

CONTENTS

- 1 Introduction to Industry 4.0
 - 1.1 Industry 4.0 Transforming Supply Chain 4.0
 - 1.2 Supply Chain 4.0: Impact on Indian Logistics Sector

- 2 Regulatory Reforms Transforming Indian Logistics Sector
 - 2.1 GST: A more efficient taxation system
 - 2.2 Introduction of e-way bill
 - 2.3 Grant of infrastructure status
 - 2.4 Establishment of Logistics Division under Department of Commerce
 - 2.5 Investments and large scale plans

- 3 Digital Transformation of Indian Logistics sector
 - 3.1 Internet of Things (IoT)
 - 3.2 Automation and Robotics
 - 3.3 Artificial Intelligence
 - 3.4 Blockchain Technology
 - 3.5 Cloud Computing
 - 3.6 Big Data Analytics

- 4 Warehouse Automation: Catalyst for the growth of Indian Logistics Sector
 - 4.1 Warehouse Automation will reduce inventory carrying cost
 - 4.2 Warehouse modernization and automation
 - 4.3 Warehouse Automation: A must-have for eCommerce Fulfilment
 - 4.4 Creation of Automated Warehouses to generate demand for skilled labour
 - 4.5 A driver for robotics growth in India

- 5 Key Takeaways

1 Introduction to Industry 4.0

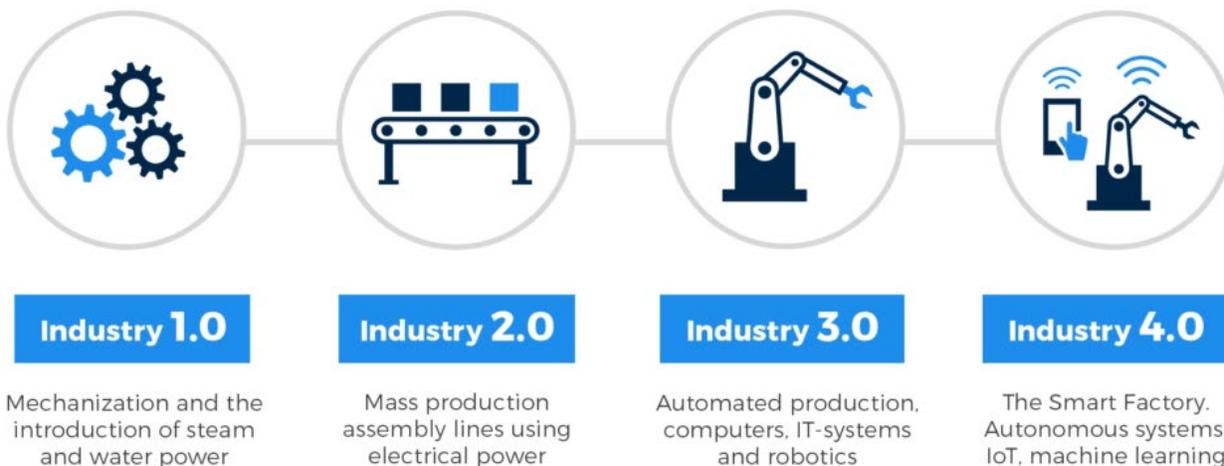
Industry 4.0 is defined as a set of highly intelligent connected systems that creates a fully digital value chain. The overarching concept of Industry 4.0 is based on creation and integration of cyber physical production systems that integrate different elements of IT, data, communication technologies, and hardware components. These systems are implemented to transform the traditional plants into smart factories, as well as traditional value chains into digital value chains. The objective behind implementation of such systems is to reduce dependencies and create a system in

Industry 4.0 is characterised by the rise of digital technologies and automation systems

which there is higher machine to machine communication and information is processed and distributed in real time resulting in profound changes to the entire industrial ecosystem.

Industry 4.0 is all about creation and optimisation of smart, flexible supply chains, factories and distribution models where machines capture and convey more data via machine-to-machine communications and to human operators. All this aims at enabling businesses to make quicker, smarter decisions, all while minimising costs.

The Four Industrial Revolutions



Sources: LogisticsIQ

1.1 Industry 4.0 Transforming Supply Chain 4.0

Industry 4.0 is fast transforming business models and operations. Digitalization, aided by disruptive new technologies such as IoT, AI, big data & analytics, machine learning, automation and robotics, cloud computing, blockchain, 3D printing, etc. and the explosive growth of smart devices, is leaving no segment of the business untouched. Supply chain management has become even more complex than before and stands to benefit tremendously from going digital. According to a study by McKinsey, an interconnected, digital supply chain can lower

operational costs by more than 30 percent, reduce lost sales opportunities by more than 60 percent, and reduce inventory requirements by more than 70 percent¹, all while making companies faster, more agile, granular, accurate, and efficient.

Transformation to a digitized, automated and fully interconnected supply chain requires significant efforts and long-term investments, but the RoI is justified as the pay-offs are huge. Bringing supply chains online can help

¹ Supply Chain 4.0 – the next-generation digital supply chain (<https://www.mckinsey.com/business-functions/operations/our-insights/supply-chain-40--the-next-generation-digital-supply-chain>, n.d.)

enterprises reach the next level of operational effectiveness and realize significant cost reductions.

Key Benefits of Supply Chain 4.0

Greater Transparency and Order Accuracy — Global supply chains involve thousands of suppliers operating within the supply chain ecosystem of a company. Ensuring end-to-end transparency and real-time asset tracking is crucial as any gaps in supply chain risk management can lead to supply chain disruptions, lost sales, and unnecessary costs.

Digitalisation of supply chain enables companies to track the entire supply chain in real time, from finding out the exact location of goods (on order, in transit, or in a warehouse). Advanced solutions can track inventory by collecting updates from supply chain partners with IoT data. This improves order accuracy and ETAs, minimizing out-of-stock situations, enhancing lot and batch control, optimizing inventory, and lowering associated costs.

Data-Backed Decision Making Leading to Cost Savings — Advanced machine learning algorithms help to predict demand for a particular item more accurately by analyzing data from sensors, social network trends, weather, etc. They also provide probability distributions of the expected demand volume as opposed to providing a single forecast number. This helps enterprises to calculate both the upside potential as well as downside risks involved in the supply chain and plan accordingly. Use of such predictive analytics methods can reduce forecasting errors by upto 50 percent. Predicting demand more accurately helps companies optimize their inventory, resulting in cost reductions.

Increased Interconnectedness and Collaboration — A fully integrated, digital supply chain software enables information to flow seamlessly between suppliers, manufactures, and customers, taking collaboration to the next level. Being a shared platform, it breaks silos and transforms planning into a continuous process. It enables greater trust and support, and joint planning solutions, especially in cases of non-competitive relationships. Stakeholders can choose to carry out supply chain-related activities together to not only save costs, but to share best practices and learn from each other.

An interconnected platform also lowers lead times through better communication, as suppliers can provide warnings early, increasing a company's responsiveness to risk. Another vital feature of such closed-loop planning is that pricing decisions are integrated with demand and supply planning; prices can be changed as per the expected demand, stock levels, and replenishment capacity. This boosts revenues and optimizes inventory.

Improved Warehouse Management — Digitalization can significantly improve warehouse management capabilities

— especially with regard to supply chain inventory and transportation logistics. For example, sensors can track goods in real time, and accurately predict how long it will take for a consignment to arrive. Such real-time tracking ensures on-time pickup and delivery. RFID technology can predict the exact location of a product, even its exact position inside a truck. Such preciseness helps managers provide location-based instructions to workers, saving time. Labor hours consumed per order are also reduced. Thanks to tracking devices, companies can avoid last-minute shocks such as inadequate quantity or non-compliance. Machine-to-machine communication also optimizes the number of carriers per shipment, reducing transportation costs. Inventory storage per square foot is also optimized through accurate demand prediction. This way, plant managers can easily control the flow of inventory globally.

