CII Institute of Logistics

BUSINESS TRANSFORMATION SERVICES - INDIA

BUILDING WAREHOUSING COMPETITIVENESS: AUTOMATION AND BEYOND

ALVAREZ & MARSAL

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A Note by the Author

Dear Readers,

The accelerated growth in ecommerce, 3PL and consumer industries has boosted demand for larger and more technologically advanced warehouses.

This report emphasises the need for automation not just to meet operational efficiency but to adapt to client needs for digitally connected supply chains. While there is greater maturity in warehousing automation in developed nations, we cannot blindly adopt these models in our country. India's demographics necessitate us to follow our own unique model, the Human and Machine Model, which demonstrates the need to strike a balance between technology and human intervention to meet client needs without compromising on cost-effectiveness.

As the Indian warehousing sector continues to transform, it is my hope that this report serves as a catalyst for informed decision-making. It is with great enthusiasm, therefore, that I invite you to read **"Building Warehousing Competitiveness: Automation and Beyond."**

Manish Saigal
Managing Director,
Alvarez & Marsal India

Foreword

It gives me great pleasure to introduce the report titled 'Building Warehousing Competitiveness: Automation and Beyond,' 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 various industries. This report is a product of the dedicated efforts of the CII Warehouse National Network (WNN), which is committed to future-proofing the warehousing sector.

The significance of this publication cannot be emphasized enough. In an era where technology is the driving force behind most business operations, gaining a deep understanding of the evolution of warehousing in India, with a particular focus on automation and the strategic utilization of automation tools, is essential. The report thoroughly explores the evolution of warehousing in India and the pivotal role that technology plays in transforming the sector. It identifies varying levels of automation maturity within the Indian warehousing landscape and provides an insightful examination of how automation can be tailored to meet the specific needs of Indian clients. The nuanced insights drawn by the CII Warehouse National Network (WNN) in this report offer stakeholders the knowledge needed to make well-informed decisions.

The logistics industry, a cornerstone of economic growth, stands to gain tremendous value from the information presented in this report. I sincerely hope that this publication will become an invaluable addition to the knowledge repository dedicated to the logistics sector, thanks to the tireless efforts of the CII Warehouse National Network (WNN) and its members.

Anshuman Singh
Chairman - CII Warehouse National Network and Chairman & Managing Director
Stellar Value Chain Solutions Pvt Ltd

The Rise of Automation in a Digitally Evolving World

In an era characterized by relentless technological innovation and evolving consumer behaviour, warehousing has emerged as one of the primary pillars of the global supply chain ecosystem.

The growing demand for expedited delivery, pinpoint accuracy, and cost-effectiveness has pushed organizations to seek out novel solutions with technological ingenuity. On this backdrop, automation, with its capacity to boost operational efficiency, is gaining prominence. As the Indian economy continues to be a bright spot amid the global storm clouds of inflation and slowing growth, the logistics sector has come to occupy a commanding role.

The sector contributes a substantial 14 per cent to India's Gross Domestic Product (GDP) and is advancing at a Compound Annual Growth Rate (CAGR) of 9-10 per cent. The Grade A + B warehouse stock in our country is also projected to grow at a CAGR of ~10 per cent during the next 5 years.

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Driving Forces for Warehouses to Increase Efficiency and Adopt Automation

The move towards warehousing modernization is propelled by several factors, each intricately intertwined with the needs of a changing world and the search for operational excellence, which deserve a deeper examination.

Increasing Demand for Warehousing in India

Consumption: Our country's net national income for FY23 has doubled from FY15, permeating the socio-economic landscape and providing greater spending power to the people. Consumption has been further boosted by the meteoric rise of digitalization and the rapid growth of e-commerce. Moreover, the retail sector has seen an explosion of Direct-to-Consumer (D2C) brands, determined to deliver their products directly to the customer's doorstep.

Demand Driven by Production: Concurrently, there has been government focus on boosting manufacturing industry, with interventions such as the recent Production-Linked Incentive (PLI) schemes for 14 sectors with an outlay of INR 1,970 billion. Growth in this industry has also brought about the need for industrial warehousing, which can be confirmed by the surge in demand from industrial automotive part clusters such as Chakan, Oragadam, and Hosur, among others.

Rise in Operational Complexity in Warehousing

Impetus of e-commerce: Growth of e-commerce has made the consumer increasingly demanding with regard to delivery service. Habituated to deep discounting on e-commerce platforms, consumers are also less inclined to pay a premium for this swift delivery, raising cost pressures on warehousing operations.

