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Logistics and Transportation Challenges in Manufacturing: An Analytical Study on Operational Inefficiencies and Strategic Solutions

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ABSTRACT :

It has been growing competitive in the present global manufacturing landscape. The efficiency of logistics and transportation systems has become a key determinant in operational success. This research studies the core problems experienced by Indian manufacturing firms in logistics management, such as high transportation costs, poor infrastructure, and fragmented supply chains, and limited adoption of digital technologies. The study focuses on some key sectors specific to automobiles, fast-moving consumer goods (FMCG), textiles, pharmaceuticals, and electronics.

The mixed-method approach involved using a structured and semi-structured survey to collect primary data through interviews with logistics managers, complemented by publicly available secondary data from government and industry reports. Findings show that most manufacturing firms are characterized by deadweight inefficiencies attributable to high reliance on road transport, lack of real-time tracking systems, and very little integration with digital tools like ERP and IoT. Most small and medium-sized enterprises (SMEs) also face limits with adoption of modern technologies for logistics because of costs and lack of technical skills.

This study also assesses the effect of recent disruptions including the COVID-19 pandemic, which exposed the vulnerabilities of the traditional supply chain and brought to the fore the need for digital transformation and infrastructure development. There were sector-specific issues like cold chain gaps in the FMCG sector and a greater reliance on just-in-time logistics in the automotive sector, implying that customized strategic interventions are necessary.

with actionable recommendations, the research concludes to include digital technology adoption, improved 3PL partnerships, government-supported infrastructure use (e.g., Gati Shakti), as well as training programs to develop logistics competency. Such insights contribute to the academic discourses around supply chain efficiency while providing industry leaders and policymakers with practical strategies toward improving resilience and decreasing costs while gaining competitive advantage within India's manufacturing sector.

INTRODUCTION

Manufacturing firms today are pressured to deliver high-quality products at lower costs, ever-shortening lead times, and higher customer responsiveness in a fast-moving and interdependent global marketplace. At the heart of these aspirations lie logistics and transportation, which, by means of these systems, ensure the smooth flow of raw materials and components to finished goods across the supply chain, namely suppliers, production facilities, warehouses, distributors, and finally to customers.

Logistics provides pathways to competitive advantage and operational efficiency, with efficient logistics measures always contributing to the reduction of lead times, enhancement of service levels, low cost, and customer satisfaction. On the contrary, logistics inefficiencies translate to production delays, inventory buildup, subsequent cost increase, and finally the loss of market share, which becomes most crucial in the manufacturing context with complex supply chains and critical time-to-market.

There are unique logistical hurdles faced by the fast-growing Indian manufacturing economy. Despite having made rapid strides in digital technologies and global supply chain management fashions, many Indian manufacturers, especially small and medium enterprises (SME), are still being majorly impeded by their outdated logistics systems. Common problems include inadequate transport infrastructure, high logistics cost (estimated at 14-18% of GDP as against the global averages of 8-10%), little multimodal connectivity, port congestion, and a heavy reliance on unorganized third-party logistics.

The COVID-19 pandemic illuminated the fragility of these logistics networks. Lockdowns, transport bans, shortages of labor, and the disruption to supplies during the pandemic created an urgent need to build logistics operations that are resilient, flexible, and digitally enabled. Manufacturers that depended heavily on just-in-time models or possessed poor visibility into their supply chains were unable to meet demand or maintain any kind of operations.

Additionally, the digital transformation in Indian logistics has picked up pace only very recently. Some technologies such as Enterprise Resource Planning (ERP) systems, Internet of Things (IoT) sensors, Global Positioning System (GPS) tracking, and Artificial Intelligence (AI)-based analytics have either been underutilized or simply not utilized at all in many companies. Major barriers include expensively high implementations, lack of technical knowledge and expertise, resistance to change, and limited government incentives for digitization at the SME level.

2- RESEARCH OBJECTIVE

The primary focus of this research is not just to study the logistics and transportation problems of manufacturing companies in India but also to provide some practical solutions to those problems. Logistics entails all the processes that aid in moving raw materials and finished products. Transportation forms a vital part of logistics, which, in turn, helps facilitate faster, cheaper, and efficient delivery of the products to their destinations.