"Intelligent" Supply Chain — "Thinking" supply chains can "learn" to recognize risks and change their supply chain parameters to mitigate such risks. They continuously evolve and learn to handle many exceptions without the need for any human involvement, except in case of any unforeseen risks, when human intervention is required to determine the next course of action.

Greater Agility — Advanced supply chain solutions integrate data from suppliers, service providers, etc. in a "supply chain cloud", ensuring that all stakeholders take decisions based on the same facts. Such end-to-end, real-time visibility will enable companies to respond more swiftly to disruptions in real time and minimize risk. Also, the emergence of "Supply Chain as a Service" will increase agility significantly.

Clearly, companies have a lot to gain from improving their supply chain management in Industry 4.0, and those that are reluctant to do so run the risk of becoming uncompetitive.

Rise of Robotics — E-commerce fulfillment centers driven by a rapid growth of online shopping are ripe for the use of robotics. We will see the price of robots continue to fall and provide more value by having a greater range of capabilities than those used in manufacturing today. We recently teamed with a leading research university to develop next-generation artificial intelligence and robotics technologies for the distribution center. Robotics can be an effective solution to make large, integrated distribution centers more efficient.

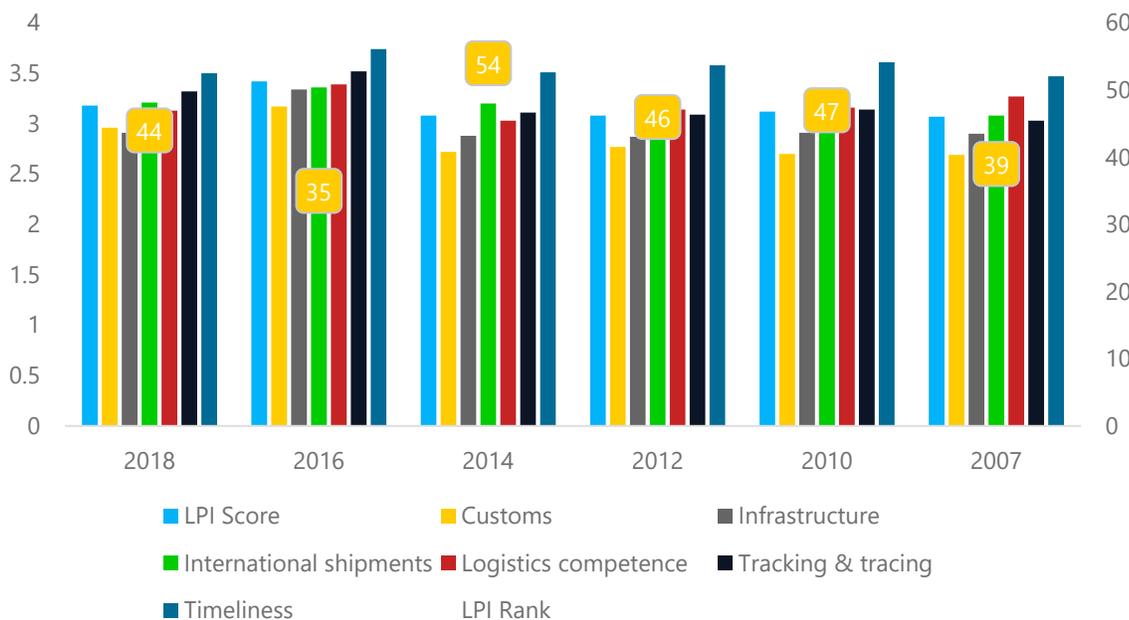
These building blocks are improving efficiency throughout the supply chain. The role of a solutions provider is to consider how these industries operate and their supply chain works, and provide them integrated systems to ultimately increase the bottom line.

1.2 Supply Chain 4.0: Impact on Indian Logistics Sector

In her Budget 2019 speech, Finance Minister Nirmala Sitharaman highlighted the importance of robust physical connectivity² in achieving the government’s vision of a USD 5 trillion economy by 2024-25. There is increasing focus on improving physical infrastructure across various modes of transport, such as the Pradhan Mantri Gram Sadak Yojana, industrial and freight corridors, Bharatmala and Sagarmala projects, Jal Marg Vikas and UDAN Schemes that can enable and improve the Indian Logistics sector. The Indian logistics sector, already a USD 220 billion market³, is set to grow at a double-digit CAGR in the next five years and has the potential to disrupt and transform the Indian economy and can reach size of USD 450 billion by 2025⁴.

With globalization, logistics is expected to play an increasing role in driving the Indian economy. In 2018, India was ranked 44th in The World Bank LPI Index that ranks countries based on their logistics performance — moving up from 54th in 2014, but down from its best ranking of 35 in 2016. While this is reflective of improvement in the sector, multiple challenges of infrastructural deficiency, lack of integration amongst stakeholders, lack of skilled manpower and slow adoption of technology continue to weigh it down. Moreover, the pace of improvement in other countries (both developed and developing) is much faster than India, however, with recent government initiatives, India has the potential to catch up and improve its ranking in the next five years.

India’s rank in Logistics Performance Index improved significantly over 2014 to 2016



Sources: LogisticsIQ

This is indeed an exciting time for the Indian Logistics sector and many Indian logistics companies are starting to create logistics ecosystems to offer integrated services. There is increased funding (both public and private) that is flowing to different areas (transportation, warehousing and technology) and transport modes beyond road are receiving

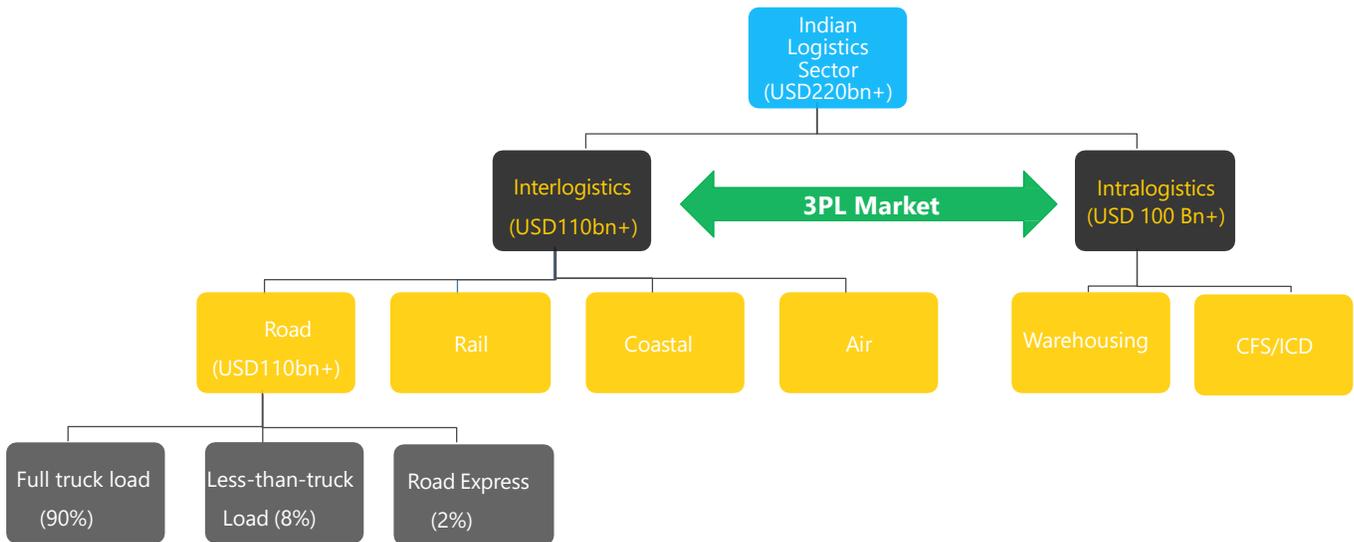
critical government attention. These emerging themes present lot of opportunities and challenges for the entire ecosystem and various players are capitalising on their advantages to enhance efficiency and reduce costs for customers, unlocking business growth.