Rise in Stock Keeping Units: As manufacturing becomes increasingly customized, there has been a proliferation in the quantity of Stock Keeping Units (SKUs). These come with their own unique handling needs, adding to the complexity of warehousing operations.

Spatial Constraints near Consumption Centres: Spatial constraints in the proximity of consumption centres, particularly Tier 1 cities, serve yet another catalyst for transformation. As urban agglomerations expand and grow denser, the warehousing sector continues to grapple with challenges around optimizing space utilization.

To preserve their competitive edge in an ever-evolving market, organizations are increasingly turning toward state-of-the-art, modern Grade A warehouses with high levels of automation and advanced technologies. This white paper attempts to explore the key trends that have come to define today's warehousing landscape and the pivotal role played by technology and automation therein.

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Emerging Themes in the Indian Warehousing Space

Expansion of Warehouse Sizes

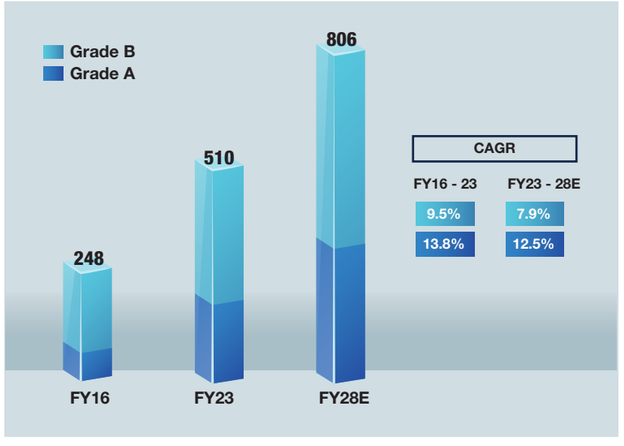
Indian warehouses have seen a remarkable increase in average size boosted by the implementation of the Goods and Services Tax (GST) in 2017, which eliminated the tax-based incentive for the establishment of regional warehouses. Key warehouse developers such as Horizon, NDR, ESR, Welspun One and Indospace have evolved from constructing Built-to-Suit (BTS) box warehouses of 50,000 square feet merely five years ago to constructing speculative box warehouses exceeding 150,000 square feet across major warehousing micro-markets today.

Increasing Logistics Outsourcing and the Rise of 3PL

The trend of increasing logistics outsourcing to 3PL providers has ushered in a new era in warehousing. This shift has facilitated the rise of multi-user warehousing, offering flexible space utilization and shorter leasing terms.

Increasing demand, especially of Grade A Warehouses

Grade A and B warehouse stock in India
(Mn Sq. ft.)



Grade A warehouses, distinguished by their modern, high-quality facilities, and state-of-the-art infrastructure, have seen a surge in their share ofoverall warehousing space. India's Grade A warehouses are seen growing at a CAGR of 12.5 per cent, culminating in an estimated 324 million square feet by 2028. Grade A warehousing absorption by e-commerce is projected to rise at a strong rate of 22 per cent, while retail is expected to follow suit with a 12 per cent growth rate between FY23-28E.

Expansion from Top Eight Cities to Top 20 Cities:

India's warehousing sector is no longer confined to metropolitan areas. Escalating land costs within Tier-1 cities, coupled with the enhancement of the road and integrated transport networks, have propelled this expansion.

Remarkably, over 30 per cent of Grade A warehousing has migrated beyond the top eight cities, and this segment is expected to grow at a pace comparable to its urban counterparts.

Sustainability and Compliance Initiatives

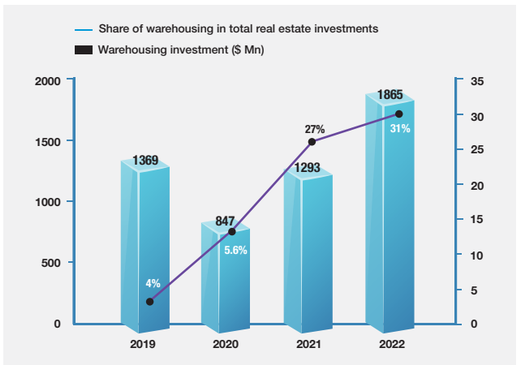
In an age where environmental consciousness is an imperative, sustainability and compliance have become paramount considerations in warehousing.

