive set of performance indicators at the national level is vital for facilitating high-level policy discussions, as well as for the preparation and execution of policies. Policymakers require a deeper insight into:

- the absolute and relative levels of logistics costs
- the primary factors influencing logistics costs
- the impact of costs and performance deficiencies on specific economic sectors.

Jeremy Shires[15] in his paper **"The impact of Policy Drivers on Logistics Supply Chain"** highlight the impact of policy drivers on the freight logistics supply chain. Policy drivers are defined as overarching goals, targets, or statements deemed beneficial by governments to achieve social and economic objectives, while policy levers are the instruments employed to realize these policy drivers. These levers can be fiscal, physical, or regulatory in nature. Some examples of policy drivers include the reduction of road congestion, the decrease in greenhouse gas emissions, the mitigation of local air and noise pollution, the reduction of transport accidents, the enhancement of working conditions, the promotion of new technologies, and the facilitation of efficient supply chains. While some of these drivers can positively influence the supply chain, others may have adverse effects, necessitating consideration of the overall welfare of society. Fiscal

[14] Rantasila, K., & Ojala, L. (2012). Measurement of national-level logistics costs and performance. International Transport Forum Discussion Paper.
[15] Shires, J. (2003). The Impact of Policy Drivers on the Logistics Supply Chain.

levers may encompass subsidies for eCommerce, the implementation of a vignette system, motorway tolling, urban congestion charges, increased fuel duties, excise duties, and emission taxes. Physical levers may involve lorry bans during peak hours, weekend lorry restrictions, dedicated lanes for heavy goods vehicles, the enforcement of working time regulations, emission standards, road transport deregulation, and the provision of open access for rail freight, public provision of inter-modal terminals, road expansion/enhancements, imposing intelligent speeds adaptation systems, reducing speed limits

Improving logistics performance through investments and policy intervention: a causal loop model" by **Amrita Jhawar, S.K Garg, Shikha N Khera[16]** talks about how infrastructural and policy changes initiated by the government can influence the logistics sector. An increase in infrastructure investment amounting to 1% of GDP could lead to the creation of an additional 3.4 million direct and indirect jobs in India (Dobbs et al., 2013). According to the authors, India requires enhanced infrastructure and reduced bureaucratic hurdles (Vasavi, 2009). There is a pressing need to transform India from a 'complex tax destination' into a 'competitive destination,' necessitating significant improvements in tax structure and administration.

Mohammad Siddiqur Rahman, Anil Kumar, Rohit Gupta[17] in their paper **"National logistics policy and its impact on the power sector logistics"** discusses the various policies introduced by the government to enhance the logistical sector of India. The Ministry of Commerce and Industry has indicated that over 22 million individuals in India rely on the logistics sector for their livelihoods. Enhancing this sector could facilitate a 10% decrease in indirect logistics costs, potentially resulting in a 5 to 8% increase in exports and a substantial reduction in power generation costs. To tackle these issues and enhance the logistics sector's efficiency, the PM Gati Shakti, also referred to as the National Master Plan for multimodal connectivity (PMGS-NMP), was inaugurated on 13th October 2021 to foster infrastructure connectivity among various economic zones and promote collaboration among different government agencies. On 17th September 2022, the National Logistics Policy was introduced, aimed at bolstering

[16] Jhawar, A., Garg, S. K., & Khera, S. N. (2017). Improving logistics performance through investments and policy intervention: a causal loop model. *International Journal of Productivity and Quality Management*, *20*(3), 363-391.
[17] Rahman, M. S., Kumar, A., & Gupta, R. (2023). National logistics policy and its impact on the power sector logistics. *Water and Energy International*, *66*(2), 48-53.

India's trade competitiveness, generating additional employment opportunities, enhancing India's global rankings, and establishing India as a logistics hub. This policy is expected to significantly contribute to national infrastructural development and overall growth, particularly in the transportation of coal, as India ranks among the largest coal producers with an estimated output of 729.10 million tonnes in 2021.

Freight Traffic Impacts and Logistics Inefficiencies in India: Policy Interventions and Solution Concepts for Sustainable City Logistics by **Prasanta K. Sahu, Agnivesh Pani, Georgina Santos**[18] talks about the role of government in creating various policies that can have a proportional impact on the logistics cost. Government departments, such as the Ministry of Shipping and Logistics, can employ a wide-range of policy measures, ranging from taxation instruments (e.g. fuel taxes, excise taxes and tolls) to financial incentives (e.g. tax rebates for supporting greener modes, capital grants) and regulation orders (e.g. vehicle design, entry time, emission standards)

A Review of the Indian Logistics Industry and Policy by **Rhitam Das**[19] assesses the condition of the Indian logistics industry and also discusses the Indian logistics policies in motion to reduce the logistical expenses, one measure is public-private partnership (PPP) which will increase private participation and bring about a commercial mindset. Other important policy towards logistics is Private Freight Terminals (PFT) Policy. This policy aims to stimulate construction of privately owned freight terminals on private land for dealing with break bulk goods, parcel traffic and containers. Coastal Shipping Policy has been proposed to boost coastal trade and various support services with special focus on coastal ships, River Sea Vessels (RSV), Inland Vessels (IV) and Cross trade compatible vessels. Recent policies have also led to the relaxation of cabotage policies by the Indian government, all these policies are aimed towards the reduction of logistical costs in India

Reduction of logistics cost" refers to the process of lowering expenses associated with moving, storing, and managing goods throughout the supply chain, benefits include Increased profitability: Lowering operational costs can directly improve profit margins. Improved customer satisfaction: Faster and more reliable deliveries can enhance

[18] Sahu, P. K., Pani, A., & Santos, G. (2022). Freight traffic impacts and logistics inefficiencies in India: Policy interventions and solution concepts for sustainable city logistics. Transportation in Developing Economies, 8(2), 31.

[19] Das, R. (2014). A Review of the Indian Logistics Industry and Policy. *Available at SSRN 2373645*.

customer experience. Enhanced competitiveness: Lower logistics costs can give a company a pricing advantage in the market.

In the article "**Logistics costs and their impact on performance" Monika Arsova, Riste Temjanovsk** [20] state that it Is necessary to conduct a thorough analysis of the supply chain to find those activities (procedures, operations) that do not add value to the end product, Engaging in negotiations with suppliers or buyers to establish lower sales or retail prices, implementing forward or backward integration for enhanced cost control, seeking more affordable resources to replace current ones, optimizing resource utilization, and employing other effective management strategies that influence overall cost levels.

In the article" **The impact of logistics management practices on company's performance"** by **Natasha Ristovska, Sasho Kozuharov, Vladimir Petkovski**[21]**,** the authors have slated several methods from a company perspective to reduce the business logistical costs. Companies that manage stock levels or maintain electronic records of minimum inventory amounts can minimize the amount of 'dead' capital tied up in storage. Improved inventory control leads to greater procurement flexibility and reduced costs. Organizations that track procurement and storage times, while continuously monitoring and refining transportation, can optimize delivery timing, thereby forecasting and lowering future transport costs. Access to transport cost data from previous shipments enables the selection of the most economical and efficient transport options, resulting in decreased transportation expenses. Research indicates that effective storage management can lower storage costs. By strategically selecting the locations for primary and auxiliary storage, companies can minimize idle time and mitigate risks associated with product spoilage and additional costs from improper storage. The article emphasizes the significance of accurate, relevant, and timely information from both internal and external sources, which facilitates appropriate and prompt decision-making. Accurate data helps prevent poor decisions and unnecessary expenses, and prioritizing information based on importance can shorten the time needed for data processing, enabling swift decision-making. Electronic databases offer access to information at any time and from any

[20] Arsova, M., & Temjanovski, R. (2023). Logistics costs and their impact on performance. *Journal of Economics*, *8*(1), 55-67.
[21] Ristovska, N., Kozuharov, S., & Petkovski, V. (2017). The impact of logistics management practices on company's performance. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, *7*(1), 245-252.

location, which is crucial for timely decision-making and ultimately contributes to reducing total costs while enhancing company success.

Amrita Jhawar, S.K Garg, Shikha N Khera[22] in their work "**Improving logistics performance through investments and policy intervention: a causal loop model"** suggest several strategies to reduce the logistical costs as well as enhance the logistical performance of India.

Enhancing road and railway infrastructure, airports, and seaports, along with upgrading existing warehouses and formulating diverse taxation and fiscal policies, is essential for improving trade through an efficient logistics system. The introduction of a single-window environment for documentation and an electronic toll collection system can address existing challenges. According to Korinek and Sourdin (2011), Korean companies saved US$ 2.1 billion following the implementation of a single-window system for trade transactions.

If third-party logistics (3PL) providers can offer advanced services and technologies at competitive prices, businesses will be inclined to outsource their logistics operations. To facilitate this transition, 3PL companies must invest in information technology, human resources, containers, warehouses, and transportation vehicles to deliver cutting-edge facilities. Logistics costs are directly related to the distance and handling involved in transporting goods (FICCI, 2011) and inversely related to the share of 3PL in the country (Kaur, 2011). An increase in 3PL participation can significantly lower logistics costs, as these firms are adept at operating on a large scale, allowing enterprises to concentrate on their core activities.

The development of an IT-enabled logistics system that tracks material flow from inception to consumption is crucial. Additionally, cultivating a skilled workforce is vital, as successful companies recognize their human capital as their most valuable asset.

[22] Jhawar, A., Garg, S. K., & Khera, S. N. (2017). Improving logistics performance through investments and policy intervention: a causal loop model. *International Journal of Productivity and Quality Management*, *20*(3), 363-391.

Horizontal logistics collaboration: decreasing costs through flexibility and an adequate cost allocation strategy" by Christine Vanovermeire, Kenneth Sörensen, Alex Van Breedam, Bart Vannieuwenhuyse, Sven Verstrepen[23] talks about how companies trying to optimize their supply chain face important trade-offs between cost, service level and sustainability

Future challenges include heightened customer demands, intensified competition, and increasing governmental pressure for sustainability. Horizontal collaboration presents opportunities for substantial efficiency and sustainability gains. This type of collaboration involves bundling transportation among companies at the same level of the supply chain with similar or complementary transportation requirements. Recently, more companies have formed horizontal alliances or coalitions to consolidate their orders and optimize logistics in which they bundle their orders and use a common transportation channel to ship them. Many companies go further than the purely operational aspects and share each other's assets (e.g. warehouses), make supply chain decisions together according to a common strategy, use the increased bargaining power of the group to obtain lower prices from logistics providers, etc., effectively creating one large supply chain.

Gülsah Sisman[24] in his paper **"Implementing Lean Six Sigma methodology to reduce the logistics cost"** talks about how the Lean Sigma Methodology can help companies to significantly reduce their Total Logistic Costs. Lean Six Sigma is a methodology that focuses on process improvement and is a combination of lean practices and 6 sigma process that means 3.14 defects per 6 million opportunities The integration of Lean Thinking principles and Six Sigma methodologies can create a robust framework for enhancing quality and logistics operations within an organization. Lean management encompasses a business management philosophy that employs a variety of effective tools, methods, and techniques, including standardization, teamwork, customer focus, organizational structure enhancement, continuous improvement (Kaizen), waste reduction, error root cause elimination, uninterrupted material flow in accordance with the Just in Time principle, and total quality management. Identifying the root cause of

[23] Vanovermeire, C., Sörensen, K., Van Breedam, A., Vannieuwenhuyse, B., & Verstrepen, S. (2014). Horizontal logistics collaboration: decreasing costs through flexibility and an adequate cost allocation strategy. *International Journal of Logistics Research and Applications*, *17*(4), 339-355.
[24] Şişman, G. (2023). Implementing lean six sigma methodology to reduce the logistics cost: a case study in Turkey. *International Journal of Lean Six Sigma*, *14*(3), 610-629.

issues allows for the application of the DMAIC process (Define, Measure, Analyse, Improve, Control) to effectively lower costs.

Freight Traffic Impacts and Logistics Inefficiencies in India: Policy Interventions and Solution Concepts for Sustainable City Logistics" by **Prasanta K. Sahu, Agnivesh Pani, Georgina Santos**[25] suggests various strategies to reduce the logistics costs. Furthermore, infrastructure solutions such as optimizing freight distribution and last-mile logistics, achieving a balanced modal mix, minimizing inventory costs, and enhancing trucking efficiency are essential. Technological advancements, including precise demand forecasting models, automation of warehousing operations, and the implementation of intelligent transport systems (ITS) like weigh-in-motion systems, delivery space reservation systems, and route planning systems, as well as blockchain and IoT applications, are also crucial. Market-driven innovations such as electric and autonomous freight vehicles, crowd shipping during transit, and collaborative planning initiatives will facilitate better resource mobilization and planning, thereby improving efficiency and reducing expenses.