² https://www.indiabudget.gov.in/doc/Budget_Speech.pdf

³ Excluding Hidden costs

⁴ https://www.business-standard.com/article/companies/logistics-market-seen-growing-10-5-a-year-to-reach-215-bn-by-2020-study-119031800701_1.html ; Industry reports, Expert interviews

The Indian Logistics Sector is estimated to be about USD 220 Bn



Sources: LogisticsIQ

However, there are several structural issues within the sector and challenges that need to be overcome before the dream of USD 5 trillion in GDP and USD 450 billion for Indian Logistics sector can be achieved. The sector is however constantly grappling with inefficiencies, because of which the cost of Indian logistics is 13-14% of GDP compared to 8-10% of GDP in developed nations⁵. These inefficiencies stem from three reasons:

1. The two most unorganized sectors dominate the logistics market—road transport and warehousing. Road transport is a highly fragmented industry with truck owners with fewer than five trucks accounting for more than half of all goods vehicles on the road⁶. There are several companies that are trying to change the trend, however the transformation is slow.
2. Road transportation accounts for 60-65% of the sector, compared to 25-30% in developed countries, leading to higher costs⁷. The use of inland waterways and coastal shipping is limited,

while the containerization of cargo in rail remains minimal.

3. Indirect costs are high⁸ and include inventory carrying costs, theft and damages—often because of poor planning, forecasting and lack of proper management of stock.

These structural issues are made even more complex by the lack of core infrastructure, shortage of skilled labour and the ever-growing demands from customers. The inefficiencies stemming from these challenges increases the overall shipping costs as well as holds back the overall development of the Indian Logistics sector. The key

Infrastructure - It is one of the biggest hurdles that has cramped growth of the logistics sector. The mix of modal transport is suboptimal, terminal transport infrastructure is inadequate, and is also marked with inefficient and ill-designed storage facilities, and inefficient operational and maintenance protocols, as well as very low level of technology adoption. This leads to high and inconsistent

⁵ <https://economictimes.indiatimes.com/news/economy/policy/multimodal-logistics-park-policy-on-the-anvil/articleshow/66202088.cms>

⁶ <https://www.crisil.com/content/dam/crisil/our-analysis/reports/Research/documents/2018/november/crisilresearch-opinion-road-turns-rough-for-small-fleet-operators.pdf>

⁷ https://commerce.gov.in/writereaddata/uploadedfile/MOC_636850448855371480_Notification-Draft-05022019.pdf

⁸ <https://www.livemint.com/Opinion/QwB4qFUMhwpQCQob0okhMN/Debunking-Indias-logistics-myths.html> ; <https://economictimes.indiatimes.com/news/economy/policy/multimodal-logistics-park-policy-on-the-anvil/articleshow/66202088.cms>

transit times, inefficient use of resources and poor fleet management, and leads to higher overall costs.

Skill Development - The availability of appropriately skilled manpower remains a challenge. Lack of skilled manpower is the result of inadequate training and there is an increased need to build a pool of skilled personnel comprising truck drivers, warehousing managers, quality inspection supervisors, that have the right set of tools to ensure that the goods are being shipped in a timely manner, as well as address the problems of theft and high inventory. There are limited institutes for soft skills, and operational and technical training. The highly fragmented nature of the sector, as well as the poor working conditions and low pay scales, does not lead to many skilled professionals opting for it as a career.

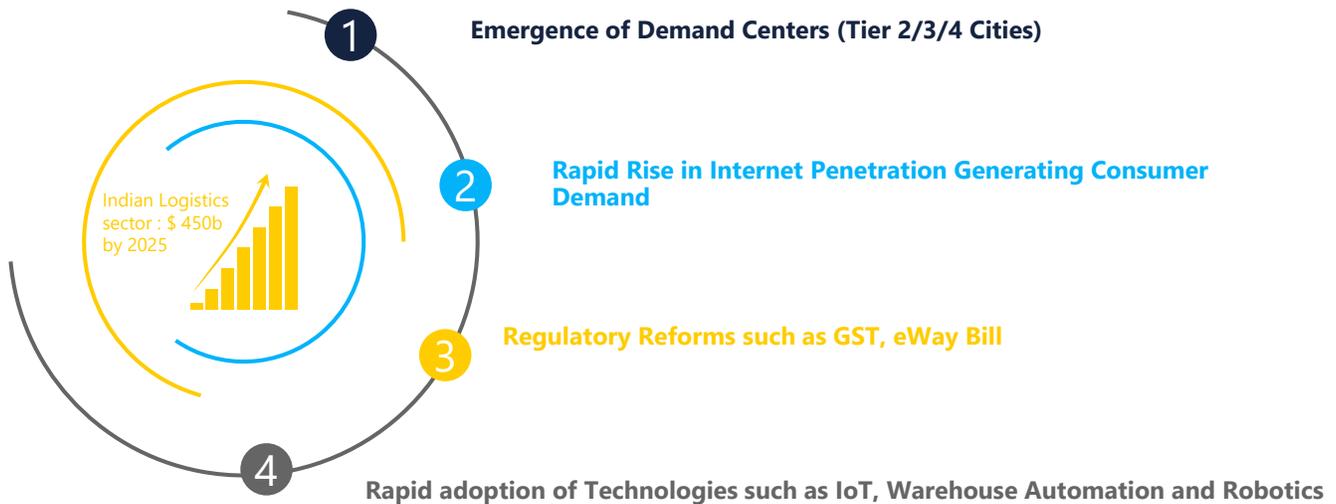
Information Technology - Awareness about the financial benefits of digital technology is low and as a result the sector has seen very less technology adoption even though there has been an uptick in the recent years. The low adoption of technology compared to developed countries

leads to operational inefficiencies and poor asset utilization. Technological infrastructure remains inadequate, and investment in IT is seen as a cost by logistics operators rather than as an asset and a differentiator.

Flexibility in Supply Chain - Consumer behaviors and expectations are also diverse with different set of customers demanding different offerings. Both individual and corporate customers demand personalized services, flexibility and faster services. Initiatives such as real-time track-and-trace and other value-added services, will help service providers cut cost, raise productivity and optimize the supply chain.

The Indian logistics sector faces challenges and there is a lot to act upon. Use of innovative models, new technological systems, international best practices, research and adequate implementation approach can all help to improve the sector, which in turn can stimulate growth and employment in the country.

Demand drivers can push Indian Logistics Sector to \$450b by 2025



Sources: LogisticsIQ

2 Regulatory Reforms Transforming Indian Logistics Sector

Significant regulatory reforms have been implemented over the past few years. There are structural reforms such as implementation of GST, introduction of e-way bill, setting up of a separate Department of Logistics, that will lead to increase in efficiencies in the sector. Logistics players can now achieve economies of scale with improving infrastructure facilities and favourable government policy changes to provide cost-effective and integrated solutions.