There are several energy optimization initiatives that are gaining momentum through the use of technology:

- Solar power panels
- Rainwater harvesting
- Wastewater treatment
- The adoption of Electric Vehicles (EVs) for distribution
- Recycling of packaging materials
- The use of ecological construction materials
- Ambient temperature management
- Air ventilation cycles

These green-warehousing initiatives are driven by dual forces: the government push and the customer pull. On one hand, government bodies at both the central and state levels offer benefits to IGBC (Indian Green Building Council) certified warehouses. These benefits include fast-track environmental clearances, Floor Area Ratio (FAR) allowances, tax incentives, and loan facilities for the establishment of renewable energy technologies. On the other hand, companies worldwide are endeavoring to achieve a net-zero carbon footprint and minimize their environmental impact across the entire supply chain.

Private Investments Fuelling the Growth of Modern Warehouses



Source: Federation of Indian Chambers of Commerce & Industry

With “infrastructure status” and 100 per cent FDI allowed for the sector in 2017, and high rental yield rates for warehousing assets, private investments have provided a great boost to the growth of modern warehouses in India. Institutional investments have poured into the sector, with warehousing receiving USD 1.9 billion in 2022. Key players in the Private Equity (PE) space, including Blackstone, Indospace, InvestCorp Group, Welspun, Caisse de Dépôt et Placement du Québec (CDPQ), and Bain Capital, have recently seized the opportunity presented by this high growth.

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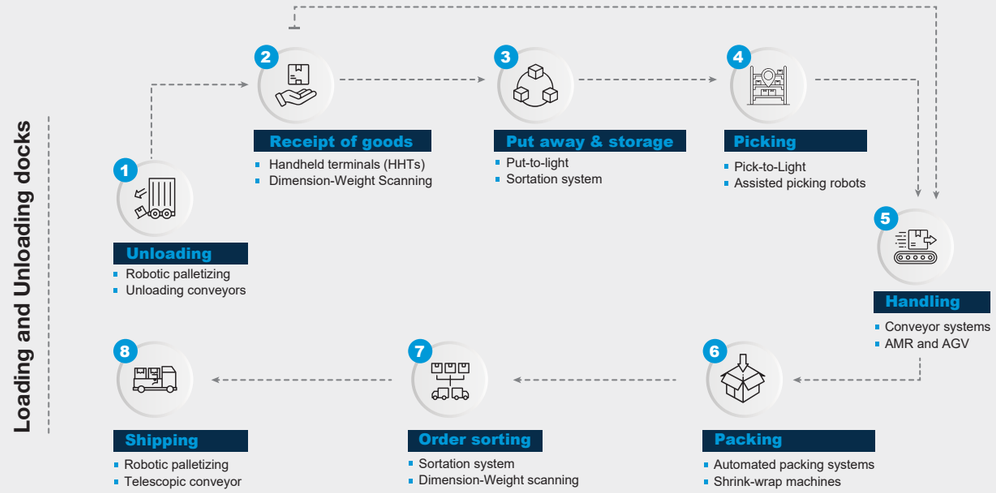
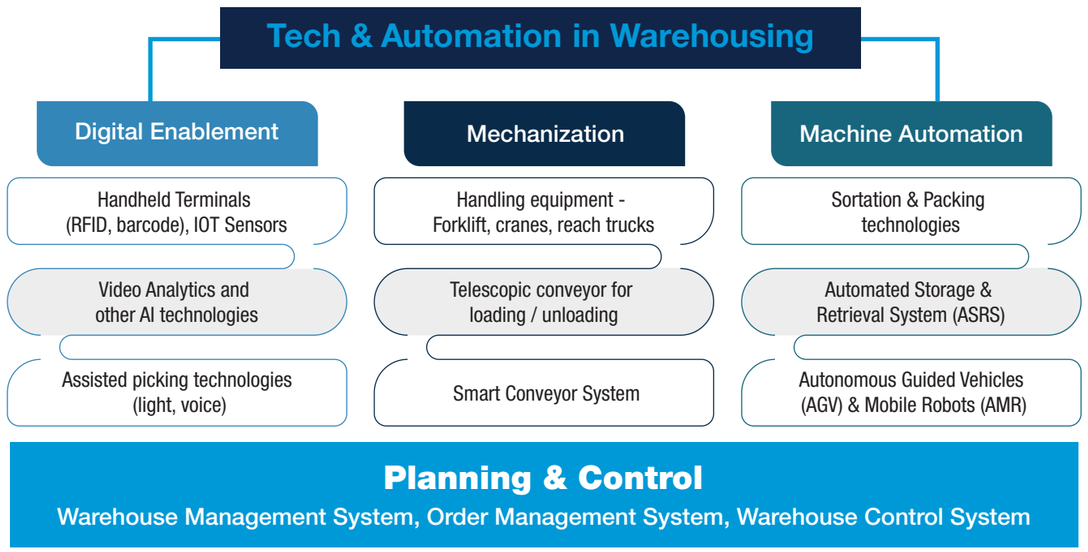
2 Tech and Automation in Modern Warehousing



Automation Solutions Across Warehousing Processes

Technology and automation have irrevocably transformed modern warehousing operations. These automation solutions traverse the entire chain of warehousing processes, from the receipt of goods to shipping.