On Fulfilling the Exigent Need for Automating and Modernizing Logistics Infrastructure in India" by **Shaurya Shriyam, Prashant Palkar, Amber Srivastava**[26] suggests the implementation of digitization, AI based integration and Smart Automation to enhance efficiency and reduce the logistics costs. This paper advocates for the creation of Smart Industrial Parks (SIPs) aimed at boosting operational efficiencies and connecting MSMEs and startups that cater to niche markets with innovative Industry 4.0 solutions. The phased implementation of strategically designed robotic automation technologies within SIPs is expected to significantly reduce India's unsustainable logistics costs. Use of a cloud-based cyber-physical system for real-time data access and analysis in SIPs would be instrumental and such centralized cloud-based monitoring of factory floors, warehouses, and industrial units using IoT infrastructure shall improve decision-making, efficiency, and safety. Access to real time data and use of predictive

[25] Sahu, P. K., Pani, A., & Santos, G. (2022). Freight traffic impacts and logistics inefficiencies in India: Policy interventions and solution concepts for sustainable city logistics. Transportation in Developing Economies, 8(2), 31.

[26] Shriyam, S., Palkar, P., & Srivastava, A. (2023). On Fulfilling the Exigent Need for Automating and Modernizing Logistics Infrastructure in India: Enabling AI-based Integration, Digitalization, and Smart Automation of Industrial Parks and Robotic Warehouses. *arXiv preprint arXiv:2310.01077*.

analytics would enable the professionals to make proactive decisions and plan much in advance before any actual disruption can take place thus reducing downtime.

CHAPTER III
ANALYSING THE CAUSES OF ELEVEATED COSTS IN INDIAN LOGISTICS INDUSTRY

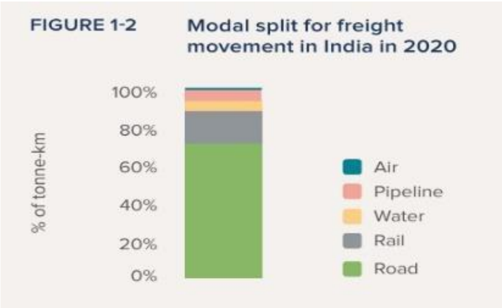
3.1 Overview of Indian Logistics Industry

In 2023, it was anticipated that the logistics industry in India would represent 14.4% of the nation's GDP. This sector encompasses 37 export promotion councils, 40 Participating Government Agencies (PGAs), 20 government entities, over 10,000 goods, and 500 certifications. To support cargo transportation, India boasts an extensive infrastructure network, featuring more than 129 inland container depots, over 168 container goods stations, and in excess of 300 million square feet of warehouse capacity.

- Transportation Sector

The surface transport sector is expected to witness the most rapid growth within India's infrastructure landscape. The distribution of freight modalities in India is notably imbalanced, with approximately 66% of goods transported via roadways, while the rail share continues to decline annually, and inland waterways and coastal shipping account for merely around 5%. A significant portion of the industry is characterized by a small fleet, as less than five trucks constitute 70% of truck owners. The road network has expanded from 62.15 lakh kilometres in FY21 to 63.73 lakh kilometres by January 2023. The transportation sector is further categorized into segments such as Full Truck Load (FTL), which was projected to reach a market size of approximately US$ 120 billion in 2021. Following this is the Less than Truck Load (LTL) segment, which ranks as the second-largest revenue contributor to the Indian surface transportation sector, generating around 12 billion dollars.

Figure 3.1 Freight Modal Split



Source: NITI AAYOG REPORT

Regarding rail transport, India possesses the fourth-largest rail network globally and holds the second-highest percentage of goods transported by volume. Railways account for nearly 28% of all freight movement in the country. From April to September 2023, total freight loading reached 758.20 million tonnes (MT), an increase from 736.68 MT in the previous year.

Figure 3.2 Annual Railway Freight

Source: Delhivery Annual Report

Air transport constitutes less than 2% of the overall modal distribution, primarily handling time-sensitive goods.

India is home to 200 minor/intermediate ports and 12 major ports, which collectively represent 65% of the nation's total value and 95% of its freight volume. the major ports collectively handled a record-breaking 795 million tonnes of cargo in 2022-23, registering a 10.4% growth over the previous year.

- Warehousing

The Indian warehousing sector is expected to attain a value of Rs. 2,872.10 billion (US$ 34.50 billion), with a compound annual growth rate (CAGR) of 15.64% projected from 2022 to 2027. Major contributors to this growth include third-party logistics providers and e-commerce companies, which are expanding into tier 2 and tier 3 cities, thereby enhancing their share in secondary markets. Third-party logistics and e-commerce dominate the market, collectively accounting for over 60% of the total storage space leased.

- Custom Clearance

The customs clearance industry in India plays a critical role by ensuring that goods entering or leaving the country comply with government regulations. Competent facilitator like Custom House Agents (CHA's), Freight Forwarders and Logistics Companies ensure seamless custom clearance through facilities like ICEGATE system, SWIFT (Single Window Interface for Facilitating Trade), Faceless Assessments and Risk Management Systems (RMS)

- Freight Forwarding

Freight Forwarding industry is currently valued at $18 Billion approx. growing at 8-10% CAGR Driven by strong E-commerce boom, Export growth (esp. in engineering, pharma, textiles, and food), Make in India and PLI (Production-Linked Incentive) schemes, Increased containerization and multimodal logistics has led to immense demand for freight forwarding services

3.2 Overview of Logistical Cost Factors

Logistics Industry is crucial to both enterprises and the economy, a nation with a strong and effective logistics sector offers an efficient forward and reverse flow of goods and services, which eventually translates to fast-paced growth. By 2030, India wants to lower its logistics expenditures from 13-14% of GDP to 8-10% of the GDP. It is projected that a 10% reduction in indirect logistics costs is expected to result in a 5% to 8% increase in exports. Unfortunately the reality is such that calculation of precise logistics cost has been a disproportionate and inaccurate endeavour due to lack of adequate data, inability to capture precise data between multiple touchpoints aggravated by the fragmented nature of the industry, applicable methodologies in the Indian Context, yet logistics costs can be considered as percentage of total GDP or percentage of actual sales, turnover or in absolute terms, in either case it is a figure meant for cross country comparison and should not be interpreted as its contribution to GDP in respect of income and job creation.

A quick look at the many factors that contribute to the issue includes Infrastructure and Modal Imbalance like poor quality and coverage of roads, railways, ports, and airports, overdependence on road transport vs. underutilization of railways/waterways, bottlenecks in last-mile connectivity and rural logistics access. Inefficient Freight and

Transportation Systems like fragmented ownership, idle time, backhauling issues. poor fleet management and outdated vehicles, congestion in urban freight corridors and highways. Warehousing and Inventory Management issues like availability, location, and modernity of warehouses and logistics parks. Lack of cold chain and temperature-controlled storage, inventory pile-ups due to supply chain disruptions, Inefficient Policy and Regulatory Environment, lack of Digitalization and Technology Adoption, Labor and Workforce Issues, Fluctuating Fuel and Operational costs are other set of factors that can majorly affect Logistic Costs

3.3 Understanding the Causes

Understanding the causes and nuances of increasing logistic costs in India requires a deeper look on a micro level into the existing infrastructural setup whether it is sufficient to efficiently handle the traffic, addressing the congestion issues because lost time is increasing cost, the pace at which cargo is moving within and in and out of the country, whether the existing policies are framed in the interest of the stakeholders, the bureaucratic and administrative challenges at the ground level, redtapism affecting the processes and basically understanding how the human resources behave and react at the various levels of supply chain which is directly correlated to the final cost that will be incurred

3.3.1 Infrastructural Gaps

India’s Road Infrastructure has been a significant area in need of reforms as road congestions and insufficient highway network hinder supply chain efficiency. Much of the country’s road, rail and waterways network is a legacy of colonial rule. Passenger and freight traffic have grown close to 300-fold since 1951. However, in the same period, road length has increased only 15-fold from 0.4 million km in 1951 to over 6.5 million km in 2024.

A major issue is that the logistics flows are highly concentrated, seven corridors account for about half of the total freight traffic these corridors are the Delhi-Mumbai, Delhi-Kolkata, Mumbai-Kolkata, Delhi-Chennai, Mumbai-Chennai, Kolkata-Chennai, Kandla-Kochi, National highways along these corridors handle 40 per cent of road freight traffic even though they are less than 02 per cent of the Indian road network, poor quality of last mile links which connect key production, consumption and transit points such as ports, mines and industry clusters to the corridors have not been the focus of efforts to build the country's logistics infrastructure leading to bottlenecks and poor service levels. Shipping costs in India especially in case of coastal shipping and rail are approximately 70 per cent higher than those in the US. Likewise, road costs in India are also higher by about 30 per cent.

Data suggests that poor logistics infrastructure costs the economy an extra USD 65 billion each year. Approximately two-thirds of these expenses are concealed, meaning they are not typically classified as logistics costs. These concealed expenses encompass theft and damage, elevated inventory holding costs, as well as facilitation and transaction costs. Although the quality of roads in India, particularly on the National Highways, is improving, it remains inadequate in numerous areas. Estimates indicate that motorable roads constitute less than 10% of the entire road network. The expressway network is predominantly still in the planning phase, with a development target of around 15,000 kilometres of expressway to be achieved by the conclusion of the 13th plan period.

Much of the freight movements are initiated and completed by trucks thus the trucking industry is another area of pain point, nearly 70% of the truck owners in India own between 1-5 trucks due to this there is fierce competition amongst operators leading to truck owners resorting to overloading thus causing additional delays and security concerns. Trucks in India have to pass through multiple check points in their journey, they have to stop at state borders, for payment of toll taxes, for RTO inspections etc, the frequent interruptions at checkpoints for inspections and toll collection impose significant logistical expenses on the economy. Additionally, Indian trucks average only 300 kilometres per day, in contrast to the global standard of 500 to 800 kilometres daily. This inefficiency, combined with a 40% rate of empty returns, contributes to increased freight costs and exacerbates emissions. Disparities in regional development have resulted in imbalances in cargo loads throughout India, leading to situations where trucks, particularly in the northeast, frequently return empty, thereby causing price fluctuations.

As far as railways are concerned rail networks are oversaturated, route kilometre has grown only at a CAGR of 3%, incorporating additional lines on existing routes is growing low at a CAGR of 6.6%. During the same period freight and passenger traffic has grown at a CAGR of nearly 55%. This had led to most high-density corridors becoming oversaturated. The contribution share of railways towards total freight transportation is declining steadily, Indian Railways policy of subsidizing passenger tariff by freight tariff has resulted in sharply rising railway freight rate over the years compared to little increase in passenger tariff rate. The result of this has been that Indian rail freight rates have already become one of the highest in the world. Again, Freight traffic is frequently subordinated to passenger traffic on the railway network, this results in a freight train taking as much as 6-8 days for a journey of 2000kms. Also, there is no guarantee on the transit time for freight trains. The railways sector is also plagued by poor quality tracks, terminals, sheds, maintenance, lack of availability of specialized wagons to carry special goods, preference for customers with Full Truck Loads and lack of flexibility all of which makes it a less appealing option.

Table 3.1 Infrastructural Gaps in Indian Logistics Sector

Infrastructural Gaps in India			
Parameter	**India's Status**	**Global Benchmark**	**Gap Identified**
Average Truck Speed	30–40 km/h	60–80 km/h	Poor roads, congestion
Warehousing Capacity	265 million sq. ft	N/A	20–25% shortfall in Tier-II/III cities
Rail Freight Share	25%	>40% in China	Over-dependence on road
Port Turnaround Time	2.0–3.0 days	<1 day (Singapore)	Manual handling, port inefficiency
Cost per Ton-Km (Road)	₹2.5–3.5	₹1.5–2.0 (OECD Avg.)	Fuel, tolls, low load optimization

Source: IBEF Report

In case of Port industry many ports have outdated equipment, limited container handling capacity, and shallow drafts that restrict larger vessels as a result there are limited ports in India that can handle large mother vessels. Overburdened ports like Mumbai (JNPT) experience delays, increasing turnaround times and costs. Last-mile connectivity gaps exist as Inadequate Road and rail links to ports increase transit times and fuel costs. There is also lack of multimodal transport integration because of limited use of coastal shipping and inland waterways, despite being cheaper and more efficient.