2.1 GST: A more efficient taxation system

- **Reduced transportation time:** A truck in India, on an average, runs for 50,000-60,000km p.a. compared to 300,000km in the US. Inter-state border checkpoints, which were responsible for scrutiny of goods and indirect tax compliance, negatively impacted overall production and logistics time, accounting for roughly 60% of a truck's transit time. There has been significant decrease (18-20%) in the turnaround time since the introduction of GST.
- **Warehousing:** Under the previous tax regime, companies established warehouses in different states to avail tax benefits. With implementation of GST, the number of warehouses has already started to fall. This is resulting in consolidation in the sector with a shift from small state warehouses to large regional ones. This shift will further be assisted with logistics sector being granted infra status as funding on more favourable terms will be available. Warehouse consolidation has also reduced inventory levels by about 30% compared to the pre-GST era (as per Knight Frank), increasing dependence on 3PL providers as industry moves to lower inventory operating models.
- **GST tax rates:** Pre-GST, indirect taxes were up to 26.5%, while GST rates for logistics usually range between 5% and 12%. Fuel is the biggest cost in the sector, and is exempt under GST due to which no input credit is available on taxes paid on it. The input tax credit mechanism will encourage shift of business to the 3PL segment, since the tax paid by intermediaries in the supply chain can be passed as input tax credit. Overall, the industry will benefit due to lower tax burden on account of elimination of double taxation.

2.2 Introduction of e-way bill

- **Reduced compliance burden:** Previously, logistics providers had to prepare documents for each of the states they passed through. However, with introduction of e-way bill, a single bill suffices even though goods are transported via several states. This has resulted in faster movement of goods since vehicles can be

detained only once in a state, unless on account of suspected tax evasion. This speeds up the entire transportation chain and creates additional capacity sans further investment.

- **Advantage for organised players:** E-way bills are required for consignments over the value of INR50,000. As of June 2018, the number of e-way bills generated crossed 110mn. Movement of goods without e-way bill has penal consequences, which acts as a deterrent to tax evasion, placing unorganised and organised players on an equal footing. Smaller transporters will have to invest in adequate IT infrastructure entailing additional costs. This lends competitive advantage to established 3PL players and their partners, who already have such systems in place.

2.3 Grant of infrastructure status

With a focus on reducing the overall logistics cost (up to 14%) to make goods more competitive, the logistics sector was granted infrastructure status in November 2017 and includes, multi-modal logistics park comprising ICD, cold chain facilities and warehousing facilities with minimum investment and area size.

2.4 Establishment of Logistics Division under Department of Commerce

The Department of Commerce established a Logistics Division in July 2017, currently headed by Mr. N Sivasailam, Special Secretary (Logistics) and previously headed by Mr. Binoy Kumar (Special Secretary, Logistics), to focus on on 'Integrated development of the Logistics sector'. The department aims to cut logistics cost to about 10% of GDP by 2022. In August 2018, a committee of secretaries approved the proof of concept for setting up of a National Logistics Portal (NLP). NLP will be implemented in three stages:

- 1) development of e-marketplace;
- 2) single window clearance for approvals from over 80 authorities; and
- 3) integration of financial services.

2.5 Investments and large scale plans

The government is investing heavily to improve the overall sector such as the Sagarmala Project, UDAN scheme and Bharatmala Pariyojna. While these projects will take a long time to be implemented, it will eventually create a more robust and integrated logistic environment for India.

3 Digital Transformation of Indian Logistics sector

In the current era of digital transformation, several technological disruptions have come together to create powerful tools that are reshaping industries across the globe. As various industries, such as retail with close links to logistics, are being redefined by digital technology, it is inevitable for such disruption to also revolutionize the logistics sector.

Digital transformation has the potential to have far-reaching payoffs for a leaner and smarter logistics by ensuring smoother interface among logistics stakeholders for seamless delivery. According to the World Economic Forum (2016)⁹, digital transformation of the logistics sector could translate into value of \$1.5 trillion for players in the logistics sector and an additional \$2.4 trillion worth of societal benefits by 2025.

Countries like Germany, Singapore, Hong Kong and USA, all of which possess more sophisticated logistics ecosystems have gone on to showcase how digital transformation has benefited their entire logistics value chain, including warehousing operations, freight transportation, and last-mile delivery. As a result, these countries have consistently ranked higher than India in the World Bank's Logistics Performance Index. Multiple digital technologies can potentially impact different activities across the entire logistics value chain to bring in operational efficiencies, maintain cargo safety, enhance customer interface, revamp business models and bring about rationalization of logistics costs.

As is being witnessed across the globe, applying these digital technologies to logistics operations in the Indian context may help improve the performance and efficiency of the sector in the following ways:

3.1 Internet of Things (IoT)

IoT is the networked connection of physical objects that can help capture information for generating new insights and adding value to business. It presents a unique technology transition and can enable the logistics ecosystem in India in the following ways:

Predictive diagnosis and monitoring performance: IoT may be used to monitor the status of assets in real time throughout the value chain. In several countries, advanced sensors are being used to monitor and detect risks pertaining to breakdowns, helping avoid process delays and fatal accidents. For instance, Union Pacific, the largest

railroad in the United States operating around 8,500 locomotives that haul freight over 32,100 route-miles of track in 23 states, uses IoT to predict equipment and component failures. Acoustic and visual sensors are embedded in the tracks to monitor the condition of train wheels. This has reduced bearing-related derailments that can result in costly delays and up to \$40 million in damages per incident for Union Pacific (DHL and Cisco, 2015)

Providing visibility for in-transit carriers: Additionally, IoT, which includes Global Positioning System (GPS) and Radio-frequency Identification (RFID) systems, is being used to provide logistics carriers with real-time information on key location stats. This has helped make the logistics ecosystem more responsive. While on the one hand this provides greater control to service providers to predict delivery times and improve asset utilization, it also enables customers to track and trace their consignment on a real-time basis.

3.2 Automation and Robotics

Automation technology in the logistics sector allows the use of control systems for operating machinery, processes, vehicles, vessels, and aircraft through the use of artificial intelligence. From the use of robots to self-driven vehicle and drones, automation technology can be adopted in the logistics sector for reducing labour costs and improving operational efficiency of the supply chain.

Robotics & automation is rapidly becoming a key success factor in eCommerce and is about to make a very large impact on the world of logistics. From AMRs and AS/RS to track & trace technologies and advanced supply chain software, it is a game changer enabling increasingly speedy, safe and error-free distribution, shorter time to market and ultimately lower costs to businesses and consumers.

Amazon Robotics automates the company's fulfilment centers using more than 80,000 autonomous mobile robots, up more than 200% from 30,000 at the end of 2015. Amazon continues to aggressively ramp up its patent applications in supply chain & logistics. The company filed at least 78 logistics patents applications in 2016¹⁰, according to tech research firm CB Insights. This was an all-time high and more than double the 33 filed in 2012, the year it acquired Kiva.

3.3 Artificial Intelligence

Artificial intelligence (AI) can help automate business processes to reduce/eliminate manual interventions for

⁹ World Economic Forum (2016), 'Digital Transformation of Industries: Logistics Industry'

¹⁰ <https://www.cbinsights.com/blog/amazon-warehouse-patent/>

freight handling, to improve quality, speed up processes and subsequently bring down logistics costs. Almost two-thirds of the logistics costs are hidden, which is attributable to theft and pilferage of cargo, and holding of inventory. Therefore, automating processes may help in eliminating hidden costs, bringing down the overall high logistics cost in India. Additionally, reducing manual intervention may also help speed up inspection by regulatory agencies, ensuring minimum handling damage and reducing the inventory holding time.