This study is considering major sectors like automotive, FMCG, textiles, pharmaceuticals, and electronics, since these are some of the largest and most important components of India's manufacturing business.

The specific objectives of this research are:

1. To Identify Major Logistics and Transportation Challenges

Familiarize themselves with common problems the companies face, among which are bad roads, long and undetermined delays, high fuel costs, and absence of modern tracking systems.

Analyze the effects that these problems have on the seamless running of factories and delivery of products.

2. To Measure the Effects of These Challenges on Manufacturing Performance

Analyze how delays or failures in the logistics system lead to production problems, extra costs, and unsatisfactory customers. Assess how these challenges differ from industry to industry (e.g., food versus car).

3. To Assess Technology Adoption in Logistics

Establish how many companies employ tools such as ERP (Enterprise Resource Planning), IoT (Internet of Things), or GPS tracking. Examine arguments in favor of using these technologies and reasons why many companies—especially smaller ones—are still not making use of them.

4. To Propose Strategic and Technical Solutions

Offer intelligent and practical solutions to issues, such as better software use, investment in green logistics, or the use of increased third party logistics (3PLs).

Provide suggestions on the ways companies can save on costs, improve delivery times, and add up to their competitiveness in the market.

5. To Add Value to Policy and Industry Improvements

Provide suggestions for improving India's logistics infrastructure as applicable to the government agencies and industry bodies involved. Align the study according to the national programs that will strengthen economic growth through better logistics, such as 'Make in India' and 'Gati Shakti.'.

3. RESEARCH METHODOLOGY

Methodology means how the study was planned and conducted to answer the research questions. It includes aspects such as how the data was collected, what sources were used, who was surveyed or interviewed, and how the data was analyzed. Mixed methods were used in this research, which means it uses both:

Qualitative methods (to interpret opinions and experiences of the people); And Quantitative methods (to analyze numbers, patterns, and data).

3.1 Type of Research

Descriptive Research: For describing the current logistics problems in Indian manufacturing companies. Analytical Research: To understand how these problems arise and find solutions using technology and strategy.

3.2 Research Design

This research was undertaken in a circumscribed way in order to cover all important areas: First, secondary data was collected from existing reports, articles, and studies. Next, through surveys and interviews, primary data was collected from people working in the logistics field.

3.3 Data Collection Methods

A. Primary Data (First-hand Information)

Collected directly from professionals working in logistics and manufacturing roles using: Surveys: A questionnaire was shared through Google Forms with people from industries like:

- Automotive
- FMCG
- Textiles
- Electronics
- Pharmaceuticals

Questions included:

- Main challenges faced in logistics
- Use of technology like ERP, GPS, IoT
- Impact of logistics on delivery delays and costs
- Interviews: Semi-structured interviews were conducted with logistics managers and operations heads to gain in-depth insights about:
- Daily operational challenges
- Problems with 3PL (third-party logistics) vendors
- Expectations from the government and digital tools

B. Secondary Data (Already Published)

- Collected from:
- Government websites (e.g., Ministry of Commerce, NITI Aayog)
- Reports made by industry leaders (Deloitte, PwC, World Bank)
- Academic books and research papers on logistics and supply chain
- News articles, trade magazines, and blogs on logistics

3.4 Sampling Method and Size

Sampling Type: Purposive sampling was used; this indicates that only people with knowledge and experience in logistics were chosen.

Sample Size: Approximately 5-10 medium to large manufacturing companies were included, with each company providing 1-2 respondents.

Sectors included: Automotive, FMCG, Textiles, Pharmaceuticals, Electronics

3.5 Tools Used for Data Collection

- Google Forms: For the digitized collection of responses
- Zoom/MS Teams: For online execution of interviews
- MS Excel: For organization and analysis of quantitative data
- Thematic Analysis: For interview answer analysis in the identification of patterns and challenges

3.6 Data Analysis Methods

A. Quantitative Analysis

- Data from surveys were summarized under:
- Frequencies (how often something occurred)
- Percentages
- Bar charts and pie charts for visual representation

B. Qualitative Analysis

The responses from the interviews were thoroughly read and categorized into various themes which included:

- Technology barriers
- Poor infrastructure
- Supply chain disruptions
- Green logistics interest

3.7 Ethical Considerations

All participants were told the purpose of the research before participation.

