



CII Institute
of Logistics

LOGISTICS AUTOMATION:

A STRATEGIC IMPERATIVE TO INDIA'S GROWTH



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Logistics in India is transforming significantly through automation, driven by the rapid growth of e-commerce, fast moving consumer goods (FMCG), pharmaceuticals and automotive industries, among others. The increasing demand for efficiency, speed, and accuracy in logistics operations amid increased output is pushing companies to adopt more advanced levels of automation solutions. This shift is being actively supported by a collaborative ecosystem of solution providers, government agencies, industry associations, and consultants, all working to accelerate the automation journeys of businesses and enhance their competitiveness in a dynamic marketplace. However, the pace, reliability, and complexity of automation adoption vary significantly across industries, shaped by their distinct logistics priorities. As India's logistics landscape continues to evolve, automation will remain a critical driver of the nation's growth.

A Note by the Author

We are delighted to present this knowledge report on Logistics Automation: A Strategic Imperative to India's Growth, which provides an in-depth analysis of the transformative role automation plays in India's logistics sector.

As the country witnesses rapid growth in key industries such as e-commerce, FMCG, pharmaceuticals, automotive, etc., the demand for efficient, reliable, and scalable logistics solutions has intensified. This paper is structured to address the critical drivers behind logistics automation, the varying maturity levels across industries, and the challenges faced by businesses in adopting these technologies.

As the logistics landscape in India continues to evolve, I invite you to read this report to gain a deeper understanding of how automation can drive the nation's growth and enhance its global competitiveness.

Manish Saigal

Managing Director,
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Foreword

It is with great pleasure that we introduce the report Logistics Automation: A Strategic Imperative to India's Growth, a collaborative effort between the CII Institute of Logistics, a renowned center of excellence in logistics and supply chain management and Alvarez & Marsal, a global professional services firm providing solutions across industries. This report is a product of the dedicated efforts of the CII "Solution de Technology Automation and Robotics (STAR) forum" which is dedicated to highlight the critical role of technology in the supply chain.

The rapid transformation of India's logistics sector through automation is not just a trend; it is a strategic necessity for the country's continued economic growth. As industries strive to meet the increasing demands of a fast-paced marketplace, the adoption of advanced logistics solutions has become a crucial factor in maintaining efficiency and competitiveness.

This whitepaper provides a comprehensive analysis of the drivers, challenges, and opportunities in logistics automation.

We hope that the insights and recommendations presented here will serve as a valuable resource for businesses, policymakers, and all stakeholders involved in the logistics sector. By embracing the advancements in automation, India can strengthen its position in the global market and drive sustained economic growth.



Section 1.

Key Drivers of Logistics Automation in India

1. Rising customer aspirations

Modern Indian consumers demand high standards of speed, accuracy and flexibility in their shipment deliveries, at minimal additional cost. The shift in delivery expectation from multiple days to within hours and now even 10 minutes has disrupted businesses and logistics in the last 4-5 years.

Growth of e-commerce and quick commerce is outpacing modern and general trade. For instance, a leading FMCG company in India generates eight percent of overall sales from e-commerce, 20 percent of e-commerce sales from quick commerce and expects both shares to continue to grow significantly. Such companies are redefining logistics, and investing significantly in automation to meet rising customer aspirations. Additionally, e-commerce platforms are differentiating themselves through faster order processing with minimal errors at each stage of logistics, to continuously meet customer aspirations.

2. Government initiatives

To enhance the contribution of manufacturing to India's GDP and bolster the global competitiveness of its manufacturing exports, the Indian government has intensified its focus on improving logistics efficiency. This has yielded tangible results, as seen in India's advancement in the Logistics Performance Index (LPI), where our ranking improved from 44th in 2018¹ to 38th in 2023. This progress can be largely attributed to the government's concerted efforts in infrastructure modernization and digitalization. The government is actively leveraging and promoting the adoption of advanced technologies through a range of targeted initiatives to sustain this momentum.