Depending upon the use case, these technologies can be categorized into the following framework:



Digital Enablement: This category includes digital tools that serve to increase transparency and provide insight by capturing and analysing data within modern warehousing operations. Tools such as handheld terminals (HHTs) for barcode and Radio-Frequency Identification (RFID) technologies, and IoT sensors fall under this category. These tools allow for the meticulous tracking of inventory levels, order management, and the optimization of goods inflow and outflow. Furthermore, intelligent automation and latest digital solutions comprising Video Analytics, AR/ VR technology would also drive efficiency and enable humans to focus on more value-add tasks.

Mechanization: This category encompasses enablement technologies designed to augment human capabilities in executing labour-intensive activities within the warehouse. Notable examples include cranes, forklifts, and conveyor systems. The advent of smart conveyor systems and vertical conveying technologies has created new ways of optimizing storage space and facilitating seamless material flow. Additionally, semi-automated options, such as expandable flexible conveyors and telescopic conveyors, have revolutionized cargo loading and unloading processes, enhancing overall efficiency.

Machine Automation: This category represents high technological innovation within warehousing, encompassing advanced solutions that fully automate processes and warehouse activities. These include sortation systems, automated packaging systems, robotic palletizing and depalletizing, Automated Storage and Retrieval Systems (AS/RS), and Automated Guided Vehicles (AGVs). Each of these technologies contributes to a complete transformation to modern automated warehouses.

Planning and Control: This category includes platforms and software solutions tools such as Warehouse Management System (WMS), Order Management system (OMS) and Warehouse Control System (WCS). The integration of these systems with Enterprise Resource Planning (ERP) and Transportation Management Systems (TMS) platforms increases efficiency and provides end-to-end visibility into warehouse operations.

Benefits of Warehouse Automation:

The imperative for warehouse automation stems from expansion in e-commerce, characterized by a rise in consumption and consumer expectations for rapid deliveries and soaring land prices. Modern warehouses equipped with advanced technologies are essential to meet the growing demand for efficiency. Companies are increasingly inclined to leverage automation solutions when the payback period for the technology does not exceed three to three-and-a-half years.

However, these are not one-size-fits-all solutions. Each tool comes with its specific benefits and use cases. While some might help optimize space utilization, others may reduce human dependency. Moreover, these solutions are at various stages of maturity in the warehousing ecosystem in India. The table below rates each solution based on its use case and level of maturity, giving a glimpse into what solution a company might choose to satisfy a specific need.