Their identity was kept confidential.

The participation was voluntary, and the respondents could skip any questions or leave the survey at any time.T

4. DATA ANALYSIS AND INTERPRETATION

This chapter describes survey and interview results regarding the logistics and transportation challenges in the manufacturing industry. The data were collected from people working in logistics departments across industries: automotive, fast-moving consumer goods, textiles, pharmaceuticals, and electronics. Both quantitative and qualitative analyses were performed.

4.1 Overview of Indian Manufacturing Sector

It is a massive manufacturing sector in the Indian economy, contributing around 17% of the national GDP and employing over 60 million people. Some major industries are:

- Automotive
- Textiles and Apparel
- Pharmaceuticals
- Electronics
- FMCG (Fast Moving Consumer Goods)

The government has been looking to ride on Make in India, GatiShakti, and PLI Schemes, but growth is hindered due to logistics problems.

MAJOR LOGISTIC CHALLENGES -:

Challenge	% of Firms Facing It
High transport and fuel costs	80%
Poor roads and infrastructure	70%
Delivery delays and long lead times	60%
Lack of real-time tracking systems	50%
Over-reliance on unorganized 3PL vendors	60%
Inefficient warehouse operations	40%

Challenge	% of Firms Facing It

Graph 1: The breakdown of the transportation Cost The pie chart indicates what sections of transportation most use cash:

- Fuel cost- 30%. (the highest)
- Driver wages 20%
- Vehicle maintenance- 15%
- 3PL charges-15%
- Toll & Taxes, 10%
- Other expenses: 10%

This explains why logistics are more expensive than other countries in India.

Graph technology acceptance with indicator: Sector

This bar graph compares the varying ways industries use ERP and IoT:



Sector	ERP Adoption	IoT Adoption
Automotive	60%	55%
FMCG	40%	35%
Textiles	30%	25%
Pharmaceuticals	35%	30%
Electronics	45%	40%

4.5 COVID Developments Impact on Logistics

- All crises around logistics have been worsened by the pandemic.
- Closed borders & lockdowns: delayed goods and raw materials.

- Labour shortage: less workforce to do loading/unloading.
- Inventory stuck in transit: overstocking or loss of sales.
- Output fell abruptly at the beginning of 2020 but started recovering by early 2022.

4.6 Government Initiatives

- Some aiding initiatives comprise:
- PM Gati Shakti: More efficient road, rail and air connectivity.
- Dedicated Freight Corridors: Freight trains only, faster, and cheaper.
- Multimodal Logistics Parks: warehousing combined with transport hubs.

These are encouraging initiatives, but industries need better implementation support.

4.7 Key Interview Insights (Qualitative)

- From logistics managers across sectors:
- Most firms are still manual systems instead of automation.
- 3PL vendors do not share real-time data which makes visibility gaps.
- Though there is interest in green logistics, the adoption rate is low because of costs.
- More training in digital logistics tools for staff is what firms would like.

4.8 Summary of Interpretation

- Transport and fuel costs are the major cost contributors.
- Digital tools are available, but they are poorly adopted by the smaller companies.
- In every industry, there is a distinct logistics problem that would need customized solutions.
- Government policies are supportive, but execution must improve.



5. FINDINGS AND RECOMMENDATIONS

5.1 Key Findings of the Research

Important findings are as follows after intensive data analysis relay on surveys, interviews, and reports, showing the real challenges manufacturers encounter in the domain of logistics and transportation in various industries across India.

1. Very High Transportation and Logistics Charges

Most organizations (80%) approximated transport fuels, tolls, and driver wages together as too high for making logistics. Transportation alone takes up a large part of total operating costs—up to 18–22% in some sectors like steel and FMCG.

2. Bad Roads and Poor Connectivity

Poor roads, traffic congestion, and a limited rail and port access lead to delays and increase the time taken for goods to reach their destinations. Some industrial regions still miss even proper last-mile connectivity, especially rural areas.