3.4 Blockchain Technology

It can be used to create common networks among entities unwilling to share information, without compromising on the integrity of the data. This technology becomes especially relevant in the Indian context, given the fragmented nature of the sector and lack of common platforms to exchange information. It may be used for:

- **Synchronizing multi-party logistics value chain:** Blockchain technology can be used to align processes seamlessly from one point of the logistics value chain to another by eliminating the need for duplicity of documentation processes. This, in turn, would also reduce the risk of errors creeping into the system due to manual data entry at several points across the value chain. It would also act as a catalyst for achieving an integrated end-to-end logistics system. For instance, Belgium's Port of Antwerp has initiated the process of using the blockchain technology to streamline its terminal's container operations. The aim is to pace up interactions between port customers, including carriers, terminals, freight forwarders, hauliers, drivers, shippers, among others, by cutting down on multiple interactions between these parties and also preventing data manipulation.

3.5 Cloud Computing

Cloud technology refers to the universal, and convenient access to a shared pool of networks, storage, servers and applications that can be accessed through the web. This technology can help the Indian logistics sector by:

- **Optimizing asset utilization:** As logistics in the country aims towards becoming leaner, optimizing asset utilization is important to enhance operational efficiency. The Indian road transportation sector remains highly fragmented and often the vehicle fleet either lies idle or returns empty after transporting the freight. Cloud computing can help service providers use assets more efficiently by collaborating with each other to share fleets and networks. Sharing

information on cloud-based platforms in real time can help service providers coordinate and collaborate for the pick-up and delivery of freight. This will not only reduce the idle time of their fleet but also make the delivery ecosystem more efficient.

- **Enabling storage and easy access of data:** With cloud technology that enables the easy storage of vast amounts of data without the need for physical servers or hard drives, logistics service providers can easily access information from anywhere. This will give flexibility to service providers to exercise control over critical processes that require round-the-clock monitoring from anywhere.

3.6 Big Data Analytics

Big data analytics, another element of the digital revolution, enables number crunching and 'sense-making' of complex data sets that are captured through 'smart' devices and stored across servers and networks. It can be employed by various logistics players for:

- **Driving future strategy:** Analytics can be applied to the entire logistics value chain to identify improvement opportunities and achieve operational efficiencies in the country's logistics framework. For instance, GE's analytics platform, Predix, or Cisco's Unified Computing System (UCS) Integrated Infrastructure for Big Data can be used to manage and implement complex statistical analysis, data mining, and retrieval processes for big data that help identify key insights and trends. This analysis can then be used to develop algorithms and estimate the remaining useful life of assets, identify areas of operational inefficiencies, eliminate redundant costs and drive future strategy.
- An expanding digital consumer base coupled with inadequate and ill-planned infrastructure facilities has left India trapped between growing demand for logistics services on the one end and a fragmented logistics services market on the other. Already some experiments are being made for adopting digital technologies in the country. But given the potential for significantly higher value to be created for the Indian economy, the sector cannot benefit much until a concentrated and collaborative effort is made by each stakeholder, including infrastructure providers, terminal operators, logistics service providers and technology companies.

4 Warehouse Automation: Catalyst for the growth of Indian Logistics Sector

The warehousing industry in India is largely unorganised and there are very few organised players. Earlier, due to the unorganised nature of the industry the returns in a development project was low. With the policy reforms that are being undertaken there is a paradigm shift in the industry structure where it is becoming favourable for organised players. On account of this structural transformation, the attractiveness of taking up a warehouse development project is evident.

Limited warehouse supply from the organised segment, amidst the increasing demand brought by reforms in the sector has translated into heightened interest and investment in the sector.

Demand for large warehousing spaces is likely to see steady increase as occupiers now to move out of their smaller warehouses and consolidate their activities in larger facilities, which are presently in short supply compared to the demand. This demand-supply gap is visible in the current premium commanded by organised players owning these assets. As more and more companies streamline their logistics networks, it would be observed that unorganised players or smaller organized players would consolidate or sell their assets to larger ones. The industry is expected to witness a structural shift over the next 3–5 years.

The warehousing aspect in the logistics supply chain globally is going through a transformation. From being a mere storage space provider for goods, the segment is offering an array of value added services such as packaging, small scale manufacturing, cross docking, automation, algorithm-based demand forecasting and distribution centres. This transition would only happen if economies of scale come into play and companies are able to consolidate their spaces and move into larger warehouses. The Indian warehousing industry which was lagging behind its global counterparts due to its fragmented structure would now enter the same league

The warehousing market in India is highly fragmented as majority of the warehouses measure less than 10,000 square feet. Further, almost 90% of the warehousing space is controlled by unorganised players and comprises small-size warehouses with limited mechanisation.

The present warehousing market in India can be categorised into three – lower stratum, middle stratum and higher stratum. The lower stratum is just godowns of the past converted into warehouses. These are old buildings, most Reinforced Cement Concrete (RCC) structures and their only utility is storage. The middle stratum warehouses comprise similar structures as in the lower stratum, but these are built with pre-engineered slabs and are known as

pre-engineered building (PEB) structures. Their planning and functioning is very basic, like that of the lower strata, but their buildings are in a comparatively better condition. Higher stratum warehouses are the modern and massive structures that perform a lot of supply chain functions along with storage.

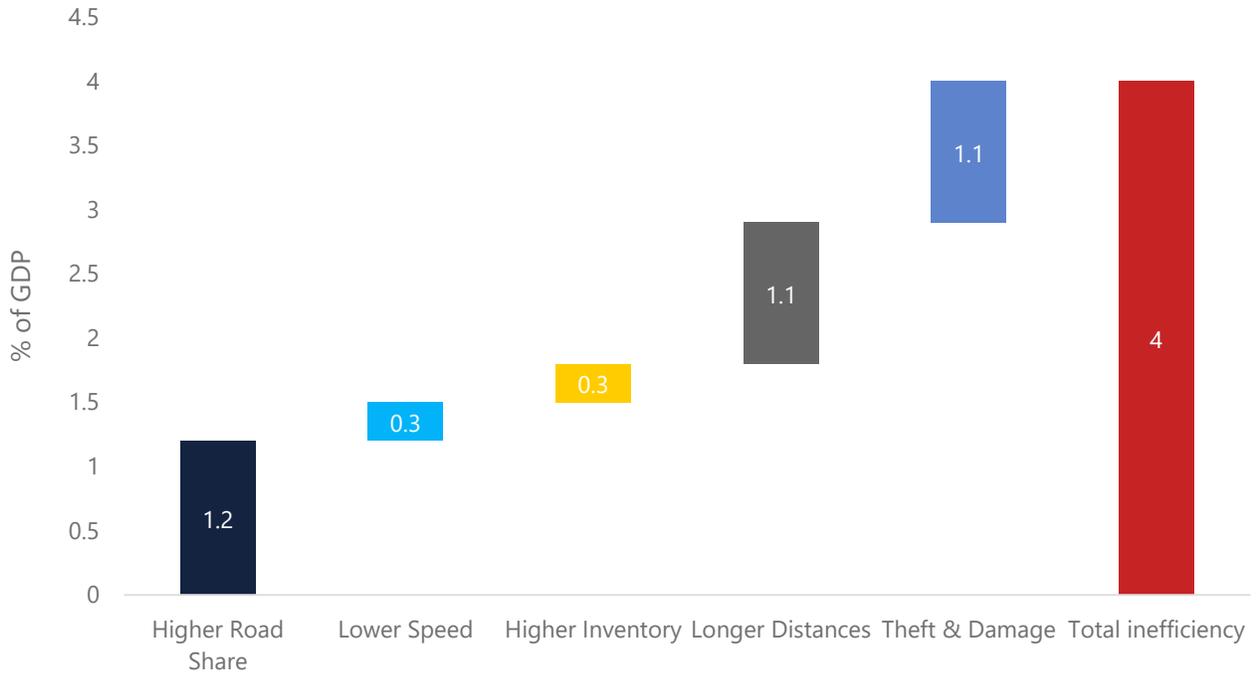
Another practise in Indian warehousing market is the lack of attention to warehouse designing. This ignorance stems from lack of awareness and/or lack of willingness on the part of landowners and developers to cater to the requirements of end users. Most warehouses are built keeping in mind the developer's perspective and not that of the end user. Hence, the focus is to save cost which results in the construction of a very basic structure for a warehouse. Such warehouses do not adhere to market standards and therefore, end users are frequently plagued with issues like lack of basic amenities and sub-standard infrastructure with lower longevity. This approach needs to change. The concept of Built-to-Suit (BTS) is still a far-fetched idea in India but practices like warehouse designing and end user centric warehouses need to definitely be focused on.