Transit times across modes in India are longer and vary widely compared to developed countries. This can be partially attributed to low average speeds. For example, the average speed of a truck is 35 km per hour on India's highways as compared to over 75 km per hour in the US. Similarly, the average speed of freight trains is 25 km per hour in India while it is close to 45 km per hour in the US. This is attributed to variety of factors like uncertainty in waiting times at toll stations, freeze in truck traffic during the day, high turnaround times at ports, low priority accorded to freight trains on Indian railways, low-quality track infrastructure and outmoded trucks susceptible to frequent breakdowns, resulting in long transit times. India's logistics network is also hampered by poor transportation equipment. Trucks are smaller, relatively unreliable and the railways use higher tare load wagons with lower axle loading (21 to 22.9 tons versus over 25 tons in the US and China) coupled with inadequate loading and unloading infrastructure

Securing extensive parcels of land for warehouses, multi-modal parks, and logistics centres poses significant challenges due to elevated costs, fragmented ownership structures, and intricate legal processes. The acquisition of land in urban and semi-urban regions can extend over several years, leading to project delays and increased expenses. In satellite areas surrounding Tier I cities, the difficulties in land acquisition stem from soaring land prices and landowners' reluctance to engage in price negotiations. Furthermore, obtaining land approval presents a substantial hurdle, while the lack of transparency regarding clear land titles represents an even greater risk for companies seeking to acquire land in India.

State of warehousing in India is quite poor, 80-85% of warehouses are traditional with sizes of less than 10,000sqft. Most of these warehouses are not leak proof, equipped with security systems, racking facilities etc. Majority of the operators of these warehouses are also small to mid-sized entrepreneurs with limited investment capacity.

Inefficient space utilization, higher labour costs, poor inventory management, cargo loss and damage, poor integration with transport infrastructure are the reasons that lead to increased warehousing costs which ultimately drives up the logistics costs. Despite the growing retail sector, pharmaceutical and chemical sector and the farm sector the state of cold chain storage in India is very sluggish nearly 40% of perishables in India gets wasted due to lack of end-to-end cold chain integration, spoilage during transport due to improper temperature control, high energy and operational costs all of which ultimately shoots up the costs

Another issue is the existing ICD/CFS infrastructure which is inadequate for the growing freight volumes. The land requirement for setting up ICD/CFS at an appropriate place is difficult to come by as several hurdles have to be cleared in the consolidation of land. As a result, many logistics companies with an interest in setting up ICD/CFS eventually fail to do so, at the same time the existing facilities are plagued with several issues like inability to expand, poor connecting roads, lack of parking causing excessive congestion etc

Multi Modal Logistics Parks which are aimed to provide integrated logistics services across multiple modes of transport and industries is yet to begin as the idea is still in implementation stages this infrastructure will be instrumental in improving efficiency and achieving economies of scale which will drive down costs

3.3.2 Regulatory and Bureaucratic Challenges

India has for long been considered as a destination that lacks ease of doing business and that holds true to certain extent as India ranks 63rd out if 190 countries in World Banks's Ease of doing business report and this also difficulty also trickles down to the fact that it is difficult for business to sustain in a country that is characterised by dynamic and evolving regulatory and bureaucratic landscape. The involvement of multiple regulatory bodies like the Ministry of Road Transport and Highways (MoRTH), the National Highways Authority of India (NHAI), the Ministry of Port Shipping and Waterways (MoPSW), the Ministry of Labour and Employment, the Ministry of Housing and Urban affairs (MoHUA) and the Central Board of Indirect Taxes and Customs (CBIC) increases the complexities of activities and delays decision making in crucial moments

Firstly tax related issues and disparities exist, the implementation of GST did eliminate state level taxes and create uniformity but the frequent rate changes and multiple rate slabs for logistics services have created issues as a result the cost of logistics of certain commodities and certain sectors are quite high, fluctuating fuel costs and inability to incorporate fuel under GST regime also results in price variations across states, Diesel, being a major cost (30–40% of truck OPEX), makes logistics significantly more expensive in states with high fuel taxes. For example, diesel is more expensive in Maharashtra, Rajasthan, and Kerala than in Gujarat or Haryana. yet another issue is the delays in GST refund for exporters that can affect the working capital and operational cycle of business. Intestate logistics is subject to state-wise permit requirements, rules, and toll policies which again adds an extra layer of cost and delay, there is lack of a truly national unified freight permit system as Interstate goods vehicles often require special state permits or declarations, especially for commercial entry causing delays at borders, leading to fuel wastage, driver overtime, and underutilization of trucks. Toll collection is not standardized; overlapping tolls occur for a single route (especially in industrial corridors). Transporters factor tolls into freight charges, raising logistics costs.

In metro cities like Lucknow, Chennai the movement of trucks in the city itself is allowed only during the night. Trucks are often delayed at border check-posts, especially for over-dimensional or hazardous cargo. Weight limitations and axle norms vary depending on various conditions which again affects payload efficiency, axle weight norms are such that trucks can be fined in one state but not in another for the same load. Frequent detentions and fines at RTO check posts leading to delays and corruption.

The Custom policies can also create an additional layer of expense, many a times exporters fall prey to the demands of these officers who threat to withhold their cargo so the corrupt system often results in additional expenses which are often hidden, again delays in customs clearance due to manual checks or inconsistent interpretation of classification codes (HSN), Redundant paperwork and poor digital adoption in some ports or ICDs (Inland Container Depots) all of these leads to additional costs as well. Multiple port surcharges, documentation fees, container scanning charges etc vary across ports especially the non-major port which further shoots up the costs

As mentioned before policies vary from state to state and there truly is a need for standardization for example- Punjab and Haryana still levy market fees and rural development cess on the movement of agricultural commodities. During procurement seasons, interstate movement of wheat or rice is sometimes restricted without prior permission which requires transporters to obtain M Form and other set of documents to carry produce out of the state driving up the cost. Tamil Nadu imposes "Green Tax" on older commercial vehicles, and state-specific vehicle entry taxes on out-of-state trucks increasing the cost of using external or long-haul fleets.

3.3.3 Technological Gaps

Technology is a crucial enabler and facilitator of efficient logistics system, countries like USA, Singapore, Germany have established themselves as logistics giants driven by cutting edge technology and automation and this is where India needs to step up its game. Lack of digitization and automation is affecting the growth prospects of the industry and causing inefficiencies There's no unified digital ecosystem connecting transporters, warehouses, freight forwarders, customs, and ports. Many logistics players (especially SMEs) still use manual or semi-digital processes resulting in poor coordination which leads to delays, misplaced cargo, and redundant paperwork and ultimately increases administrative and labour costs.

Small fleet operators (who make up 70–80% of the market) do not use TMS software to manage routing, tracking, or invoicing which results in inefficient route planning leading to empty miles fuel wastage, and underutilized fleets.

Many warehouses lack Warehouse Management Systems (WMS) or only use basic inventory tools. There is no real-time tracking of goods, space usage, or shelf life which leads to inventory mismanagement, spoilage in food/pharma and increased storage time. Lack of systems like ASRS (Automatic Storage and Retrieval Systems) and increased reliance on manual picking and sorting increases labour costs driving up the overall prices

IOT (Internet of Things) is another missed opportunity many trucks and containers do not have GPS or IoT tracking due to cost or technical constraints as a result of which clients have no visibility on shipment status, causing uncertainty and poor customer satisfaction. Delays or theft often go unnoticed until it's too late thus increasing insurance claims and associated costs

Multi modal coordination is not digitized, transfer of goods between road, rail, air, and sea is not digitally synchronized resulting in longer transit time, increased idle time at terminals, and missed cargo connections. lack of real-time updates between modes results in poor decision making and higher operational costs

Different stakeholders use incompatible systems with non-standard formats (e.g., different consignment codes, invoicing formats). Manual data entry or reconciliation increases processing time and error rates and costs and makes end-to-end automation impossible.

Most logistics companies do not use AI or data analytics for demand forecasting, dynamic pricing, or predictive maintenance resulting in High buffer stocks, unexpected downtimes, and excessive safety margins thus increasing costs.

3.3.4 Skilled Labour Shortage

There is an acute shortfall of personnel with adequate training and education in logistical management in India. At management and mid-tier levels, the unorganized structure of the Transportation, Logistics, Warehousing and Packaging Sector in India has led to problems of poor organisation, lack of leadership, disjointed skills and a lack of process-driven systems which are required for overall sectoral growth and development. The gap has been felt primarily in the key business areas like transportation, warehousing, Information Technology and communication skills and other value-added services

At the ground level India faces a shortage of commercial vehicle drivers, with an estimated 1 driver available for every 1.5 to 2 trucks. Long working hours, poor working conditions, low social status, and lack of training discourage new entrants, this results in higher wages for available drivers. Underutilization of fleet assets due to unavailability of drivers, Increased reliance on sub-contracted fleets, adding middlemen costs are other set of issues caused due to labour shortage

In the warehousing sector Most warehouse workers are unskilled or semi-skilled, lacking knowledge of inventory systems, handling equipment, and safety protocols, this results in Higher error rates in picking, packing, and inventory counting, longer training periods and higher turnover leading to repetitive onboarding costs, Increased product damage, leading to insurance or replacement costs.

There is a short supply of trained logistics professionals like Logistics managers and planners with expertise in TMS/WMS, route optimization, demand forecasting, and data analytics who can take the business to the next level, shortage of these employees and failure to take advantage of these systems means over-reliance on manual planning, inefficient routing, poor demand planning, and sub-optimal warehouse layout design which translates to higher operating and holding costs.

The logistics sector, especially warehousing and last-mile delivery, experiences frequent attrition due to temporary/contractual labour and lack of career growth. Constant churn leads to disrupted operations and loss of productivity. Cost of recruitment, training, and onboarding rises significantly. Only 4.7% of the 22 million employees in the logistics sector are formally skilled. Additionally, the logistics sector faces a separate 20% deficit in truck drivers, with only 80,000 available compared to the 100,000 needed.

3.3.5 Fragmentation of the Industry

The fragmented nature of the Indian logistics industry is one of the core reasons why logistics costs in India is on the higher side, the industry is dominated by numerous small, unorganized players. 70–80% of road freight is handled by small fleet operators with fewer than 5 trucks, Warehousing is largely unorganized, with many small godowns lacking tech, standardization, or automation, Freight forwarding, customs brokerage, and last-mile delivery are often handled by different, disconnected service providers.

The main issue arising is that since most of the operators are small, they cannot achieve economies of scale. Small operators find it difficult to invest in tech, modern trucks, fuel-efficient practices, or training. Small loads are often consolidated manually, causing delays all of this results in higher per-unit costs, inefficient asset usage, and lower operational efficiency.

Multiple vendors are involved in handling one shipment (e.g., a different transporter, warehouse operator, and delivery agent) this results in duplication of efforts and resources, redundant documentation, handovers, and coordination issues increase time and cost. Each player uses their own systems, formats, and manual workflows, lack of real-time tracking or consolidated dashboard across the supply chain results in slower processing, poor customer service, and miscommunication. Again, fragmented networks mean data is siloed, and analytics is rarely used which leads to bad planning, route duplication, and reactive instead of proactive logistics management which makes it harder to optimize costs, fuel, and delivery schedules

Individual small players have little bargaining power with clients or infrastructure providers ultimately higher input costs are passed on to customers and presence of too many intermediaries increases transactional and commission costs all of which drives up the overall logistics costs

3.3.6 Urban Congestion and Last Mile Inefficiencies

Cities like Delhi, Mumbai, and Bengaluru rank among the most congested in the world, Freight vehicles often spend 30–50% of delivery time stuck in traffic this leads to more fuel consumption, driver overtime, and higher vehicle wear and tear, low vehicle productivity causing higher cost per delivery. Delays caused by traffic congestion on urban roads cost the Indian economy an estimated $22 billion annually in fuel and lost productivity.

Many cities impose entry restrictions on heavy vehicles during daytime (e.g., 7 AM to 11 PM) forcing companies to run deliveries at night or use smaller, less efficient vehicles, resulting in more trips with smaller loads, driving up fuel and labour expenses thus increasing costs

Most last mile deliveries are handled by independent contractors or third-party services with minimal route planning. Overlapping routes, high failed delivery attempts and returns inflate costs. The importance of last-mile logistics, despite being the shortest link in supply chains, stems from the fact that it constitutes up to up to 13%–72% of total logistics costs in many supply chains, and up to 55% in supply chains involving E-commerce. Urban e-commerce often sees 15–30% return rates, especially in fashion and electronics, Additional logistics costs for reverse pickup, repackaging, re-entry into inventory, and resale delays wastes fuel, manpower, and increases reverse logistics expenses.

Most cities lack urban logistics hubs for staging or consolidating cargo before local distribution, no consolidation leads to direct-to-door single-parcel deliveries, which are costlier and slower compared to hub-and-spoke models.