- **Unified Logistics Interface Platform (ULIP):** ULIP, one of the initiatives under the National Logistics Policy (NLP), promotes single window, real time access to information and data from the logistics value chain. ULIP provides industry players secure access to sector-specific data and resources available with various ministries. At present, over 30 systems from seven ministries are integrated through more than 100 APIs for usage by the stakeholders. With ULIP, companies are building innovative solutions to optimize their logistics operations and related transactions. Recognizing the substantial advantages in visibility and efficiency, more than 600 industry stakeholders have registered and are actively involved in the initiative.
- **Make in India and Production-Linked Incentive (PLI) schemes :** These flagship initiatives from the Indian government aim to increase the share of manufacturing in the country's GDP from ~17 percent to ~25 percent in the next 2-3 years². This is expected to drive accelerated growth of medium scale manufacturing companies and their demand for logistics automation to achieve better efficiency levels. The Centre's Make in India 2.0 vision mapped out in 2021 identifies robotics as one of the 27 sub-sectors to further enhance India's integration in the global value chain³. This will help build domestic capabilities in the robotics field and drive the development of automation solutions.
- **Other key initiatives:** There are various other government initiatives such as the NICDC Logistics Data Services (NLDS) for tracking shipping containers via RFID, the development of a supportive regulatory framework for drone delivery, and various other measures that are driving increased automation in logistics and fostering innovation among startups.

1. Economic Survey 2023-24, Ministry of Finance

2. FDI in Make in India: Transforming the Manufacturing Landscape, InvestIndia.gov.in

3. Draft National Strategy on Robotics 2023, Ministry of Electronics and Information Technology

3. Growing merchandise exports

Global supply chain disruptions over recent years, which have led organizations worldwide to adopt the 'China+1' mindset, are providing an unprecedented opportunity for Indian exporters. The strong focus on global trade is evident from India's increased participation in global value chains (GVCs) - the share of GVC-related trade rose from 35.1 percent in 2019 to 40.3 percent in 2022⁴. Typically, logistics cost is a significant portion of the product cost, and if controlled, can help India gain a cost advantage. The continued efforts towards export growth necessitates highly efficient logistics operations across trade gateways and stakeholders such as ports, airports, customs and trade channels. For instance, the port community system is gaining significant traction in India for the ability to accelerate port and maritime throughput with controlled cost.

4. Increasing supply chain complexity

Supply chains in India are characterized by their complexity, driven by several factors:

- The country's vast geographic expanse
- A large population scattered across urban and rural areas
- Diverse market conditions
- Seasonal variations
- A multifaceted labour and regulatory environment

With the increasing demand from tier-3 cities and beyond, management of supply chain operations is getting more complex and increasingly difficult to manage centrally. It is imperative for companies to have strong pan-India omnichannel supply chains and be cost efficient across all channels to ensure competitiveness in the market. Automation, especially tools that provide visibility across channels, sites, and stock keeping units (SKUs), are picking up significant pace of adoption.



5. Technological innovation

India is witnessing a notable increase in the number of logistics automation service providers, accompanied by significant advancements in automation technologies. India ranked 11th in the list of countries by annual installation of robots in 2022, with 5,400 installations of industrial robots. This is a significant increase from ~3,200 installations in 2020⁵. At the same time, real-time decision making, predictive analysis and autonomous operations have shown tremendous potential and are gaining significant traction in India. This burgeoning ecosystem of innovation offers companies a diverse range of sophisticated automation solutions that offer greater efficiency and reliability. These more accessible, improved automation options are driving a transformative shift within the logistics sector, enabling companies to meet the growing demands of the market more effectively.

4. Economic Survey 2023-24, Ministry of Finance
5. World Robotics 2023 Report, International Federation of Robotics

Key logistics priorities across industries

Beyond the macro drivers, each industry has its own set of automation drivers, propelled by the unique traits of the industry and logistics priorities. For instance, while FMCG typically aims for faster delivery and higher visibility to solve for stockouts, e-commerce additionally focusses on reliability to ensure minimal returns. Priorities across product velocity, reliability and complexities related to number, shape, weight and size of SKUs lead industries to explore and adopt specific automation solutions that solve for these priorities.