Nearly one-third of India's logistic cost (~4% of GDP) is due to inefficiency such as lower road & rail speeds, higher inventory levels and theft & damages. We see several factors combining to reduce these inefficiencies over the next decade. A favourable confluence of GST tailwinds, reducing transit times, warehouse consolidation, the new infrastructure status and rapid adoption of technology solutions are estimated to drive down inefficiencies and also the growth of the logistics sector in India. According to several global studies, of the 13-14% spends on logistics in India, roughly ~4% is related to inefficiencies in the system. These relate to:

- a. **Transportation related:**
 - i. Higher share of road transport (1.2%): PPP adjusted; road/rail is 30%/70% more expensive than US
 - ii. Lower transport speed (0.3%): ~50% of global average.
- b. **Warehousing/inventory related:** Additional inventory (0.3%): Higher transit inventory
- c. **Common costs:**
 - i. Longer distances (1%): Based on longer average distances travelled relative to other large countries.

ii. Theft and damage (1%)

Demand drivers can push Indian Logistics Sector to \$450b by 2025



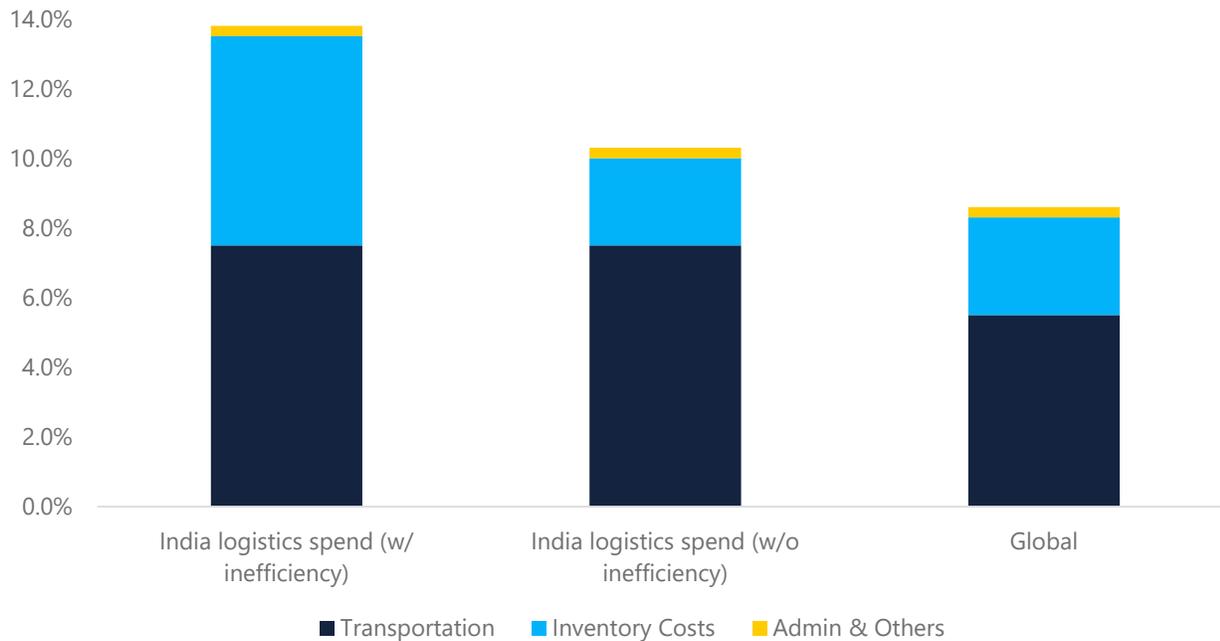
Sources: LogisticsIQ, NITI Aayog

4.1 Warehouse Automation will reduce inventory carrying cost

Of the total inventory related cost, carrying cost constitutes ~90%. In the storage/warehousing segment, industrial warehousing is the largest sub-segment in value and space terms. However, cold chain warehousing is expected to be

the fastest growing segment. Traditionally, like road FTL, industrial warehousing has also been dominated by unorganised local players. There has been no pan-India player because of land acquisition issues. Also, traditionally the focus has been on pricing and not quality of service. This has been changing recently.

A large part of logistics inefficiency is due to high inventory costs



Sources: LogisticsIQ, NITI Aayog

Warehouse Automation is going to play the key role to overcome these issues related to transportations, inventory cost as Indian e-commerce industry has been on an upward growth trajectory and is expected to surpass the US to become the second largest e-commerce market in the world by 2034.

4.2 Warehouse modernization and automation

The industry comprises both kinds of warehouses—the modern multi-purpose logistics centers as well as the traditional storage facilities, commonly known as godowns. More often than not, these two kinds of warehouses belong to two distinct types of warehouse providers as well. The modern logistics centers are provided by players from the organized sector, while the godowns largely belong to the unorganized sector. These can be categorized into Grade A and Grade B warehouses. Grade A warehouses generally have the following characteristics:

- Additional height and higher floor load-bearing capacity.

- Better infrastructure with access to mechanised MHEs, fire detection and prevention systems, clean environment.
- Land use with space for parking heavy vehicles/MHEs movement, multi-modal connections.

There has been a marked increase in the demand for Grade A space over Grade B in the last few years. While in 2018, overall India absorption in Grade A space was 17.7 mn sq ft against Grade B absorption of 14.1 mn sq ft. The available supply of warehouse stock has also seen a transformation with the cumulative Grade A supply reaching 38% of the total available supply in the country.

The growth of Grade A supply is restricted by the high cost of land that constitutes a major component of a warehousing project investment. However, given the highly dense urban population in the country, and the lack of commercial and industrial space within Tier-1 and Tier-2 cities, modernization of warehouse stock is the only logical option as it increases the overall storage handling capacity.