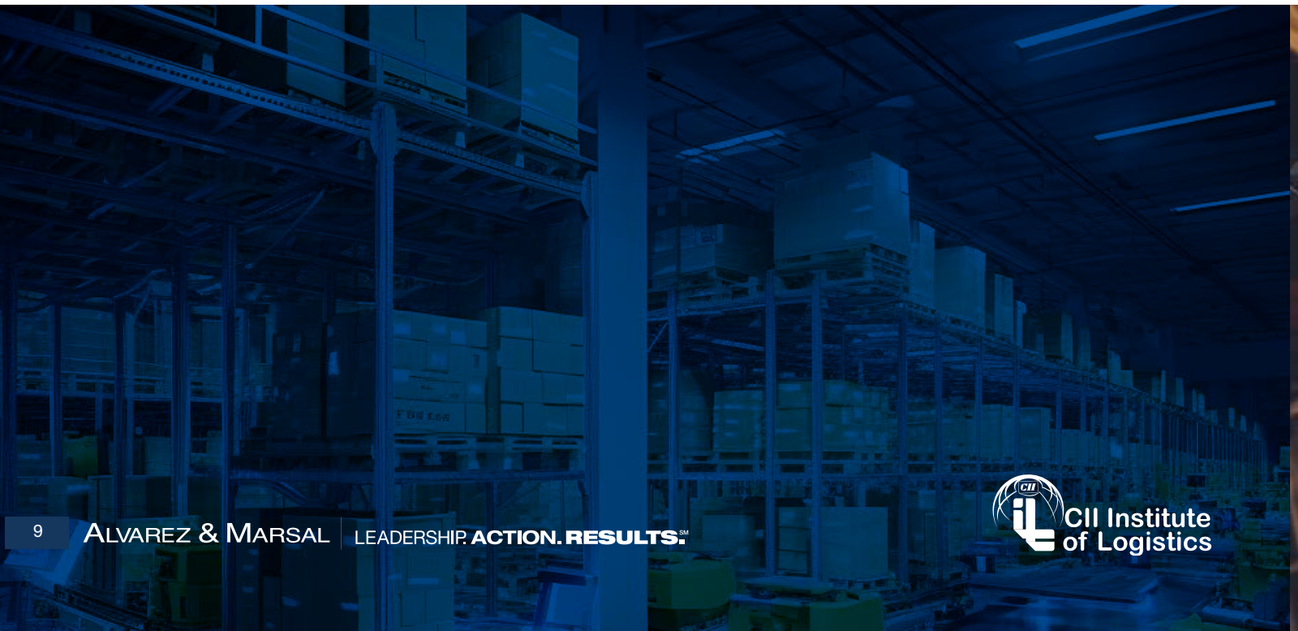
Solution Category	Solution	Solution maturity in India context	Impact of Automation solution		
			Increased efficiency and space utilization	Increase accuracy and reliability	Reduced human dependency
Digital Enablement	Handheld Terminals (RFID, barcode)	High	◑	●	◔
	Video Analytics and other AI technologies	Low	◑	◕	◑
	Assisted picking technologies (light, voice)	High	◑	◕	◑
Mechanization	Handling equipment	High	●	○	◕
	Telescopic conveyors for loading / unloading	Medium	◑	○	◕
	Smart conveyor systems	Low	●	◔	◕
Machine Automation	Sortation system	Medium	●	◕	◕
	Automated packing systems	Low	◑	◑	◕
	Automated Storage & Retrieval System (ASRS)	Low	●	◑	◕
	Autonomous Guided Vehicles (AGV) & Mobile Robots (AMR)	Low	◑	◑	◕

Legend: Estimated benefit

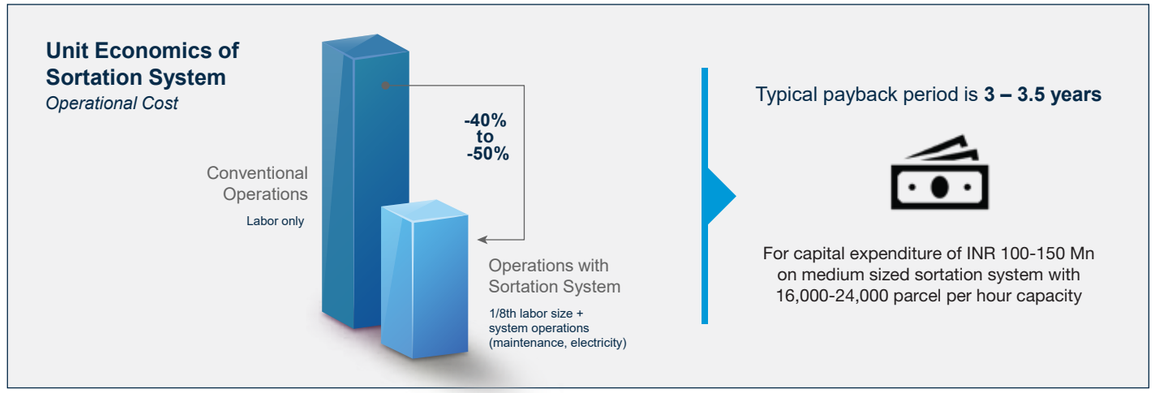
○ ◔ ◑ ◕ ●

Low — High

The implementation of automation technologies in warehousing also necessitates an assessment of the associated costs and benefits to determine their economic viability. Below, we see a cost-benefit analysis for two key automation technologies, the sortation system and the pick-to-light system, looking at their respective payback periods.