Exhibit 1 – Logistics Priorities for Industries

Industries	Velocity	Reliability			Complexity		
	Product velocity	Accuracy	Visibility	Returns management	Number of SKUs	Different forms & shapes of SKUs	Weight, size & nature of SKUs
Apparel & Textile							
Automotive							
Cement							
E-commerce							
FMCG							
Paint & Chemicals							
Pharmaceutical							
Steel							

Source: A&M analysis

Priority for the Industry







Low High

Typically, consumer industries such as e-commerce and FMCG, which operate on high-volume and high-velocity requirements, are increasingly demanding quick and efficient handling and transport solutions, along with real-time visibility and predictive analytics to manage the customer experience and stock levels across sites. Pharmaceutical and chemical enterprises prioritise compliance with stringent regulations to ensure the safe handling and transportation of sensitive drugs and hazardous chemicals. Automotive logistics must deal with complexity related to multiple SKUs of different forms, shapes and weights while maintaining the speed to ensure timely and adequate availability of components and spares. Heavy industries such as steel and cement are increasingly scouting for efficient and robust material handling for bulk and break-bulk raw material, as well as finished goods. Automation drivers also differ based on spread and scale of operations for an organization - typically stronger in larger companies due to the greater scale of operations, higher capital reserves allocated to efficiency improvement, and larger potential benefits.



Section 2.

Logistics Automation Maturity Analysis

Different industries and organizations stand at different maturity levels of automation, and often use different solutions within the same maturity level. As stated earlier, the automation journey is driven by the critical priorities of the industry and organization such as velocity, reliability and complexity depending on their logistics operations.

Considering the varying priorities across industries and companies, logistics automation solutions span across multiple maturity levels.

Level 1: Basic Automation

This level involves mechanical power to support labor and basic tech intervention such as record keeping solutions. Mechanical solutions such as forklifts, cranes, and conveyors etc., and solutions such as basic inventory management software and barcode scanners are included at this level. The workforce requires basic upskilling to operate such machines and tools.

Level 2: Assisted Automation

Assisted automation involves solutions providing guidance, assistance, or insights for human action. While tasks are still performed by humans, they are assisted by automation to reduce errors and increase the speed of processing. This level requires upskilling of the workforce to be able to understand the tools, workflow and processes, and act based on the insights and guidance that the solutions provide.

Level 3: Autonomous Automation

This level involves automation working with very limited human intervention for specific actions or parts of a process. Level 3 can be further segmented into the following two parts:

Level 3a: Autonomous automation without intelligence – At this level, machines perform tasks independently, but don't have the capability to learn and change the course autonomously. Solutions such as Assisted Guidance Vehicles (AGVs) with static paths in a warehouse belong to this category.

Level 3b: Autonomous automation with intelligence – Here, machines learn continuously and refine their actions. Solutions such as Autonomous Mobile Robots (AMRs) which can optimize the path in a warehouse fall under this category.

While the solutions in level 3 are autonomous, the workforce needs to be trained to effectively collaborate with the solutions - monitor actions, interpret output and handle exceptions.

Level 4: Autonomous and Connected Automation

This level is the pinnacle of automation and involves two or more automation solutions working together autonomously.

Connected solutions exchange information and refine the course of action, with very limited human intervention.

However, the workforce needs to be significantly upskilled to monitor the actions and manage exceptions and failures. Faults in one solution could lead to a domino effect of failure across all connected solutions. An example of such automation might be an integrated system encompassing dimensioning devices, sortation solutions, AGVs connected directly or through a warehouse management system (WMS), wherein dimensioning devices provide inputs to sortation solutions, which in turn interact with AGVs to place goods in bins, once sorted.

Exhibit 2 - Levels of Logistics automation

Level 1	Level 2	Level 3		Level 4
		3a	3b	
• Bar code scanner • Basic order management, inventory management system • Conveyor systems • Material handling equipment - forklifts, cranes, pallet jacks	• Digital freight procurement • Logistics Control Tower • Pick by voice, put by voice • Pick to light, put to light • Port Community Systems • Telematics • Track and Trace • Transport Management Solutions • Virtual warehousing and digital twins • Warehouse management Systems • Yard/Dock solutions	• Automated guided vehicles • Automated storage and retrieval systems • Dimensioning devices • Loading and unloading robots • Palletizer / Depalletizer robots • Sortation solutions • Unmanned drone delivery	• Autonomous mobile robots • Autonomous trucks, vehicles • Intelligent drone delivery • Intelligent Sorting • Robotic itemized picking and putting • Unmanned aerial vehicles for inventory count	• Machine to machine automation - eg. Dimensioning devices providing inputs to sortation solutions, which inturn interact with AGVs to place goods in bins once sorted.