Grade A Warehouse Stock will be ~50% by 2022



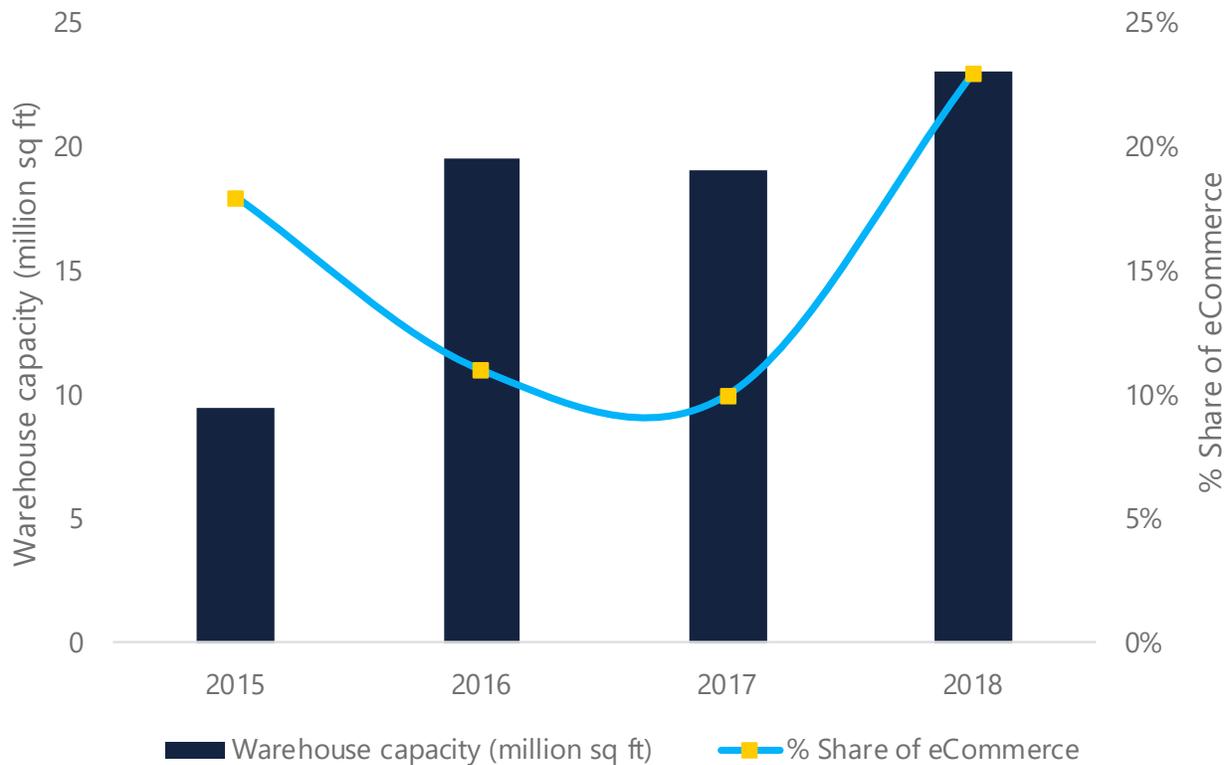
Sources: JLL India, LogisticsIQ Research

4.3 Warehouse Automation: A must-have for eCommerce Fulfilment

The E-commerce market is expected to reach Rs 13,97,800 crore (US\$ 200 billion) by 2027 from Rs 2,69,076.5 crore (US\$ 38.5 billion) in 2017. India's e-commerce market has the potential to grow more than four folds to Rs 10,48,350 crore (US\$ 150 billion) by 2022 supported by rising incomes and surge in internet users. Online shoppers in India are expected to reach 120 million in 2018 and eventually 220 million by 2025. Average online retail spending in India was US\$ 224 per user in 2017. Earlier last year, leading supply chain and logistics company Gati KWE and Indian e-

commerce giant Flipkart signed on Pitney Bowes TrueSort – an automated parcel sorting system and the Pitney Bowes OneSort automated data capture system. Gati required an efficient automated solution to help manage its large volume of parcels and is now leveraging TrueSort – an automated system that is capable of processing a combination of parcels, polywrap bags, magazines and flats with speed and precision. System. Meanwhile, Flipkart is using OneSort, an all-in-one data capture solution that enables users to instantly process instructions for labeling, routing, postal documentation, client billing, and custom reporting while receiving full access to critical information through a comprehensive data stream.

Demand for warehouse space is being driven by eCommerce



Sources: CBRE, LogisticsIQ Research

The country's warehouse leasing market, which grew by more than 45 percent in 2018, has witnessed the ecommerce industry driving up the demand, and this momentum is expected to continue in the years to come, according to a report by CBRE.

CBRE South Asia, a leading real estate consulting firm, in its latest report *"Online retail driving realty – elevating the ecommerce game"* said that the share of ecommerce in the overall warehousing leasing has risen from 10% in 2017 to 23% in 2018. Anshuman Magazine, Chairman and CEO, India, South East Asia, Middle East and Africa, CBRE, said: *"The sector has seen unprecedented growth and we expect supply to touch almost 60 million sq. ft. by the end of 2020. Innovative technologies, coupled with viable government reforms such as GST and other global collaborations will further push the envelope of development for the Indian logistics sector and given the dynamics at play, demand and supply are both poised to burgeon in the coming years."*

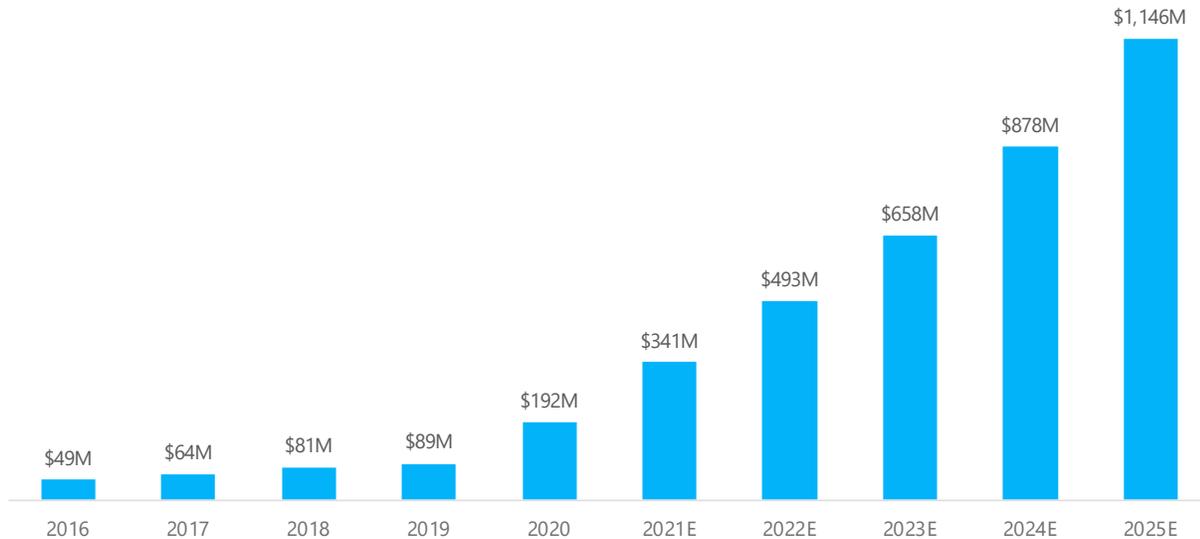
The warehouse leasing crossed 25 million square feet mark in 2018, which was more than 45 percent year-on-year growth. According to CBRE, ecommerce warehousing in the long run is likely to see a greater number of ecommerce companies and retailers collaborating and share fulfilment centres to rationalise costs. This is expected to lead to mushrooming of small-scale warehouses, especially in regions close to highly-populated residential catchments.