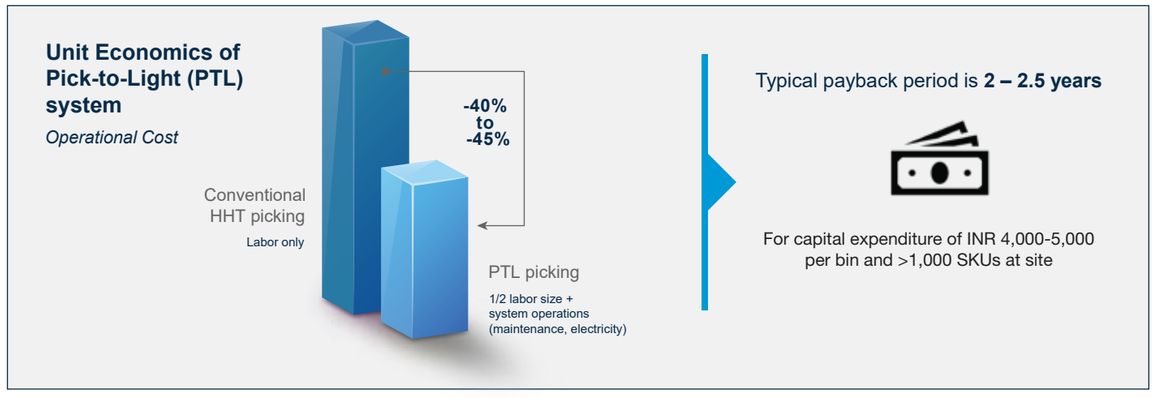


Sortation System:



A sortation system efficiently categorizes and routes products for shipment, reducing manual labor and order processing times. Sorters are necessary for large throughput volume. In the context of e-commerce or courier dispatch, the manual sorting capacity typically stands at 70 to 80 parcels. In stark contrast, a machine-driven sortation system has a capacity ranging from 3,000 to 80,000 parcels per hour. If we consider medium-sized sorters with a capacity of 16,000 to 24,000 parcels per hour operated at high utilization levels for double shifts, it is expected that the investment will be recouped within a relatively short timeframe of 3-3.5 years.

Pick-to-Light System:



The pick-to-light system increases picking productivity and order accuracy by identifying the right storage location. In industries characterized by a high volume of order picking, such as Fast-Moving Consumer Goods (FMCG) and e-commerce, the efficiency gains derived from automation technologies like the pick-to-light system can be substantial. Typically, a human picker can manage approximately 60 lines per hour. However, with the assistance of pick-to-light technology, productivity can witness more than a two-fold increase. If the daily volume surpasses 2,500 orders or 50,000 eaches, the capital expenditure (CapEx) incurred for the implementation of the pick-to-light system is likely to be recovered in an impressively short span of approximately 2-2.5 years.

The cost-benefit analysis of automation technologies in warehousing demonstrates their potential to yield substantial returns on investment. While the analysis factors the efficiency improvement using warehouse automation, additional benefits such as reduced human errors and reduced pilferage would also improve warehouse operations. Both the sortation system and the pick-to-light technology exhibit favourable payback periods. However, organizations must ensure that the chosen technologies align with their strategic goals and operational requirements.

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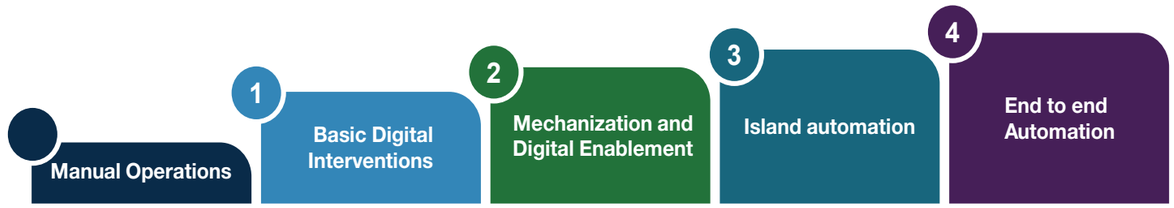
Warehousing Automation Maturity

The maturity of automation in warehouses is an indicator of the extent to which automated technologies and processes have been incorporated into warehouse operations. The trajectory of warehouse automation has been significantly influenced by technological advancements, particularly the advent of artificial intelligence (AI), and robotics. However, the automation levels within warehouses can vary widely, contingent on several factors including organizational priorities, warehouse size, product characteristics, volume throughput and complexity of the supply chain.

Products that are small, lightweight, and have high turnover rates, such as fashion and FMCG, are more suited to automation due to the efficiency gains associated with automated systems. Conversely, products that are large, bulky, and have lower turnover rates, such as paints and petrochemicals, may be less suited for automation due to the complexities involved in handling such items.

Furthermore, automation is more common in industries where speed and efficiency efforts are rewarded well, such as e-commerce and parcel/courier handling.