3.3.7 Fuel and Operational costs

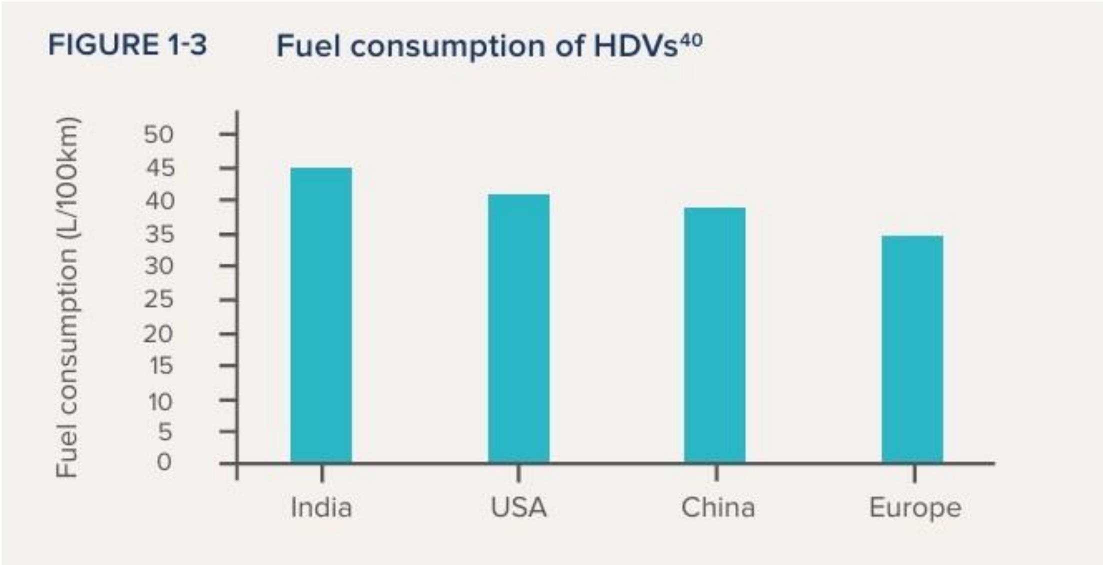
Given that over 60% of freight in India moves by road, these cost factors directly impact the cost-efficiency, competitiveness, and scalability of logistics operations. Diesel powers most commercial vehicles in India and diesel prices are among the highest in the region, due to high taxation (over 50% of retail price). Since fuel constitutes 30–50% of total transportation cost frequent price fluctuations create cost planning challenges and squeeze profit margins and the transporters pass on fuel hikes to clients, increasing end-to-end logistics costs.

Efficiency is yet another issue, many fleets consist of older trucks, often 10–15 years old, with poor mileage and maintenance. Congestion, poor road conditions, and overloading reduce fuel efficiency further which increases fuel consumption per ton/km. Poor maintenance causes frequent breakdowns which lead to downtime and higher repair costs.

Higher driver hours, rerouting, and warehouse bottlenecks increase labour and time costs, poor route optimization leads to more kilometres travelled per delivery, burning more fuel, shortage of trained drivers results in higher wages and incentives to retain staff and rising per-km labour cost, particularly in long-haul and night transport routes.

India has thousands of toll plazas and additional state border levies despite GST reforms which add significantly to per-trip operational costs, especially for multi-state transporters.

Figure 3.3 Fuel Consumption of Heavy-Duty Vehicles



Source: NITI AAYOG Report

3.4 Case Studies

Case Study of Vietnam

The story of Vietnam has been incredible, from a poor country with GDP less than 2 billion Dollars to an economy with high growth rates compared to the world and the region and a GDP of nearly 500 billion Dollars. The key industries include textiles, electronics, agriculture, seafood and exports made a significant percentage of its GDP however the country was struggling from logistical challenges like: -

Port Congestion & Low Capacity

- Major ports like Hai Phong and Saigon suffered from chronic congestion.
- Shallow berths couldn't accommodate large vessels.
- High port dwell times: **7**–10 days on average.

Poor Inland Connectivity

- Weak road and rail connections between factories and ports.
- Rural areas lacked reliable infrastructure for transporting agricultural products.

Manual & Bureaucratic Customs

- Slow and paper-heavy clearance procedures.
- Lack of coordination between border agencies.
- Clearance time: 5–7 days for exports, up to 2 weeks for imports.

High Logistics Costs

- Up to 25% of product cost, especially in rural exports (coffee, rice, seafood).
- Overdependence on road transport: ~80% of freight moved by road.

Lack of Skilled Workforce & Technology

- Logistics firms relied on manual planning.
- Limited adoption of automation, ERP, or warehouse management systems.

Case Study of Nigeria

Nigeria is one of the largest and populous country in Africa with Crude oil and Agricultural commodities as the major exports but the country is suffering from a deficient logistical landscape which is plagued by several issues and in spite of repeated efforts the situation doesn't seem to improve as Nigeria was ranked 131 out of 190 countries in its Ease of Doing Business, and 110 in the Logistics Performance Index. Its logistical challenges include: -

Inadequate Road Infrastructure

- The road connecting Lagos ports to inland regions is severely dilapidated.
- Lack of reliable rail or inland waterways meant 95% of freight relied on road transport.
- Resulted in very high turnaround times and inflated transport costs.

Complex and Corrupt Customs Procedures

- High levels of bureaucracy and overlapping agencies at the ports (15+ agencies operating at Apapa).
- Informal payments and bribes were commonplace.
- World Bank's Doing Business 2020 ranked Nigeria poorly in "Trading Across Borders."

Congested and Inefficient Ports

- Nigeria's Apapa Port, the country's main maritime gateway, is chronically congested.
- Truck queues stretched for up to 20 kilometres, with cargo clearance taking 10–30 days.
- Poor port infrastructure, manual paperwork, and corruption plagued port operations

Criminal and illegal activities

- Criminal activities of cartels and groups were rampant who often used to hijack the cargo, demand ransom thus causing additional delays and security concerns

Lack of Integrated Logistics Policy

- Unlike countries like Vietnam, Nigeria lacked a unified logistics and transport strategy. Fragmented policy ownership across federal, state, and local governments led to poor coordination.

3.4.1 Reform attempts and Innovations

Vietnam's Turnaround Strategy

- Vietnam introduced the National Logistics Development Plan (2015–2025) which was aimed to reduce logistics costs to below 16% of GDP, it focused particularly on multimodal transport, smart logistics zones, and digital integration.
- Developed Cai Mep–Thi Vai deep-sea port complex with foreign co-investment which enabled direct shipping to Europe and the U.S., bypassing Singapore/China transshipment. This boosted Vietnam's container handling capacity by 300% over a decade.

- Invested heavily in infrastructural connectivity, built expressways (e.g., Hanoi–Haiphong, HCMC–Long Thanh–Dau Giay). Revamped rail corridors for freight. Expanded inland container depots (ICDs) and dry ports to decongest seaports
- As a part of Customs Digitization & the National Single Window clearance system they introduced the VNACCS/VCIS systems with Japanese assistance, integrated 13 ministries into a National Single Window for trade documents, all of these efforts cut customs clearance time from 5–7 days to 24–48 hours.
- Introduced Public Private Partnerships (PPP) and FDI, encouraged logistics investments from global players like Maersk, DB Schenker, Nippon Express, Incentivized joint ventures in warehousing and 3PL services, Domestic companies like Gemadept and SNP upgraded their fleets and systems.
- Supported SME adoption of TMS, WMS, IoT via state-funded tech parks and promoted logistics programs in universities.

Nigeria's Failed Reform Attempts

- Lagos Port Modernization (2015–2021) Promised automation and faster clearance, however implementation was stalled due to contractor disputes and corruption.
- Presidential Order on Port Decongestion (2017) mandated 24-hour port operations, however Most terminals still operated on 8–12 hour shifts due to poor power supply and labour constraints**.**
- Truck Call-Up System (2021) was introduced to reduce truck congestion near Apapa. The issue of hijacking by cartels charging illegal fees, all of this resulted in black markets and inefficiency.
- Efforts like PAAR (Pre-Arrival Assessment Report) and NICIS II (Customs IT system) were introduced, they were undermined by: Partial adoption, Manual override systems, Resistance from vested interests

3.4.2 Comparative Analysis of Vietnam and Nigeria's logistics setup

Table 3.2 Comparative Analysis

	VIETNAM	**NIGERIA**
Initial Logistics Challenges	- High logistics costs (~25% of GDP) - Congested ports (Hai Phong, Saigon) - Bureaucratic customs - Weak infrastructure	- Extremely high logistics costs (~30–40% of product value) - Severely congested ports (Apapa, Tin Can) - Complex, corrupt customs - Inadequate Road network
Main Bottlenecks	- Port dwell time 7–10 days - No deep-sea port - 80% freight by road - Low digital adoption	- Port clearance up to 30 days - Lack of multimodal logistics - 95% freights by road - Rampant corruption and poor enforcement
Government Response	- Logistics Master Plan (2015–2025) - National Single Window for customs - Heavy infrastructure investment	- Presidential orders (e.g., 24-hour port ops) - Call-up system for trucks - Port concessioning with private players (partial)
Technology Adoption	- VNACCS (Japan-supported digital customs) - Full digital integration of 13 ministries - SME support for logistics tech (ERP, TMS)	- PAAR system and NICIS II - Poor uptake and digital override loopholes - Manual processes remain dominant

Public-Private Partnership (PPP)	- Strong: Encouraged FDI from DHL, Maersk - Built logistics parks with private players	-Weak-Policy inconsistency - Private players frustrated by corruption, inefficiency
Training and Talent Development	- Logistics courses in universities - State support for skill development	- No national strategy - Major skill shortages in warehousing, transport
Infrastructure Development	- Built deep-sea ports (Cai Mep–Thi - New expressways and ICDs - Boosted multimodal transport	- Very slow road improvements - Rail freight minimal - Inland waterways underutilized
Logistics Cost (2023) **LPI (2023)**	~14–15% of GDP 39th globally	~30%+ of GDP 129th globally
Success/Failure Factors	- Strategic planning - Policy coherence - Infrastructure + tech - FDI/PPP-led execution	- Poor enforcement - Policy fragmentation - High corruption - No national logistics strategy

3.4.3 Key Lessons

- Government led planning along with collaboration and coordination at all levels is crucial to create a working unified national logistic plan which will address the issues at various levels and reduce the logistic costs and inefficiencies
- Infrastructure combined with digitization leads to cost reduction, Modern ports and customs tech dramatically improved speed and reduced costs.
- Human capital and SME tech support are essential to efficient operations.
- PPP and FDI is necessary to bring in capital inflow, reduce inefficiencies and operate with a commercial mindset
- Infrastructure investment without systemic reform doesn’t work
- Lack of policy integration causes misalignment.
- Corruption and rent-seeking culture inflate logistics costs

3.5 Conclusions

Logistics cost is an important factor highlighting the efficiency of a country’s logistics industry keeping it as low as possible within single digits is usually preferred. However, an important pattern that has been observed is that the main reasons for increased logistic costs across all developing countries be it India or other Asian and African countries is somewhat the same Infrastructural deficiencies like poor road conditions, congestion, and bottlenecks on national highways, inadequate rail freight infrastructure and underutilization of inland waterways. Regulatory and policy challenges like lengthy customs procedures and inefficient paperworks, excessive administrative hassle, corruption and external interferences, poor law enforcement. Technological deficiencies like low adoption of digital tools (TMS, WMS, GPS, RFID) among small operators, manual tracking, poor visibility, and outdated fleet management practices. All this is in stark contrast to developed countries like USA, Singapore, Dubai etc who have already figured out these areas and have world class infrastructure and systems in place as a result of which their total logistics costs continue to be low in single digits.

CHAPTER IV
ECONOMIC, SOCIAL, ENVIRONMENTAL CONSEQUENCES OF INCREASED LOGISTIC COSTS

4.1 Impact on Regional and National economy

The impact of increased logistics costs on the regional and national economy of India is substantial and multidimensional. It affects not just trade and production efficiency but also regional development, employment, and the overall economic growth trajectory.

With logistics costs estimated at 13–14% of India's GDP, compared to 7–9% in developed countries, a significant portion of national income is spent on moving goods instead of productive investment. This disparity translates to an estimated $180 billion competitiveness gap compared to global peers, this inefficiency acts as a drag on GDP growth and reduces the competitiveness of Indian industries globally. Indian exporters often face high freight in terms of overall transportation costs, warehousing, and compliance costs, making products costlier in international markets. It reduces our market share in labour-intensive sectors like textiles, engineering goods, and agro-exports. High logistics costs are passed through supply chains to end consumers, raising prices of essentials like food, fuel, daily goods and other retail items like textiles, electronics etc. This ultimately contributes to structural inflation, especially in low-income urban and rural households.