Omni-channel retail will further drive warehouse demand from companies seeking deeper access to more neighbourhoods, the report said. The consolidation by leading players led to the average size of warehouse leasing by e-tailers going up by 2.3 times in a year – averaging around 170,000 sq. ft. in 2018. This overall increase in demand will also witness considerable spike from the supply side. This is likely to result in improved quality of supply as large-scale tech-backed logistics facilities are coming up around the country, at par with established global

standards. While the overall warehousing supply (grade A and inferior grade) for the sector is expected to be around 60 million sq. ft. till 2020 end, at least 22 million sq. ft. of this supply is estimated to be in the grade A category. Commenting on the growth of the sector, Jasmine Singh, National Head – Industrial & Logistics, CBRE said, “We

anticipate warehouse leasing activity to remain vibrant going forward, driven by continued demand from e-tailers, policy impetus, and growing demand from Tier-II cities. Modern tech-powered warehouses will rule the roost, pushing inferior grade properties down the demand pyramid.”

India Warehouse Automation Market Size (2016-2025) in US\$ Million



Sources: LogisticsIQ Research

E-commerce companies are not alone in this race. Reportedly, Indian logistics automation players are contributing with their unique and customized solutions for Automated Guided Vehicles, Autonomous Mobile Robots,

Storage, Order Picking etc. Addverb Technologies has also launched multiple solutions for Indian and overseas market to serve the clients like Havells, Patanjali, Reliance, Unilever, Asian Paints, Coca-Cola, ITC, MRF and Tata Chemicals.

Mobile Robots – Dynamo, Zippy and AddMove



Sources: Addverb Technologies, LogisticsIQ Research

Walmart-owned Flipkart has deployed around 100 robots in one of its delivery hubs in the outskirts of Bengaluru to help sort packages and streamline its supply chain. According to the company, the robots which are automated guided vehicles (AGVs), will be working in a tight grid and use collision avoidance technology to ensure free movement. It will be responsible for picking products from a conveyor belt, scan them and drop them down a chute which is assigned to a particular pin code. As of now, Flipkart's robots are able to sort nearly 4,500 packages in an hour which is reportedly ten times more than a single human would achieve at the same time. The product throughput can also be increased by five times with minimal increases in infrastructure and the addition of more robots.

Today warehouse automation forms the backbone of e-commerce players in India such as Amazon, Flipkart, Zivame, Myntra among other bold-faced names. In the US and China, the cost of the robot is less than the labour cost due to the shift in aspirations of the youth (who want more high-end jobs) and hence automation has resulted in huge cost saving in warehousing in these countries. Apart e-commerce, warehouse automation is getting a good adoption for industries like Automotive, Food & Beverages, Retail and Pharmaceutical in India.

4.4 Creation of Automated Warehouses to generate demand for skilled labour

For a country like India where labour is in abundant supply and cheap, fully automated robot operated warehouse is a distant dream. For example, in the US, Amazon has robots in their warehouses but when Amazon builds a warehouse in Hyderabad the company prefers human employees for its operation. However, this scenario is changing as consumers' behaviour and expectations in India are increasingly becoming higher, and timely delivery and return is as important as its cost associated.

As we move towards a more sophisticated warehousing solution, some warehousing activities may be automated in warehouses. We will need skilled people to operate these sophisticated warehouses and there will be a shift in the skill set mix for operating these automated warehouses.

4.5 A driver for robotics growth in India

China remains the world's largest industrial robot market with a share of 36% of total installations. In 2018, about 154,000 units were installed, compared to 4,771 in India.

China has a five-year plan for the period 2016-2020 to make significant progress in the production capacity, creativity and competitiveness of the robotics industry. The plan calls for building competitive advantage in 10 types of industrial robots, such as , precision welding, surgical applications, vacuum cleaning, and associated infrastructure of services

and AI programming. Breakthroughs were expected in core components of robots including sensors and servomotor.

India has lagged behind China in having a dedicated robotics policy. In industrial robotics, the gap is too huge due to the immense manufacturing industry in China and it will take huge effort to catch up to China. However, warehouse automation can present an exciting opportunity in India, and several Indian companies have already started to develop solutions and are competing with global players.

The robots deployed in warehouses are small and their shipments are expected to cross the shipments for industrial robotics in the near future. Robotics development also opens up the opportunities in developing related capabilities such as AI programming, sensors and motors.

With the right policies, Indian companies can develop robotics products that can cater to the domestic demand as well as compete in the international market. This will again generate demand for skilled professionals such as robotics engineers, software developers as well as maintenance engineers.

5 Key Takeaways

1. The government's various initiatives for the logistics sector such as giving infrastructure status to the logistics sector, the 'Make in India' programme, development of multimodal transport networks and initiatives to set up industrial corridors like Delhi Mumbai Industrial Corridor (DMIC), Delhi Kolkata Industrial Corridor and logistics parks are propelling the growth of the entire sector.
2. The Logistics sector has the potential to contribute USD 450 bn to the economy by 2025, and a lot of inefficiencies can be weeded out, presenting a huge opportunity to logistics service providers as well as technology companies.
3. Rapid adoption of automation and data analytics is leading the logistics industry into a new era
 - a. Automation-driven technology for the logistics industry is fast evolving into a fully automated system. From inventory management in the warehouse through WMS to drone delivery, most processes in the logistics services can be done unmanned.
 - b. With data being used for new identification techniques, routing, space optimisation and monitoring stock data, the face of the logistics industry is changing.
 - c. Digitization has transformed the logistics industry and is constantly improving on productivity and performance metrics. App-based provision of logistics services, transparency in the market by readily making available information such as price, type of service, equipment used, quality standards, product location, is transforming the entire industry as well as increasing the customer satisfaction levels.
4. The warehousing aspect in the logistics supply chain globally is going through a transformation. From being a mere storage space provider for goods, the segment is offering an array of value added services such as packaging, small scale manufacturing, cross docking, automation, AI based demand forecasting and distribution centres. This transition would only happen if economies of scale come into play and companies are able to consolidate their spaces and move into larger warehouses. The Indian warehousing industry which has lagged behind its global counterparts historically due to its fragmented structure, can aspire to become equally competitive.
5. In the coming years, there would be greater adoption of automation and technology such as Internet of Things, Wearable Technologies, drones, automated guided vehicles and autonomous mobile robots, cloud technology, RFID for the introduction of a programmed Warehouse Management System (WMS) in order to address customer requirements quickly. Hence, it is also imperative to set up skill augmentation centres to address the training needs for personnel working in the warehouse of the future.

Transformation of the Indian Warehousing Sector



Government Initiatives are leading to the transformation of Logistics Sector



Attractive Opportunity for Logistics Service Providers and Technology Players



Consolidation of warehouses from large number of multiple facilities to a few larger centers



Skill Development a must to equip personnel with tools to work with technology and automation



Implementation of automation and smart warehousing solutions in warehouse operations



Transformation of warehouse from just storage to one providing value added services

Sources: LogisticsIQ Research



About Addverb Technologies

Addverb is the leading company for intralogistics automation solutions. We use our deep technical insight and rich operational experience to integrate Operational Technology & Information Technology to design and implement best-in-class automation solutions. Our products incorporate the latest technologies and vastly improve the efficiency and accuracy of the intralogistics operations. With our innovative products and solutions, we facilitate our customers to embrace Industry 4.0. We intent to disrupt the way warehouses operate in world by providing intelligent solutions which offer quick returns on investment.

<https://www.addverb.in>

logistics

The logo for LogisticsIQ consists of a white lowercase 'i' followed by a white gear icon, all contained within a blue square.

About LogisticsIQ

LogisticsIQ™ is a research and advisory firm empowering decision makers from top fortune 1000 companies, financial and research institutions, private equity and high growth start-ups with market insights in supply chain & logistics sector to make better decisions.

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