Below are the various levels of automation maturity seen in warehouses:



% grade A-B India warehousing space in 2023

30-35%	45-50%	10-15%	<5%	0%

Level -0 Manual Operations:

At this basic level, warehouses rely heavily on manual labour for core operations such as picking, packing, and the movement of goods. Digital interventions are limited or non-existent, and the warehouse operates primarily through traditional, labour-intensive methods.

Level -1 Basic Digital Interventions:

This level introduces basic forms of digital interventions, which may encompass data tracking, inventory management software, and the utilization of barcode scanning systems. While these interventions introduce a degree of digitalization, they are often rudimentary in nature.

Level -2 Mechanization and Digital Enablement:

This level marks a significant advancement, combining manual and automated processes. Warehouses at this stage might employ conveyor systems to transport goods, forklifts for picking, and put-to-light systems to assist with order fulfilment.

Level -3 **Island Automation:**

Warehouses at this level leverage more advanced technologies such as automated sorting systems, Automated Guided Vehicles (AGVs), and robotics. These technologies are typically employed to streamline specific processes within the warehouse, optimizing efficiency and reducing reliance on manual labour.

Level -4 **End-to-End Automation:**

At the pinnacle of automation maturity, Level 4 warehouses operate with minimal human intervention. This level includes the deployment of autonomous robots for tasks such as picking and packing, Automated Storage and Retrieval Systems (AS/RS) that manage inventory storage and retrieval, and advanced AI-driven systems that optimize every facet of warehouse operations.

In India, most warehouses fall within Levels 0 to 2, with Level 2 being predominantly occupied by Third-Party Logistics (3PL) providers and e-commerce companies. Warehouses at Level 3 are relatively rare, building the case for further adoption of automation in the Indian context.

Challenges in the Adoption of Automation in Warehousing

While automation brings substantial advantages, its adoption is not without challenges, particularly in the Indian context. The decision to automate warehouses requires a meticulous assessment of multiple factors, each contributing to the overall viability and success of the endeavour.

Economic Factors - Labor vs. Automation: With China's monthly average wages being approximately five times that of India's, and the United States' average wages being approximately eighteen times that of India's, lower labour costs. The long payback periods for automation solutions often clash with the shorter lease terms typically offered by 3PL providers, posing financial challenges for potential adopters.

Automation Ecosystem: Fully automated solutions are still in the innovation phase and are primarily located outside India. Developing a robust ecosystem for automation requires time and investment in local service providers, cost-efficient technology tools, competitive differentiation, and ongoing maintenance and technical support.

Workforce Upskilling and Change Management: The transition from manual to automated processes requires upskilling the existing workforce. India faces a shortage of skilled resources capable of managing automated systems, making this a key challenge to consider.

Scale of Warehousing: Automation's return on investment (ROI) is typically higher for larger warehouses with high package volumes. India's warehouses are considerably smaller than India's global counterparts. While India's average warehouse size is ~160,000 square feet, logistics parks in China such as ESR's E-commerce logistics park have warehouse Gross Floor Area of more than 1 Mn square feet. The warehouse size in India limits the financial feasibility of certain automation technologies.

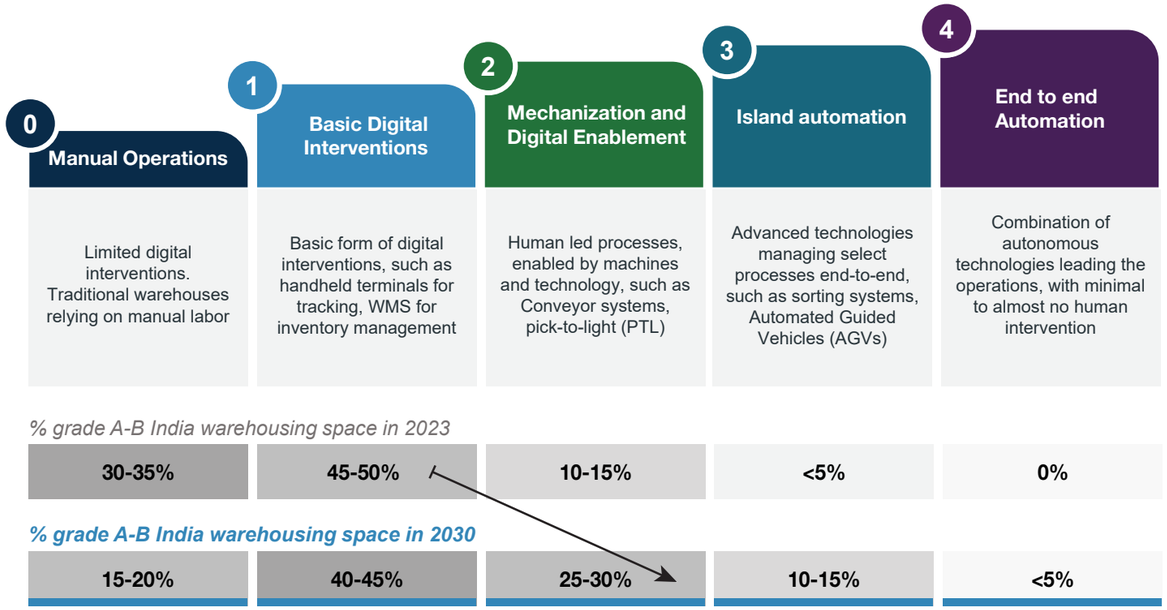
Design Compatibility: Integrating automation into existing infrastructure and IT systems can be challenging, as existing warehouses may not be designed to accommodate plug-and-play automation solutions. Additionally, warehouses built with a generic design to attract a broad range of potential occupants may require structural modifications or design-level changes to accommodate automation. Compatibility assessments, proper planning, and collaboration with technology providers are essential to navigate these challenges.