Investors often compare logistics performance when deciding between locations. India's high cost and infrastructure bottlenecks make it less attractive than peers like Vietnam or Indonesia where the labour costs are comparatively lower. Sectors like electronics, auto, and pharmaceuticals may prefer countries with leaner supply chains. High logistics costs affect large sectors such as agriculture, manufacturing, e-commerce, and retail because due to the inefficiencies in logistics and supply chain, additional costs keep on adding up at the various stages of the value chain and ultimately the price of it has to be paid by the customer.

States and regions with poor logistics infrastructure (e.g., northeast India, tribal belts) are isolated from mainstream economic flows thus they are missing out on lot of opportunities, in spite of being an area of endless opportunities the lack of efficient systems often drives the price up of goods coming from these areas making them uncompetitive in the market

Investment, manufacturing clusters, and jobs tend to concentrate around better-connected regions like Gujarat, Maharashtra, Tamil Nadu. Western and southern states like Maharashtra, Gujarat, Tamil Nadu, Karnataka, and Telangana have advanced logistics infrastructure, bolstering their industrial growth, in contrast, northern states such as Punjab and Uttar Pradesh face logistical challenges, impeding their economic development. States without direct access to ports incur higher transportation costs, limiting their participation in export markets and deterring investment. Landlocked and remote regions often lack adequate logistics infrastructure, leading to increased transit times and costs, and hindering regional economic integration.

Farmers and small manufacturers in remote areas struggle to access urban or global markets due to poor last-mile connectivity and high freight costs, this traps many in a low-income cycle, contributing to rural distress and migration. Perishable goods like fruits, vegetables face higher wastage, which can go as high as 30% due to delays and lack of technical innovations which eats into their profits and to compensate for their loss they initiate a significant markup. Farmers' income drops significantly as increasing transport costs eat into their profits.

Due to inefficient inter-regional logistics, the same product can cost significantly more in a remote state compared to a metro area, this regional price disparity fuels inequality and undermines the goal of a unified national market. Small businesses rely on affordable logistics and due to inefficiencies of the logistics players at the local level cost spikes are frequently common which hurts profitability of these small businesses. E-Commerce growth in tier 2 and tier 3 cities is not growing fast enough as per expectations due to last mile delivery challenges which is driving up the logistical costs.

Increased logistics costs in India significantly impact the national economy by reducing export competitiveness, contributing to inflation, and hindering GDP growth. Regionally, disparities in infrastructure and access exacerbate economic inequalities. Addressing these challenges through targeted policies and infrastructure development is crucial for India's sustainable economic growth.

Table 4.1 Impact on National Economy

Logistics costs borne by the Economy		
Sector	**Logistics Cost as % of Product Value**	**Key Drivers**
Agriculture	14 – 18%	Poor cold chain, fragmented distribution
Manufacturing	8 – 12%	Inventory and inbound freight issues
FMCG	10 – 13%	Last-mile and warehousing inefficiencies
Retail & E-commerce	11 – 14%	Reverse logistics and last-mile delivery
Pharmaceuticals	9 – 12%	Sensitive goods, cold logistics gaps
Auto and Engineering	7 – 10%	Just-in-time demands, multimodal mismatch

Source: McKinsey Report

The logistics industry began to experience significant challenges due to the economic downturn in 2019, which led to a decrease in available trips for small fleet operators. Many of these operators faced defaults on their truck EMIs and were nearing bankruptcy by early 2020. The pandemic lockdowns exacerbated the situation, striking hard on an already vulnerable sector. Furthermore, freight charges have surged dramatically in recent years, driven by rising input costs such as fuel and toll fees, along with a shortage of available trucks.

The industry's fragmented structure is a primary factor contributing to the immense pressure on the Indian economy, as it predominantly consists of small fleet owners, with a limited number of organized players. Most of the organized entities focus on metropolitan areas or special economic zones, leaving tier 2 and tier 3 cities, which host a significant number of fragmented MSMEs and cottage industries, reliant on local unorganized logistics providers. Recently, a mismatch between demand and supply has emerged nationwide, causing fluctuations in freight rates. The availability of trucks at shipping points has diminished, resulting in increased trucking costs, sometimes by as much as 30%, particularly impacting the northeastern and southern regions. Seasonal variations in agricultural output and disruptions from monsoons or cyclones have further contributed to these cost fluctuations. The rise in expenses and disruptions has adversely affected supply chains throughout the country, leading to production delays, higher overhead costs, late deliveries, and lost sales. Consequently, manufacturing firms are compelled to reassess their supply chains and transportation partners to enhance stability and resilience in their operations.

The fluctuation in freight charges, though, does not have a significant impact on the freight volume because it constitutes only a small portion of the total goods price. If the fluctuation is steady, the charges are passed down the distribution chain to the consumer. When the cost fluctuations are short term, companies rearrange production and shipping schedules to tide over the same. Having said that, in sectors like agriculture and mining where transportation costs are a significant cost component, freight volumes have a direct relationship with freight costs.

4.2 Sector Specific Impact

The logistics sector serves as a backbone for various industries and sectors in India providing initial transportation, storage and warehousing, inventory management, packaging and servicing, distribution as well as last mile connectivity. All these stages add a certain level of cost to the final product, a massive cost spike in any of these stages can result in a significant increase in the prices in that particular industry. Industrial sectors that are heavily reliant on logistics are discussed below

4.2.1 Agricultural sector

Logistics is involved in various levels and capacities throughout the agricultural value chain. It takes care of agricultural supply logistics, production logistics as well as distribution logistics. Currently, India loses nearly 25% of its agricultural production to wastage in the supply chain, reducing that wastage could both provide an income boost to farmers and also lower overall prices for produce, creating better access to high quality food for Indian citizens. Transportation costs in agriculture are a critical component that affects every stage of the agricultural process, from procuring seeds and fertilizers to delivering the final products to the market. These costs are influenced by a variety of factors including fuel prices, infrastructure quality, and distance from markets. Majority of the agricultural logistics is handled by truck which is again plagued by operational inefficiencies in the trucking industry, fluctuating fuel costs, involvement of middlemen all of which significantly bumps up the prices of agricultural commodities in India leading to higher food inflation.

Similarly, India's export competitiveness in case of produce like basmati rice, spices, fruits, tea, coffee and seafood items also suffers massively as they face high inland and port related costs, as a result exporters often lose out to countries like Vietnam, Thailand, and Kenya with lower Agri-logistics costs.

Farmers bear the brunt of rising transport and storage costs, especially when market prices are fixed or low. In India, farm-to-mandi transport cost can account for 20–30% of the price realized by farmers in remote areas, higher logistics costs reduce net earnings, especially for perishable or low-margin crops like vegetables or milk. The scarcity of cold storage facilities further aggravates spoilage, affecting farmers' incomes and food availability. High logistics costs discourage farmers from selling in distant or more profitable markets, this reduces price discovery and competition, keeping rural incomes stagnant.

4.2.2 Manufacturing Sector

Logistics plays an important role in supporting the manufacturing sectors in India be it metals, chemicals, automobile, petroleum, textiles etc, in the movement of materials, components, assemblies, finished products throughout the supply chain. Supply chain management (SCM), inventory and warehouse management, transportation and distribution, reverse logistics are the various stages in managing the logistics in manufacturing sectors. Increase in costs in any of the stages can have a negative and compounding effect on the manufacturing sector

Sourcing raw materials and components can become more expensive due to rising freight, geopolitical escalations, tariffs, warehousing, and fuel costs, the result is squeezing of profit margins which will directly result in increase in the final price of the output. For example, a car manufacturer may source parts from 100+ suppliers across the country; even a slight increase in logistics cost per component can significantly impacts total cost of production. For manufacturing sectors that rely on just-in-time (JIT) inventory systems, delays or inflated transport costs disrupt production schedules. Industries like automobiles, textiles, and electronics suffer the most due to complex, multi-tier supply chains.

Higher logistics costs inflate the cost of finished goods, making them less competitive both in domestic and export markets. Competing countries like Vietnam or China with more efficient logistics gain an edge in cost-sensitive sectors like garments or consumer electronics. Poor last-mile connectivity, port congestion, and multimodal inefficiencies extend lead times. Delays in getting raw materials or delivering finished goods to customers can lead to production halts, penalties, or loss of contracts. For export-driven sectors, any delay in hitting international timelines hurts reputation and leads to client attrition.

To buffer against transport delays or unreliability, manufacturers maintain excess inventory, tying up working capital, high warehousing and handling charges further inflate overhead costs. For small and medium manufacturers, increased inventory requirements can strain cash flows and reduce operational agility. MSMEs often lack scale to negotiate good freight rates or build warehousing, they face higher per-unit transport costs, and limited access to digital logistics platforms. The cost disparity widens the gap between large players and smaller units, affecting sectoral inclusivity and competitiveness.

As a result of these inflated logistic costs, exports become less competitive, domestic capacity and job creation, supply chain becomes more vulnerable to shocks and investments decline in inefficient logistic zones

4.2.3 Ecommerce and Retail Sector

India is currently witnessing another booming stage of retail sector through rising Ecommerce and Quick commerce. With the rise of online shopping, quick commerce and omnichannel retail, logistics is becoming the lifeline of this sector and has become a key competitive differentiator but this is one such sector where margins are tight, customer expectations are high, and speed of delivery plays an important role. Efficiently managing the cost of logistics is a challenge and directly impacts profitability

When logistics costs increase due to fuel hikes, warehousing charges, or last-mile inefficiencies those added costs erode profitability, A ₹500 product may incur ₹70–₹100 in delivery charges. If costs rise further, the company either absorbs the loss or risks customer churn by increasing prices. Companies often pass increased logistics costs to customers in the form of higher shipping fees, increased minimum order values for free delivery, costlier returns or exchanges this negatively affects customer satisfaction, especially in price-sensitive Tier 2 and Tier 3 markets, where e-commerce is just gaining traction.

Rural and semi-urban areas are already cost-intensive for delivery due to poor infrastructure and sparse order density. Rising costs make it economically unfeasible to serve remote regions profitably. Last-mile delivery is the most expensive leg, often accounting for over 50% of total shipping costs. Urban congestion, poor address systems, and multiple delivery attempts increase fuel use, labour time, and reverse logistics costs, when last-mile costs rise, e-commerce companies may delay deliveries, cancel COD options, or cut service in high-cost zones, impacting brand trust.

Reverse logistics is still one of the biggest challenges, India has a 25–30% return rate in categories like fashion and electronics. Processing returns involves double transport, inspection, repackaging, and warehousing, high logistics costs make returns unviable, often leading to loss-making orders

Higher logistics and warehousing costs inflate inventory carrying costs, especially for fast-moving or perishable goods, retailers find it difficult to balance cost vs. speed, which often leads to inefficiencies or service gaps.

MSME's and small cale sellers who make use of market place models and platforms like Flipkart, Amazon etc rely on platform provided logistics like fulfilled by Amazon, assured by Flipkart, rising fulfilment and storage fees eat into already slim margins for small sellers. It discourages MSME participation and widens the gap between top-tier sellers and smaller vendors.

4.2.4 Service Sector

Service sector is perhaps the most vital in Indian context as it contributes over 50% of the GDP and employees nearly 30% of the workforce. Rising logistics costs places significant burden on India's service sectors, especially those that rely on physical goods movement, time-bound operations, or regional reach.

Increase in logistics costs results in increased operating expenses for asset heavy services. Sectors like hospitality, healthcare, construction, and maintenance rely on timely and cost-effective delivery of equipment, consumables, and spare parts, rising transportation and warehousing costs inflate operational overheads, squeezing margins.

Service-based companies that rely on mobility and rapid deployment may experience delays due to traffic congestion, poor infrastructure, unreliable delivery of service equipment/tools. These delays reduce customer satisfaction and SLA (service-level agreement) compliance. High logistics costs limit service expansion into Tier 2, Tier 3, and rural areas. This restricts market penetration and widens the urban–rural service gap, especially for healthcare, education tech, and maintenance services

As input logistics become more expensive, service providers pass on the cost to clients, this affects sectors like courier and express delivery services, home services and on-demand platforms, facility management etc, this results in reduced affordability and demand, especially among price-sensitive segments.

Companies like Urban Company, Zepto, Zomato, and Swiggy are especially vulnerable as they depend heavily on efficient last-mile mobility, low delivery costs, fleet utilization Rising fuel and vehicle maintenance costs make their unit economics weaker, leading to increased charges or reduced service availability.

4.2.5 MSME Sector

The increase in logistics costs has a disproportionately negative impact on MSMEs (Micro, Small, and Medium Enterprises) in India, affecting their survival, competitiveness, and scalability. Since MSMEs operate on tight budgets and lack access to logistics economies of scale, even small cost increases create significant issues in their operational viability Any increase in input transport, warehousing, or distribution costs directly reduces their already narrow profit margins.