Source: A&M analysis

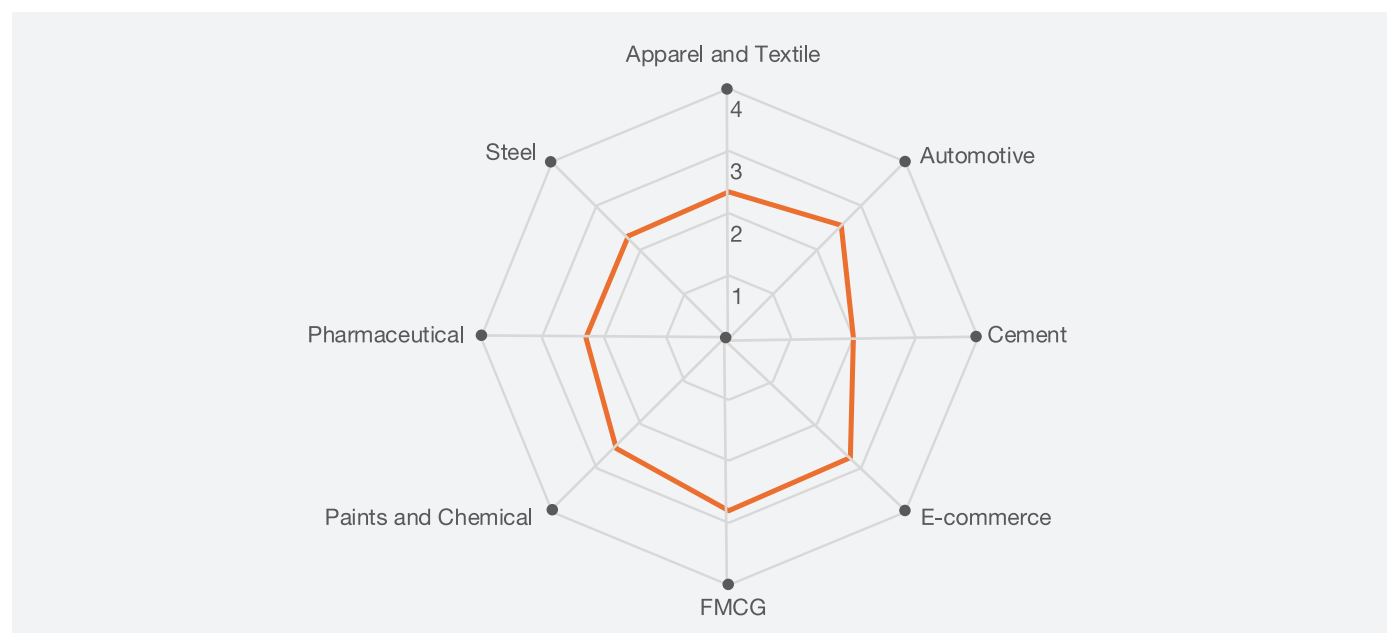
Note: This list of solutions is non-exhaustive

An assessment of select industries reflects the adoption of different solutions across maturity levels in alignment with their logistics priorities. For example, for the high-volume, high-velocity and varied SKU operations of e-commerce and FMCG industries, the most suitable solutions would be:

- Sophisticated inventory and warehouse management solutions
- Sorting systems
- Dimensioning systems
- Automated storage and retrieval systems (ASRS)
- AGVs requiring minimal human intervention

These industries have, therefore, reached Level 3 automation. However, heavy industries such as steel and cement typically don't require solutions such as dimensioning devices or sorters, since the SKU count is relatively low and the products are bulky. Hence, they only need robust and efficient material handling and management solutions, such as forklifts, and transportation management systems. The below exhibit represents the logistics automation level attained by different industries.

Exhibit 3 – Levels of automation adoption by top 10 players across select industries



Source: A&M data and analysis

Note: Analysis of Top 10 listed companies in India; for e-commerce, Top 10 includes non-listed companies

Case Study 1:



Industry: FMCG

Challenge: A leading FMCG company, operating across home care, personal care, beverages and packaged foods were aiming to move away from the distributor model to serve retailers directly. However, the distribution centres could handle only cases while retailers ordered eaches. The company has a wide range of SKUs with varying storage and handling requirements.

Solution: The company implemented automation solutions consisting of – 1) carton shuttles (an ASRS solution) to improve order fulfilment efficiency; 2) pick-to-light to improve pick rates; 3) dimensioning and weighing systems and 4) high-quality cameras and analytics for anomaly detection.

Impact:

The solution successfully introduced efficient each picking in the distribution centre (DC).