3 Striking a Balance between Human and Machine

Balancing the benefits and challenges of automation with the integration of human labour and intelligent machines is emerging as the most suitable approach.

Automation is not a one-size-fits-all solution, and it demands a thoughtful evaluation of when and to what extent automation should be integrated into warehouse operations. This is crucial in the Indian context, where specific nuances come into play, notably, the presence of an economical labour force. Moreover, India cannot merely replicate warehouse technology and automation solutions and architecture from more advanced countries as the local infrastructure and operational intricacies differ significantly.

By the end of this decade, warehouse operations in the country are expected to progress through the maturity framework, with at least 40 per cent of grade A & B warehouses adopting mechanization, digital adoption and advanced automation.



To capitalise on the human and machine model, it is important for organizations and solution providers to focus on the following themes.

Focus on Augmenting, Not Replacing Humans: Prototypes of end-to-end automation in warehousing are compelling. However, in the Indian context, humans and machines are likely to coexist for the foreseeable future. This coexistence will be characterized by a division of labour, with workers undertaking value-additive activities and tasks requiring nuanced judgment, while machines are assigned repetitive, high-throughput responsibilities.

Empower the Workforce: The advent of automation necessitates a fundamental shift in the roles of the existing workforce. Offering training and upskilling opportunities becomes important to ensure a harmonious transition. As technology evolves, employees must possess the competencies required to operate, maintain, and troubleshoot automated systems effectively. Thus, reskilling initiatives are integral to empowering the workforce and equipping them for the demands of an increasingly automated warehousing landscape.

Invest in Newer Businesses Models: High upfront capital expenditure is one of the biggest barriers to automation. The availability of more flexible and innovative business models such as Robotics-as-a-service or pay-per-use solutions can help in rapidly driving automation adoption. These solutions would be more relevant for moving robots vs. fixed installations.

Conclusion

As India continues to chart its course in global logistics, the warehousing sector remains a linchpin of the supply chain. While adoption remains a major decision for Indian firms, the E-commerce, 3PL, retail, FMCG and automotive segments are the front-runners in adoption of automation. Increasingly, businesses are looking to assess the value enhancement due to automation and are willing to take initial steps for moving up the automation maturity curve. The go-to solutions for these businesses include WMS, OMS, assisted picking (PTL) and handheld terminals. Modernization and automation are not just options but necessities in this ever-evolving landscape. The development of high-quality infrastructure, technology adoption, and the coexistence of human expertise and automation will be pivotal in achieving supply chain efficiencies, fostering economic growth, and ensuring India's warehousing sector remains competitive.

About Confederation of Indian Industry - Institute of Logistics

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering 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 over 9,000 members from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from 294 national and regional sectoral industry bodies.

The CII Institute of Logistics (CII-IL), established by the Confederation of Indian Industry as a 'Centre 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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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.

With over 8000 people across six continents, we deliver tangible results for corporates, boards, private equity firms, law firms and government agencies facing complex challenges. Our senior leaders, and their teams, leverage A&M's restructuring heritage to help companies act decisively, catapult growth and accelerate results. We are experienced operators, world-class consultants, former regulators and industry authorities with a shared commitment to telling clients what's really needed for turning change into a strategic business asset, managing risk and unlocking value at every stage of growth.

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