Unlike large companies, MSMEs lack bulk shipping capabilities or preferred rates with logistics providers. They pay higher per-unit costs for transporting goods, especially to distant regions A large firm may ship at ₹5/kg, while an MSME might have to pay ₹12–₹15/kg, making their goods more expensive and less competitive. Due to high logistics costs, many MSMEs are confined to local or regional markets, reaching new cities or export destinations becomes expensive, this restricts their growth, limits market diversification, and increases risk from local demand shocks.

When logistics costs are passed to customers, MSME products often become less price-competitive compared to large or imported brands. Retailers and online platforms may prefer vendors with better pricing or faster delivery. This affects MSMEs' market access on e-commerce platforms like Amazon or Flipkart, where delivery speed and cost matter.

High inland freight, port congestion, customs delays, and container shortages inflate export costs. MSME’s face difficulties navigating these systems without large trade teams or global networks, many potential exporters give up due to the high cost and complexity of international logistics.

4.2.6 Energy Sector

India’s energy and fuel sector relies heavily on the transportation of bulky and hazardous materials like coal, crude oil, natural gas, and petroleum products. Given the vast distances between extraction/import points and consumption centres, even minor inefficiencies or cost escalations in logistics can create ripple effects through the entire energy value chain.

Thermal power plants still produce over 70% of India’s electricity, depend heavily on coal transported via rail and road. Rising freight charges, fuel prices, and last-mile inefficiencies increase the delivered cost of coal, driving up the cost of electricity generation. A ₹500/ton increase in coal transport cost can raise power tariffs by 20–25 paisa per kWh.

India imports ~85% of its crude oil, which must be transported from ports to inland refineries, and then distributed across the country. Rising logistics costs (due to fuel prices, tolls, tanker shortages, or port congestion) inflate the cost of refining and distribution, affecting Petrol/Diesel prices, LPG cylinder costs, Aviation turbine fuel (ATF), These costs are either passed to consumers or absorbed by oil companies, impacting profitability.

When domestic logistics become too costly or unreliable (especially in coal), power producers shift to imported alternatives, India's power plants often blend domestic coal with imported coal from Indonesia or Australia, further increasing fuel costs when logistics is inefficient.

Solar and wind power require transport of heavy components (turbines, panels, batteries) to remote installation sites. Rising costs and delays in moving these components inflate capital expenditure for renewable energy projects.

High logistics costs trickle down to end consumers, especially in rural and remote regions, hilly and northeastern states, island territories like Andaman & Nicobar. This affects energy affordability, usage, and access, undermining energy equity goals. Rising costs of compliance, security, and maintenance inflate the cost of moving energy products, especially in remote or border areas.

4.3 Environmental Impact

Environmental impact in India caused by the logistics industry stems from inefficient, outdated and polluting logistic systems that have remained unchanged over the past several decades, poor infrastructure and inability to adopt automation and sustainable practices on large scale. Currently India's logistics sector contributes 13.5% of total GHG emissions, with road transport accounting for 88%, making it among the most carbon-intensive globally., the share of CO_2 emissions from logistics is around 7% of the total CO_2 emissions in India, which will undoubtedly grow as "Make in India" accelerates. In Delhi, freight amounts to 67% of the total PM2.5 emissions from the transport sector, 61% of the total SO_2 emissions from the transportation sector, and 62% of the total NO_x emissions from the transportation sector

Nearly 70**%** of freight in India moves by road, Trucks are often diesel-powered and older, contributing disproportionately to CO_2 emissions, Particulate matter (PM2.5) and NO_x, worsening air quality. India's road freight emissions are among the highest in the world, projected to grow by over 200% by 2050 if left unchecked. Higher fuel consumption due to congestion, longer routes, and poor vehicle efficiency leads to increased emissions, A 10% increase in diesel prices leads to 5-7% more emissions as trucks take longer, inefficient routes to save costs. Urban logistics and last-mile delivery inefficiencies cause traffic congestion in cities like Delhi, Mumbai, and Bengaluru. trucks and delivery vans stuck in traffic burn fuel without moving, producing unnecessary emissions, Congestion-related delays add 15–25% to logistics costs and increase fuel consumption by up to 20%.

Lack of multi-modal integration is yet another reason for increased environmental degradation, Rail freight emits 75% less CO_2 per ton-km compared to road freight, Inland waterways are cost-effective and eco-friendly, but poorly developed, this under underutilisation of railways at only 28% and inland waterways at 2% both of which are greener alternatives is one of the main reasons for consistent pollution stemming from Indian logistics sector

Fragmented and under-optimized warehousing networks which lead to increased logistics costs also leads to increased emission levels as longer distances exist between multiple touchpoints which leads to redundant trips and increased reverse logistics expenditures. These older warehouses also lack any kind of green certifications, deploy age old infrastructure like diesel generators, inefficient refrigerators all of which lead to increased energy consumptions and hence greater emissions

Packaging in Ecommerce is one of the major areas of expenditure in retail sector which adds up to the overall logistics costs, the use of excessive cardboards and plastic to protect goods over long journey adds to the increasing solid waste problem particularly in urban areas

Cold-chain and transport inefficiencies which already leads to increased logistics costs as discussed results in 30–40% of perishables being wasted post-harvest, this wasted food contributes to methane emissions from landfills a greenhouse gas 25 times more potent than CO_2.

All these reasons ultimately result in causal loop where inefficient logistics systems lead to higher logistics costs which in turn leads to increased emissions which in turn results in greater environmental degradation creating higher mitigation costs and lower sustainability

4.4 Social Impact

An increase in logistics costs doesn't just affect businesses and the economy, it also has deep and far-reaching consequences on the social fabric of India, especially given the country's large rural population, regional disparities, and dependence on low-cost goods and services. When logistics systems become inefficient and expensive, it leads to reduced access, inequality, economic exclusion, and regional imbalances, all of which erode social cohesion and stability.

Widening regional disparities and urban-rural divide is one of the major impacts, since logistics costs is often a function of distance, places that are isolated from logistical infrastructures often require high expenditure to gain accessibility hence these regions are deprived of opportunities. Remote and underdeveloped regions (e.g., Northeast India, tribal belts) face higher freight costs and weaker logistics connectivity, this limits access to markets, employment, healthcare, and education services. States with poor logistics infrastructure (e.g., Northeast, Bihar, parts of Jharkhand) suffer from underinvestment due to high operating costs. This reinforces a cycle of poverty, underdevelopment, and social alienation. This fuels regional discontent and hinders national integration.

High logistics costs make it expensive to transport goods and services to remote and rural areas as a result, people in villages often pay higher prices for essential goods, or have limited access to quality products, costly Medicines, fresh produce, and consumer electronics are either costlier or unavailable in tribal and hilly areas due to high freight and poor connectivity, this deepens rural marginalization and limits opportunities for social and economic mobility.

Poor logistics in the form of cold chain inefficiencies and transport delays lead to 30–40% post-harvest loss of fruits and vegetables. This creates a gap in the market and perishables often don't reach low-income or rural consumers affordably. These losses reduce food supply, drive up prices, and limit nutritional options for the poor. Despite agricultural abundance malnutrition persists in many parts of India, partly due to logistics-related supply chain gaps which results in increased hunger and health disparities, especially among children and women.

High logistics costs drive up prices of everyday essentials like food, medicines, and household goods. These price increases disproportionately affect low- and middle-income families, who spend a higher share of income on essentials. This results in reduced real income, increased financial stress, and lower quality of life for millions. Logistical inefficiencies contribute to congested roads, increased traffic, and pollution in cities. Delivery vehicles, lack of freight zones, and long-haul trucks entering cities at peak hours worsen commuting and air quality, all of this causes public health issues and declining urban liveability.

Poor logistics and increased logistics costs reduce the productivity of manufacturing and agriculture sectors, slowing formal job creation. Informal logistics workers (e.g., truck drivers, loaders) face poor working conditions, low wages, and long hours. This results in social insecurity, poor labour standards, and widening informal-formal job gap.

High logistics costs make small producers and artisans uncompetitive, cutting them off from urban and export markets, this leads to loss of income, migration to cities, and the erosion of traditional livelihoods. Transport workers migrate to cities for better-paying jobs. Farm labourers shift to construction due to unstable agro-logistics incomes. Sometimes steep climb in prices can also lead to social unrest, chaos and instability as in the case of truckers who go on strikes frequently due to abrupt increase in fuel and toll prices which directly disrupts the supply chains, farmers agitation against high mandi transports costs is also quite common

4.5 Government Initiatives to reduce Logistics Costs

The government has initiated several steps towards the reduction of logistics cost in our country from the existing parameters of 13-14% to 8-9% so as to align with the global benchmarks in logistics performance and efficiency and also to provide world class logistical services

- **National Logistics Policy**

A comprehensive policy involving various ministries taking a broad view of all the sectors in order to boost the nation’s economy and competitiveness by establishing an integrated, seamless, effective, dependable, green, sustainable and cost-efficient logistics network that makes use of best-in-class tools, procedures and qualified personnel. The aim is to reduce logistics costs to under 10%, enable seamless multi modal transport, digitize logistic processes, promote skill development and boost employment and MSME participation

- **PM GatiShakti National Master Plan**

This initiative highlights the importance of dismantling obstacles between departments and merging infrastructure with logistics networks. The PM GatiShakti program aims to reduce disruptions and improve efficiency by prioritizing multi-modal connectivity and ensuring timely project delivery. By implementing a National Master Plan, it seeks to establish a cohesive transportation and logistics network that promotes value addition and creates employment opportunities.

- **National Logistics Law**

This is a proposed comprehensive legal framework aimed at reforming logistics, which will support the One Nation, One Market initiative and foster a more adaptable regulatory environment. The legislation will facilitate the removal of complex registration procedures and streamline operations by introducing a unique logistics account number, standardizing the bill of lading across various transport modes, and implementing additional measures to simplify the overall system.

- **Unified Logistics Interface Platform**

It is a fundamental aspect of India's National Logistics Policy, intended to dismantle barriers, minimize paperwork, and enhance supply chains by consolidating over 30 digital systems from various ministries, ports, railways, and private entities into a single cohesive platform. The goal is to establish a unified data exchange system that allows for real-time tracking, document sharing, reduced turnaround times, lower costs, increased transparency, and supports data-driven decision-making.

- **National Logistics Workforce Strategy**

A collaborative program to examine and respond to current and increasingly future skills needs, with the idea of integrating logistics education and training into the formal education system starting from primary school, including post-graduate, and a certified logistics professional (CLP) program to stimulate the participation of such experts. The Driver Employment and Empowerment Programme is one of the programs mentioned to mitigate logistics cost by seeking to attract truck driving as a viable profession because of major shortage of truck drivers means logistics costs and ultimately product costs will be affected negatively.

- **Logistics Databank System**

A digital tracking system that tracks containers across ports, railways, and roads using RFID and analytics. It is now integrated with ULIP as a part of NLP. The objectives include real time container tracking, using data analytics for policy making, improving supply chain efficiency and reducing dwell time of containers

- **Dedicated Freight Corridors**

These are high-speed, large-capacity railway corridors that are built to facilitate the seamless transportation of goods and commodities across India. The project is aimed at decongesting railway networks, reducing logistics costs, and boosting freight efficiency and consists of two major corridors spanning 3,360 km designed exclusively for freight trains. The Eastern Dedicated Freight Corridor from Ludhiana in Punjab to Dankuni in West Bengal and Western Dedicated Freight Corridor from Dadri in UP to JNPT in Mumbai

- **Multimodal Logistics Parks**

These parks are a strategic initiative designed to develop large freight-handling facilities on 100 acres or more that are usable by shippers adding a modicum of flexibility in modes of transportation - road, rail and air. The facilities will also create more accepted forms of storage in areas such as mechanized warehouses, cold storage, and services such as customs clearance, and quarantine. The Multi-Modal Logistics Parks (MMLPs) evolve out of the federal government's exploration of 35 sites for easy movement of goods through various modes.

- **Introduction of E-waybill**

The logistics system requires electronic documentation for truckloads over Rs. 50,000 as the logistics sector requires copious amounts of documentation and often cumbersome border checkpoints to confuse and waste time. The aim of e-way bill is to make logistics more efficient by forcing users to electronic document every truckload so only document is produced, not provincial documentation. Unnecessary barriers increase turnaround times and hamper supply chain speed and efficiency by requiring subservience to local bureaucracies.

- **Logistics Efficiency Enhancement Programme (LEEP)**

A government initiative aimed at modernizing India’s logistic sector through technology adoption, process reforms and infrastructural upgrades. LEEP is designed to improve freight transport efficiency. Associated cost, transportation time, and logistics practices like goods transferring and tracking through infrastructure technology and process interventions.