- 10x improvement in pick rate, allowed pickers to fulfil eight customer orders simultaneously
- Scalable capacity to fulfil 5,000 orders in a day for peak demand
- Accurate and timely delivery of orders, including overnight fulfilment, while minimizing manpower intervention

Case Study 2:



Industry: E-commerce

Challenge: One of the largest e-commerce marketplaces was facing a labour management challenge and wanted to reduce dependence on labour to store and retrieve parcels from its shelves and packaging of the same. The company's efficiency and cost for these processes were higher than competitors.

Solution: The company implemented a solution consisting of several individual advanced technologies – 1) ASRS to accurately store and retrieve products from shelves; 2) shipping robots to transport packages to and from the shipping dock; 3) AGVs for warehouse movement of goods; 4) robotic packaging arms on the floor to ensure seamless and autonomous packing of various sizes of parcels and 5) cross-belt sorters for efficient sorting of SKUs of multiple shapes and sizes

Impact:

- Turnaround time reduced by ~40 percent
- 4,500 packages sorted every hour - a significant improvement from the previous 500 parcels per hour done manually.
- Optimized manual labour
- Improved accuracy across processes

Case Study 3:



Industry: Cement

Challenge: A leading cement company runs a fleet of 60,000 trucks and over 45 rakes, transporting 5.7 million bags every day to more than 30,000 destinations. The company was facing challenges in visibility of delivery and a high transportation cost.

Solution:

- Built a freight e-bidding portal for all units to have competitive freight pricing and transparency for road volumes
- Developed a logistics control tower, which serves as a digital platform that integrates multiple sources of information to enable real-time decision-making. The control tower was extended to sales teams through a mobile application
- Developed an automated vehicle movement system to improve asset utilisation and reduce truck turnaround time by providing stage-wise visibility of trucks

Impact:

- E-bidding has resulted in optimized freight for all sectors
- Real-time visibility of dispatches and pending orders, and a view of stagewise turnaround time
- Comprehensive improvement in on-time-in-full (OTIF) for both trade and institutional customers
- Reduction in telephonic interactions between functional and cross-functional stakeholders, leading to faster decision making



Section 3.

Challenges and the Way Forward

While the top players in each industry are evidently transforming their logistics operations by adopting automation solutions and generating competitive benefits, there is a significant gap in adoption vis-a-vis the followers, especially the small and mid-sized businesses as exhibited below.

Exhibit 4 – Levels of automation adoption across select industries



Source: A&M data and analysis

The gap in adoption is a result of varied challenges, ranging from an unclear view on the return on investment to uncertainty related to success due to gaps in existing infrastructure, skills, and IT systems. To address these challenges and enable a more broad-based adoption of automation solutions, stakeholders including user industries, solution providers, governments, industry associations etc., need to work collectively and develop mitigation measures.

Challenge areas	Management's awareness	Technological uncertainties	Change Management	Downtime and maintenance cost	Compatibility with existing infrastructure
Challenge	Key decision-making stakeholders in companies lack complete awareness of the available solutions and associated value proposition	The rapid pace of technological advancement makes it difficult to predict which solutions will become industry standards. Also, with numerous automation solutions available, companies face the challenge of determining the most relevant solution	Automation adoption requires changes across processes, skills, roles etc. Change management is difficult and may often lead to unsuccessful automation implementation or limited adoption	Concerns exist regarding impact of adverse events on business operations, such as time and cost to fix failures, maintenance cost, ability to switch back to manual operations etc	Non-suitability of existing infrastructure such as size, layout, strength etc. of facilities (e.g. old warehouses, ports, cargo terminals etc.) pose constraints to introduce automation solutions and complete benefits
Mitigation measures	Focused workshops and collaborative events by industry associations, solution providers to exhibit automation solutions and communicate benefits while seeking feedback from user companies on unique use cases/ challenges requiring solutioning	• Solution providers and Industry consultants to educate on best suited solutions and the path to automation • POCs and small-scale pilots to build conviction	• Solution providers to bring change management teams to leverage best practices customized for the user • Explicitly allocate responsibilities amongst stakeholders through capability mapping	• Clearly defined SLAs to address downtime • Proactive and Predictive maintenance • Options for user companies to select maintenance packages (esp. for mechanized automation) that help overcome the reluctance	• Solution providers to develop customized and modular solutions for varying constraints
Stakeholder(s) responsible	• Solution providers • Industry associations • User companies	• Solution providers • Industry associations and consultants	• Solution providers and consultants • User companies	• Solution providers	• Solution providers