3. Low Technology Adoption

Not more than half of the firms fully make use of ERP, GPS, or IoT in logistics. Small and medium enterprises (SMEs) suffer the most-high costs, lack of training, and fear of change.

4. Weak Third-Party Logistics (3PL) Partnerships

Most companies are forced to use unorganized or local source transporters, not allowing for real-time tracking or even proper service level guarantees. In case of delay or loss, accountability becomes a significant issue.

5. Industry-Specific Issues

Automotive: Heavily reliant on just-in-time delivery, delays in the process affect the full assembly line. FMCG: Demand necessary in cold chain and pyjama style deliveries in rural areas.

Textiles: Variation lead time is highly owing to improper efficiency on the ports and customs. Pharma: Temperature-sensitive products require precise logistics systems. Electronics: Storage issues while in long transport are high.

6. Effect of COVID-19

The pandemic lead to a complete supply chain break, caused long delays in first shipments, and resulted in empty stores, as well as a shortage of labor. It further made companies realize the need for creating flexible and digital logistics systems for future interruptions.

7. Awareness But Little Implementation

Most professionals can enumerate the benefits of smart logistics, but they have implemented them poorly, especially smaller firms.

5.2 Recommendations For Both Industry And Policy Maker

1. Implement Digital Technologies (ERP, IoT, AI)

Use ERP systems for checking real-time visibility of stock and shipments.

Implement IoT in the tracking of vehicles and environmental conditions (e.g., temperature for pharma/FMCG). Employ better routing, cost and planning via AI. Benefit: Improvement in reducing delays, fewer mistakes, and smarter decision-making.

2. Improvement in 3PL Relationships

Partner with professional logistics providers using digital dashboards and meeting deadlines. Sign contracts with clear KPIs (delivery time, damage control, updates). Benefit: Improves trust, accountability, and delivery performance.

3. Employment of Multimodal Transport

For long-distance transport, carry by road, rail, and port.

Make full use of Dedicated Freight Corridors (DFCs) and logistics parks developed by the government. Benefit: Faster and much economical shipping and hence less road traffic.

4. Cold Chain Development and Last-Mile Delivery for FMCG/Pharma

Bury the investment in temperature-controlled vehicles with rural delivery hubs.

Collaborate with local vendors using technology to improve rural coverage. Benefit: Less spoilage, improved freshness, and customer satisfaction.

5. Train Logistics Staff and Build Digital Skills

Hold workshops and online training sessions for logistics professionals on: ERP usage Fleet tracking Route optimization

Benefit: Reduces resistance to change and builds digital confidence in teams.

6. Encourage Green Logistics

Use electric vehicles, CNG trucks, and sustainable packaging. Plan shorter delivery routes and reuse materials wherever possible. Benefit: Reduced carbon footprint and a greener image for the company.

7. Policy Suggestions

The above need to be done by the government: Digital transformation subsidies for SMEs. Public-private partnerships with private sectors should be promoted in the matters of logistics parks or cold chain build up. Technology adoption in logistics should be simplified through compliance.

Benefit: Encourages more companies, especially smaller ones, to modernize.

6. Conclusion

This research paper sought to explore real-world issues in the management of logistics and transportation faced by Indian manufacturing companies. It is evident that logistics is not simply a background activity and is a core aspect, which has a direct bearing on cost, production, and delivery, and consequently, on customer satisfaction.

The study notes that a lack of adequate finances, heavy fees for transport services, poor infrastructure (condition of roads or ports), and limited use of modern technology such as ERP, GPS, or IoT, as well as weak third-party delivery partnerships are the main challenges faced by Small- and Medium-Sized Enterprises.

Every industry has its own separate problems to deal with:

- Automotive companies are reliant on fast and timely deliveries.
- FMCG and pharma companies require cold chains and rural delivery networks.
- Customs delays and damages occur in textile and electronics industries.

The strains created by COVID-19 only magnified these problems and reminded all and sundry of the importance of a flexible and strong logistics system.

Nonetheless, hope and direction have arisen from this study. If companies and the government collaborate and start using digital tools, build better partnerships, and invest in infrastructure, India can match its logistics to competitive advantage rather than weakness.

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