- **Sagarmala Programme**

A project that aims to modernize India's port infrastructure, promote coastal shipping to decongest road and rail, enhance connectivity and facilitate coastal community development. A major push for the Indian Maritime sector to boost its productivity and improve the logistics efficiency. The project includes upgradation of 12 major ports as well as announcement of 6 new mega ports

- **Bharatmala Pariyojana**

A mega road development program aimed at creating economic corridors and freight corridors across the country. The objective is to create economic corridors, feeder routes, national corridors, border roads, expressways and ring roads to connect 550+ districts with high quality roads, decongest existing highways, improve last mile connectivity, reduce logistics costs and boost economic growth

Table 4.2 Projected Timeline

Projected Impact of Reforms in India		
Initiative/Reform	Estimated Cost Reduction Potential	Implementation Horizon
PM Gati Shakti Master Plan	1–2% of GDP	Medium to long term (2025+)
National Logistics Policy (NLP)	1% of GDP	Medium term (by 2026)
ULIP & Digitization	0.5% – 1% of GDP	Short to medium term
DFCs and Multimodal Hubs	1% of GDP	Medium to long term
EV and Green Freight Programs	Cost efficiency in last-mile delivery	Ongoing (through 2030)

Source: Research papers

CHAPTER V
CONCLUSION AND STRATEGIC RECOMMENDATIONS FOR REDUCING LOGISTICS COSTS IN INDIA

India, as a rapidly growing economy, faces significant logistics inefficiencies due to infrastructural bottlenecks, regulatory complexities, fragmented operations, and outdated technology. India's logistics costs, accounting for approximately 13-14% of GDP, which is significantly higher than global standards (8-10%). These inflated costs are a major obstacle to the trade competitiveness and economic growth of our country. it has been seen that a reduction in the share of logistics costs by 14% in the final price of goods leads to an increase in demand for those goods by 8–18% and increase job creation in that sector by 2.5%-16%. Such an impact is particularly important for micro small and medium enterprises, which employ over 110 million Indian citizens, particularly for agricultural products, another critical sector of the Indian economy, the same reduction in logistics costs to 10% of final prices increased demand by 12% and increased agricultural employment by 6% boosting both rural incomes and nutrition and food security for the entire country. Ultimately the objective of this report is to identify gaps in the existing logistics system and put forward actionable strategies that can help to combat and bring down logistics costs in India

5.1 Infrastructure development

As previously discussed, India's logistics infrastructure faces significant challenges in meeting the needs of a growing economy. Freight flows are highly concentrated, rely excessively on roads and are characterised by severe inefficiencies The shift towards a balanced network design is extremely crucial, the percentage share of railways as well as coastal shipping in total freight movement needs to increase. The right mode of transport has to be used, rail and waterways should be prioritised for long distances, and roads including expressways for shorter stretches. a balanced modal approach is necessary to lower transportation costs, achieve improvement in efficiency and be more sustainable.

As of now only 2 DFCs are operational but they are still not operating at their potential. Many industries like steel plants in Odisha, auto hubs in Pune lack direct rail links to DFCs which increases first and last mile costs and time hence building first and last mile rail connectivity is vital to ensure efficiency. Some sections still use diesel locos due to incomplete electrification which needs to be addressed quickly. The cargo mix is still sub optimal with major dependence on bulk cargo like coal so specialised wagons that can carry break bulk as well as cold chain integration needs to be implemented quickly. Mini freight terminals can be set up to encourage and promote MSME businesses.

Introduction of PPP models and allowing private operators like Adani, JSW to operate on these routes can bring in additional investments and fast track development. Double stacked container train needs to be normalised as early as possible which will increase load carrying capacity but for that infrastructural upgrades need to be done like adjusting the overhead electrifications, conducting route surveys for overhead passes, construction of appropriate tunnels and bridges. Better terminals need to be set up to improve the cargo handling capacities. The tare load of existing wagons can be lowered from 6.5 tons per axle to 5 tons per axle by shifting from Corten steel wagons to stainless steel wagons, this will result in lower fuel costs per ton-km as stainless steel wagons carry higher payload as well as lesser investment requirements. Indian Railways has already begun using stainless steel BOXN wagons, however, the Railways should explore new designs that can further reduce tare load in the existing BOXN-HL wagons. Similarly, efforts to increase average axle loading from 21.5 tons to 22.9 tons must be made as our axle load is significantly lesser than that of our China and America who operate with axle load of over 25 tons

Figure 5.1 Road and Rail freight % tonne-km

Source: NITI AYOG

More dedicated rail freight corridors need to be constructed between industrial belts like Delhi Mumbai, Delhi-Kolkata, Mumbai-Chennai, Delhi-Chennai, Mumbai-Kolkata, these corridors will need to be supported by 30 to 40 expressways, road and rail links across the 150 connectors and 700 last mile links. More spend is needed on rolling stock and other additions such as new tracks, rail line doubling and gauge conversions, this need to be supplemented with the development of logistics parks and last-mile road and rail links which can facilitate better integration across modes. While rail DFCs serve as a low-cost and better service option for long-haul traffic on high-density routes, they need to be accompanied by improvements in costs and service quality of short-haul traffic routes. Expressways on 100 km to 300 km long stretches serve as the most efficient connectors in the overall network structure, increasing the number of expressways to about 30 to 40 and accelerating the completion of projects underway is critical to increase the number of efficient connectors across the network.

Last mile connectivity is another major area of infrastructural development, Upgrade 50,000 km of rural roads to connect farms, MSMEs, and warehouses with highways as part of Pradhan Mantri Gram Sadak Yojana (PMGSY). Development of dedicated industrial access roads for industrial clusters in Tamil Nadu, Karnataka, Gujarat, Pune etc and implementation of One district One logistics park to reduce last mile costs Accelerate Bharatmala Project implementation to develop 65,000 km of highways and freight corridors, prioritize expressways and economic corridors that connect major production and consumption centres. Develop truck terminals, parking bays, and rest areas at regular intervals on national highways, inclusion of weighbridges, repair stations, and sanitation facilities to support truckers. Retrofitting existing bridges and roads to handle high-axle load vehicles and multi-axle trucks. It is also suggested that warehousing and truck terminals should be co-located with multi-modal logistics parks which will ensure seamless road connectivity between these hubs and major highways resulting in shorter turnaround times and lower freight consolidation costs

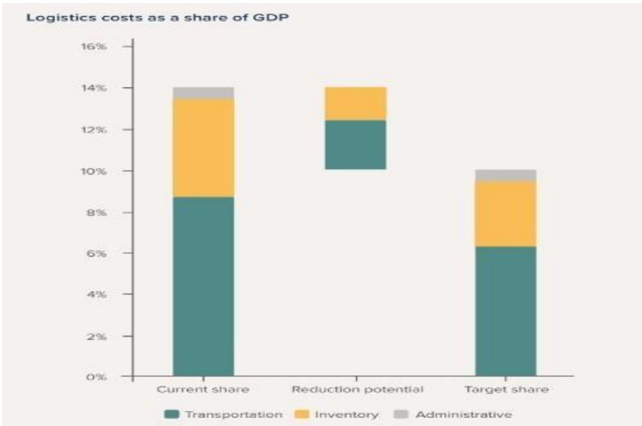
Another important development that needs to happen is that India needs to put in place several enablers to help maximise the efficiency of its infrastructure, these include building logistics parks, standardising containers and pallets etc. Cities like Mumbai, Bangalore, Cochin, Hyderabad, Kolkata, NCR, Ahmedabad, Nagpur, Vishakhapatnam being the hub for industrial centres trade and commerce could be the ideal choices for hosting these Logistics parks in order to attain cost advantages in transportation and storage across various modes. Currently as a part of our NLP it is proposed to have MMLPs in 33 different locations throughout India but only very few of them have attained operational status, infrastructural development needs to be initiated to ensure that these facilities operate at their full potential. Infrastructure upgrades to ensure standardisation of containers and pallets also needs to be done which will facilitate seamless transfer of cargo across multiple transport modes saving time, effort and resources

Inland waterways and coastal shipping are the cheapest and least-energy intensive mode of transport, The transportation costs (excluding last-mile costs) on waterways is around INR 1.06 per ton-km, well below the INR 1.36 per ton-km for rail and over INR 2.5 per ton-km for road. India's inland waterways contribution in domestic freight movement is much lower than countries like China where the share is nearly 30%, so to make use of this opportunity effective infrastructure needs to be in place with a complete, integrated network from coastal shipping, to ports to last mile connectivity. Dredging rivers and ports to provide access to larger vessels and maintaining year-round navigability on routes like NW-1 (Ganga), NW-2 (Brahmaputra), NW-4 (Godavari-Krishna), removal of silt and sandbars which is critical for NW-5 (Brahmani-Mahanadi), construction of locks and barrage systems (NW-3 in Kerala) mechanised handling facilities like automatic cranes, conveyor belts for faster cargo movements as well as construction of dedicated berths for domestic traffic and coastal cargo to avoid delays. Construction of multi modal terminals on NW-1 (Varanasi, Sahibganj, Haldia) & NW-2 (Dhubri), Roll on Roll off terminals to board ships in areas like Mumbai, Goa as well as construction of ICDs and CFS near waterways to promote these movements and reduce dependence on road. Coastal shipping also needs to be focussed which includes strengthening the West coast – Kandla to Kochi – and East coast – Kolkata to Chennai – coastal freight corridors

5.2 Inventory Optimisation

Transportation costs in Western nations are said to range between 5 and 6% of GDP, inventory costs between 2 and 3%, and administrative and overhead costs between 0.5 and 1%. If transportation costs are hovering at around 7%, inventory costs are somewhere near 6.3%, and administrative overhead costs stand at 0.7% in India, then the Indian economy can immensely benefit from mechanisms that help keep inventory and transportation costs to a minimum while ensuring that administrative and overhead costs remain constant. For example, in 1982, logistics in the United States carried the cost of more than 14% of GDP, with inventory costs of 7.2%, transport costs of 6.8%, and overhead costs of 0.5%, thus nearly similar in structure to the present costs in India. The cost of logistics dropped substantially in the U.S. by 2002 to under 9% of GDP, inventory at 2.8%, transport at 5.5%, and overhead at 0.4%. This significant drop in inventory costs over 20 years was a major factor behind the logistics efficiency revolution experienced by the U.S. and is an important avenue for India to pursue for improving logistics efficiency.

Figure 5.2 Logistics Costs split



Source: NITI AYOG

There are two approaches to reducing inventory costs —reducing cycle stock inventory and reducing buffer stock inventory

Cycle stock inventory is the inventory that firms hold on hand in order to satisfy normal sales demand. Reducing cycle stock is usually accomplished by moving from infrequent large orders to smaller, more frequent orders —known as just-in-time (JIT) replenishment. However, without real-time visibility into inventory holdings and the ability to rapidly and automatically share that information up the supply chain, JIT ordering practices become impossible. To effectively implement Just-In-Time (JIT) strategies, companies must initially develop the digital capabilities necessary for real-time inventory tracking, as well as establish digital connections throughout the supply chain to swiftly relay that information.

Buffer stock inventory is a guard against variability, both in consumer demand and in the time, it takes suppliers to deliver goods, known as lead times. One key approach to dealing with variance in consumer demand is to better understand the root causes of variance and anticipate it also known as demand forecasting. However, in India’s highly fragmented and relatively immature distribution system, that point-of-sale visibility is often impossible to create and many of the smaller less advanced suppliers would not be in a position to effectively use that visibility, both of which pose a major barrier to buffer stock reductions. Another approach to dealing with demand variability is to insulate the supply chain from it. As long as demand variance from different points of sale is independent, having a single inventory stock cover many points of sale will diversify away the variance created by any single point of sale and reduce the total buffer stock in the distribution system.

5.3 Policy Reforms and Regulatory Simplification

The Govt of India has launched several schemes and initiatives along with massive funding and Capex to boost the logistics sector in India, improve efficiency and reduce the logistical costs. These schemes include NLP, GatiShakti Master plan, ULIP, LDB etc, all these are individually brilliant schemes however all of this needs to come together and work in synchronisation which is often made difficult because of different jurisdictions and power structure imbalances that exist in our country

A better implementation of the NLP is required which should involves establishing state-level logistics policies and nodal agencies to ensure alignment with national goals, integrate efforts under PM Gati Shakti for data-driven planning and infrastructure prioritization, monitor and enforce Key Performance Indicators (KPIs) such as cost per ton-km, turnaround time, and reliability. Standardisation of rules which should focus on harmonizing road permits, axle-load norms, and transit rules to reduce inter-state logistics friction, implementing "One Nation, One Permit" policy to streamline documentation and enabling pan-India movement of freight vehicles without delays at borders especially for perishables.