Challenge areas	Skill Gap	Upfront investment / Capex	Integration with existing IT systems	Return on investment (RoI)
Challenge	Time and cost associated with necessary upskilling of users for effective adoption of automation solutions is a significant investment. Inadequate investment in trainings may lead to delayed or failed adoption	Automation, especially mechanized automation often requires significant front-loaded investment, thus becoming a deterrent for small and medium scale companies	Automation solutions need to be integrated with a company's existing technology ecosystem. However, existing IT systems are often not adequately flexible or require significant customization effort for integration	Quantifying the benefits of automation is usually not straightforward. ROI calculation for logistics automation should account for improvement across parameters such as throughput, shorter working capital cycles, delivery accuracy, labor costs, customer satisfaction etc. Aligning cross-functional teams to measure these benefits accurately and attributing them directly to logistics automation investments can be challenging
Mitigation measures	• Government, industry associations and solution providers can focus on skill development programs • Develop training programs for various cohorts based on skill gap, roles, others, focusing on regular upskilling	• Opex business models such as as-a-service, throughput-based, outcome-based models need to evolve further and be promoted • Government incentives for automation adoption	• Build microservices-based, flexible solutions that can integrate with existing systems	Solution providers and user companies should develop holistic view for RoI assessment considering all factors impacted by automation, beyond the basic ROI constituents
Stakeholder(s) responsible	• Government • Solution providers • Industry associations and consultants • User companies	• Government • Solution providers	• Solution providers	• Solution providers • Industry associations and consultants • User Companies

While a few stakeholders are taking steps to address these challenges in their individual capacity, the complete ecosystem needs to come together to develop a roadmap and identify joint interventions to accelerate automation adoption across industries and companies in coming years.

As the challenges get subsided, industries such as FMCG, e-commerce, textile and apparel, will potentially see step-up adoption from mid-sized companies and advancements of automation levels from large-sized companies. Additionally, continued customer expectations regarding prompt availability, quality, packaging etc., amid growth in consumption scale are expected to substantially drive-up automation levels for large companies to gain market share. Industries such as cement and pharmaceuticals, which are undergoing consolidation, are expected to continue leveraging logistics automation to drive improvements in EBITDA (earnings before interest, tax, depreciation and amortisation) performance.

Conclusion

Logistics automation will continue to be a critical factor in the management of supply chains and operations. However, the path to automation is not uniform across industries, as each industry will require different levels of automation and specific solutions based on its unique logistics priorities. While industry leaders are already addressing their specific needs by deploying the most suitable solutions, the journey towards widespread adoption among mid-sized and smaller companies in India is still in its early stages. Significant challenges such as return on investment (ROI), upfront capital expenditure, manpower upskilling and constraints linked with existing infrastructure and IT systems must be addressed by the automation ecosystem to accelerate the adoption. As these obstacles are addressed, the shift towards higher automation adoption will improve broad-based competitiveness of different industries and ultimately strengthen India's participation in the global trade.



About the CII - Institute of Logistics

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering with industry, the government and civil society through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization with more than 9,000 members from the private and public sectors, including SMEs and MNCs, and an indirect membership of more than 300,000 enterprises from 286 national and regional sectoral industry bodies.

The CII Institute of Logistics (CII -IL), established by the Confederation of Indian Industry as a center of excellence, serves as a driving force in propelling the growth and competitiveness of the logistics and supply chain sector.

Through its array of services, CII -IL acts as a catalyst, elevating the performance of Indian supply chains to unprecedented levels by establishing a sustainable ecosystem through active stakeholder participation and a global network. This ripple effect not only empowers industries to garner deeper insights into emerging trends, but also enables them to tackle industry-specific challenges of national significance while adopting globally recognized best practices in the logistics and supply chain sectors.

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ABOUT ALVAREZ & MARSAL

Companies, investors and government entities around the world turn to Alvarez & Marsal (A&M) for leadership, action and results. Privately held since its founding in 1983, A&M is a leading global professional services firm that provides advisory, business performance improvement and turnaround management services. When conventional approaches are not enough to create transformation and drive change, clients seek our deep expertise and ability to deliver practical solutions to their unique problems.

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