Simplification of approval processes for logistics parks, cold chains, and warehouses under Ease of Doing Business, providing fast-track clearances and land acquisition support via dedicated logistics zones. Addressing inverted duty structures that penalize logistics service providers, offering input tax credit on warehousing and transport infrastructure, rationalization of toll pricing on national highways to avoid double-charging and incentivization of bulk movement. Creating performance-based incentives for efficient logistics operators by introducing rating systems based on based on delivery efficiency, emissions, and technology use, provide tax rebates or faster clearances for top-rated operators, promoting logistics sector as a “productivity-linked incentive” (PLI) candidate, especially for tech-enabled cold chain and green transport. Incentivizing modal shift or multimodal transport by providing subsidies or tax breaks for shifting bulk cargo from road to rail or waterways, creating common carrier licensing frameworks that allow flexible use of roads, rail, and water by private players. Implementation of policies that mandate fuel efficiency standards and promote CNG/electric freight vehicles via subsidies, Introduction of carbon credits or tax deductions for sustainable logistics practices. Creation of National Logistics Regulatory Authority, an independent body established to coordinate between various ministries like Road transport, Railways, Ports, Commerce etc that will oversee policy implementation, resolve disputes, and maintain a central logistics database.

digitization of supply chains and enforcement strategies can improve trucking efficiency so the govt should focus on enforcing policies that reduces inefficiencies, for example weigh-in-motion (WIM) implementation helps to penalize shipments that are exceeding the allowable limits and helps to identify the defaulters in the freight system; this also allows for effective check post clearance since trucks do not need to stop for inspections. Policies to be implemented that makes government mandated paperwork to be done digitally as it can enhance efficiency. Currently in India, the electronic way (e-way) bill under GST, necessary for movement of goods, can be generated from the e-way portal, SMS, or through a mobile phone application

Logistics firms need to optimize the geography of their distribution networks however; they can only do so effectively to the extent that the land they need is made available to them to build those facilities. Land use policies to be implemented in such a manner that land should be made available for logistics development at major modal intersections that are in proximity to significant freight generating areas, such as cities or industrial clusters, these logistics facilities should be clustered with other logistics facilities so as to create economies of density that lower transport costs and increase efficiency. Zoning policies should reserve suitable land for urban logistics purposes, for example urban logistics spaces for parcel delivery, can actually enhance urban quality of life for urban residents by giving them superior access to goods and services while simultaneously reducing truck travel into and out of cities as a result logistics sprawl can be slowed or reversed

Policies that promote night time deliveries can be implemented because avoiding congested time periods can enhance delivery efficiency, not only the ones who deliver the goods but the ones who receive the goods should also be incentivized as it can increase the uptake of night deliveries. The carrier also has benefits as it enables easy transfer of goods off the truck and into the store or business, the carrier can deliver substantially more goods per tour, reducing the unit delivery costs. Furthermore, firms making night deliveries often also make daytime deliveries, allowing for much greater productivity of urban delivery trucks\

Congestion feebates can be yet another policy implementation, applying a feebates concept to urban access would charge trucks to enter the city during congested periods while incentivizing them to enter during nighttime hours

Other set of policy measures can include encouraging PPP models for construction of infrastructure like bypass so that long haul trucks can go around the city instead of adding to the city traffic, building truck terminals and parking facilities outside the city limits to encourage the shifting of wholesale activities, implementing auto-fuel policies that call for tighter emission regulations and fleet upgrades

5.4 Technological Innovation

Digitization is the backbone and technology is the key enabler of efficient supply chain. Digitization, equipped with adequate technology, can be a solution to low productivity practices, high inventory costs, and inefficient urban distribution. A digitized platform to integrate supply chain, right from demand forecasting to load consolidation and truck routing and dispatch scheduling, can reduce the delivery time and costs

The potential solutions through these technological, digital and operational advancements can be explained on seven fronts: (i) developing more accurate demand forecasting models through enhanced inventory visibility, (ii) automation of warehouse processes, (iii) deploying inventory data insights in distribution network design to deal with demand volatility, (iv) implementation of just-in-time inventory systems and fostering lean ordering behaviour among establishments, (v) achieving efficiency in truck routing and dispatch through real-time information, (vi) implementing intelligent transport systems (ITS), such as weigh-in-motion systems, delivery space booking systems, and route planning systems, and (vii) promoting carrier collaboration and accomplishing higher levels of operational efficiency through "Internet of Things" applications.

Supply chain digitization and accessibility to point of sales data can help in improving data analysis to turn that data into accurate demand projections, being able to effectively project demand surges can enable firms to build up extra inventory to meet demand rather than permanently holding excessive safety stock to meet non-random demand surges. In the future, visibility beyond the point of sale into direct consumer behaviour though data enabled internet of things (IoT) holds the potential to further improve demand projections and reduce safety stock holdings. Network design that minimizes total cost is a complex computational process with significant data demands. Mobilizing rich data sets around demand composition, transport capacity, transport price and the seasonality of all the above allows logistics managers to rapidly simulate huge numbers of network configurations and select one that minimizes cost

Digitization and automation can be introduced in the warehouse processes, Warehouse management systems (WMS) can be used to reduce inventory costs both by increasing the efficiency of how goods move through and are stored in warehouses. These types of software systems, and the automated processes they enable, can both reduce operating costs within warehouses but are also an important element of lean supply chains as they can help to identify and resolve inefficiency and waste that lead to higher inventory levels

Digitization of blocks and signals in the rail network can encourage modal shifts to rail networks and result in cost reductions, rail systems usually use analogue solutions where a block is a physical section of track which only one train may occupy at a given time, digitizing the physical blocking systems through virtual moving block systems, can enable maximum network throughput by computing minimum train following distance based on real time information about train location, speed and braking distance, while increasing safety and reliability

Digitization of the loading process can result in massive time savings and revenue generation, in traditional logistics processes, data about available loads is held by brokers and contracting for loads is an analogue process involving phone calls and large quantities of paper documentation. Digitizing the process of finding and contracting for loads, potentially through applying shared mobility business models to trucking markets, can keep trucks on the road moving freight and generating revenue

Real time tracking and route optimization is yet another technological innovation that can result in cost savings, by using GPS coordinates of trucks and loads, usage of RFID and IOT sensors as well as other variables such as delivery time windows and real time traffic data, computers can greatly increase the efficiency of truck dispatch and routing, with the growth of cloud computing and software as a service (SaaS) business models, the potential efficiency gains from improved truck management are increasingly becoming available to the broader market.

Systems like ITS (Intelligent Transport Systems) use information technology to improve the efficiency of transportation. Various solutions under ITS include Weight-In-Motion (WIM) systems, vehicle location and condition monitoring systems, traffic controlling and monitoring systems, delivery space (for parking) booking systems, route planning systems, location monitoring systems and freight status monitoring systems, this enables enforcement of individual violations as well identification of habitually offending carriers for ongoing monitoring and enforcement.

Digitization of parking and unloading infrastructure can be done through technological innovation, multiple possibilities are available, first is the ability to find open parking in advance of a delivery by an app rather than driving a truck around in circles looking for it. Second is the ability to pay for and schedule that parking space in advance, allowing trucks to guarantee that a suitable space is available in advance of arrival. Finally, digitized parking enforcement, identifying and enforcing fines on vehicles that illegally park in delivery bays, can ensure that trucks actually have access to the infrastructure built for them

The implementation of the single window interface for trade (SWIFT) will considerably simplify customs clearances for import-export establishments. Similarly, ELDs and tracking systems will also aid the logistics operators in compliance.

Automated vehicle is one of the revolutionary advances in logistics transportation from self-driving trucks to autonomous drones. These technologies make the delivery process more efficient by reducing human errors, cutting down on operating costs, and increasing speed and accuracy.

IOT might revolutionize logistics by enabling the real-time tracking of shipments. Connected devices and sensors on cargo provide detailed information throughout the entire supply chain journey; this allows not only for precise monitoring but also encourages proactive decision-making on the part of stakeholders, thereby reducing delays and improving visibility.

Deemed as the real disruptor, blockchain technology could address the issues of transparency, security, and traceability in logistics. The very moment one describes it as a secure and decentralised ledger, fraud, and distrust between parties in a supply chain context will go by the wayside, along with any paperwork. Documentation and transactions supported by smart contracts are then automated, resulting in smooth logistics operations.

Predictive analytics allows logistics professionals to foresee disruptions and, accordingly, optimise routes and schedules. Analysing historical data and trends, predictive analytics models may forecast potential interruptions ranging from traffic delays, untoward weather, to inventory shortages. Being prevented beforehand allows logistics companies to allocate resources better and maximize transport capabilities, hence enhancing on-time deliveries and efficiency

AI Algorithms are revolutionizing logistics and transportation through advanced route optimisation. Given the massive datasets, they come up with the most efficient routes by considering traffic patterns, fuel consumption, and delivery windows to name just a few. It basically minimises transportation costs and reduces environmental impact by optimising fuel consumption.

For last mile delivery, drones certainly can be a revolutionary answer to all challenges. Since they can easily navigate through highly congested urban areas to reach remote places, they decrease the time and cost of delivery enormously. Hence the innovation is considerably in demand with E-Commerce and Express Parcel services.

Better integration of the ULIP platform along with other offerings like LDB and India Stack and 30+ other digital systems from various ministries like port, railways, road, commerce etc which will enable online registration and documentation, reduces documentation time, improves coordination, enables real-time cargo tracking, improve efficiency and reduce costs

5.5 Organisational Capacity and Individual Skill Development

To optimize their logistics performance, reduce logistics costs and improve overall logistics efficiency organizations need to focus on capacity building and strengthening their internal capabilities while leveraging technology, talent and process excellence. Strategies need to be developed which will ensure that human capital and institutional capabilities are aligned with evolving technological and business demands.

Adoption of integrated supply chain systems like deployment of ERP, TMS, WMS which will ensure end to end visibility, real time data tracking and drive data-based decision making as well as integration of company systems with ULIP, LDB etc which will provide real time visibility and better accessibility

Standardisation of processes and implementation of ISO 9000 ISO 28000 and lean logistics practices which will reduce delays, errors and redundancies in logistics workflows. Implementation of standard operating procedures (SOPs) can further streamline the processes creating uniformity, documenting the procedures and reducing redundant costs

Implementation of Lean and Six Sigma practices such as Kaizen workshops to eliminate inefficiencies, DMAIC (Define, Measure, Analyse, Improve, Control) for process refinement, 5S Methodology (Sort, Set in order, Shine, Standardize, Sustain) in warehouses. For example, Toyota Kirloskar reduced their logistical inefficiencies by over 30% through implementation of 6 Sigma practices

Strengthening vendor and 3Pl partnerships by consolidating vendors for bulk discounts. Use of performance scorecards (on-time delivery, cost/km) and shift to outcome-based contracts (pay per delivered ton, not per trip). For example, HUL saved over 300 crores per year by renegotiating their 3PL contracts

Implementation of performance metrics and KPI'S, measurable KPIs like OTIF (On-Time-In-Full), delivery time, cost/km, and warehouse throughput help to analyse the efficiency and reliability of processes and fine tune them for better results, it drives accountability and continuous improvement and helps to reduce costs over long run

As far as skill development is concerned there is need to expand government initiatives like the Logistics Skill Council (LSC) which offers NSQF-aligned courses, PM Kaushal Vikas Yojana (PMKVY) and Skill India Mission in logistics specific roles like warehouse operator, logistics managers, cold chain technicians etc, NATRIP which provides specialized training for auto logistics

Digital and tech focussed upskilling for employees in areas like AI/ML, Blockchain, Big Data, Predictive Analytics, robotics etc through which they can make more meaningful contributions

On job training and simulations can enhance the productivity and experience of employees for example, VR based operations training, gamified logistics challenges and cross functional rotations can improve the real-life experience of employees during simulation of various crisis which will help them react better during actual time of crisis thus reducing losses

5.6 Conclusion

In conclusion Indian logistics industry is one with immense potential, with rising GDP, per capita income and a growing middle class, the economy and need for goods and services is only going to boom when this is combined with the geopolitical changes taking place currently where global companies are trying to move out of China and establish their production hubs in countries like India the possibilities are endless. When such changes are taking place the growing role of logistics and allied services becomes imperative as we are looking at a 500-billion-dollar market by the end of next decade. But as discussed throughout the paper there are lot of gaps that exist in the Indian logistics industry in the form of infrastructural deficiencies, regulatory and bureaucratic hurdles, lack of technological adoption, human resource and skill shortages all of which breeds inefficiencies throughout the supply chain and ultimately results in high logistics costs, these issues and gaps needs to be addressed as early as possible through the actionable strategies proposed in this chapter. If implemented efficiently the logistics costs can be reduced to single digits and our logistics infrastructure which is already blessed with sufficient landmass, adequate human resources, access to natural resources and its geographic location has the potential to become one of the best in the world

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