How AI is disrupting the logistics industry

Abstract

A recent study calculates that AI-enabled supply-chain management has enabled adopters to improve logistics costs by 15%, inventory levels by 35%, and service levels by 65%.

It is no surprise that over half of the logistics companies worldwide have started digital transformation initiatives, especially during the pandemic. Technologies like Artificial Intelligence (AI) and Machine Learning (ML) are not new. However, they are now delivering on the promises they made earlier. Investment in AI is increasing yearly, and it is getting C-level sponsorship more often now.

This white paper explores how Artificial Intelligence (AI) impacts the logistics industry. The topics include:

- **Examples of early adopters and how they are using the technology**

- **Use cases across the logistics value chain**

- **Our POV on the future of AI**

- **Nagarro's solutions for the logistics industry.**

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Introduction

The adoption of AI technologies in logistics is projected to continue growing, with the global AI market in logistics expected to reach $6.5 billion by 2023.

Companies generate billions of gigabytes of structured and unstructured data every day. AI harnesses this data to make real-life business and operational decisions – that were made by human intelligence earlier.

For example, **in the logistics industry, AI offers tremendous advantages over traditional methods in automating time-consuming processes such as forecasting demand or optimizing routes.**

And there's more. Let's explore how AI continues to help logistics businesses improve efficiency, optimize resources, and drive the top line.

Early adopters of AI in logistics

The logistics industry is beginning to see the value of AI in improving production and delivery. We look at some examples of how AI is creating an impact in the sector.

a. A few early adopters have started experimenting with autonomous vehicles. For example, Volvo has introduced the Autonomous Transport Solution, offering a new hub-to-hub autonomous transport solution – designed to serve four main customer segments: shippers, carriers, logistics service providers, and freight brokers. They have partnered with the global logistics provider DHL Supply Chain (as their first customer) to pilot the hub-to-hub solution.

b. ZIM (a cargo shipping company), in collaboration with the Data Science group, is developing AI tools for the maritime shipping industry, tackling container crises that could reduce bottlenecks in the container supply chain.

c. Another AI technology invested heavily to enhance businesses' supply chain management is - warehouse robots. DHL (the global logistics service provider) has partnered with Locus Robotics to deploy autonomous mobile robots for picking 100+ million units in its warehouses in Hanover Township, Pennsylvania.

According to the MHI Annual Industry Report 2022, **AI can expect the most accelerated growth over the next five years – from 15% to 73%, a nearly five-fold increase.**

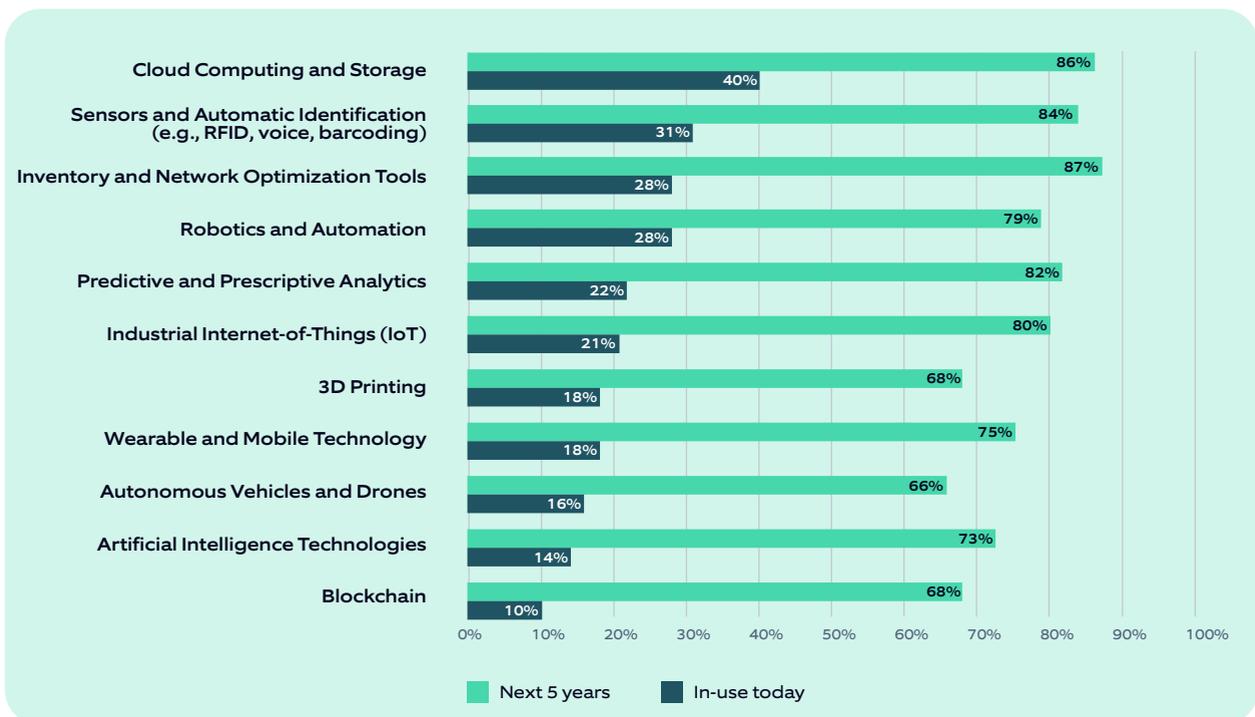| Technology	Next 5 years	In-use today
Cloud Computing and Storage	86%	40%
Sensors and Automatic Identification (e.g., RFID, voice, barcoding)	84%	31%
Inventory and Network Optimization Tools	87%	28%
Robotics and Automation	79%	28%
Predictive and Prescriptive Analytics	82%	22%
Industrial Internet-of-Things (IoT)	80%	21%
3D Printing	68%	18%
Wearable and Mobile Technology	75%	18%
Autonomous Vehicles and Drones	66%	16%
Artificial Intelligence Technologies	73%	14%
Blockchain	68%	10%

Fig 1: Adoption rates of supply chain innovations and technologies (in 2022)

Applications of AI in logistics

AI has delivered significant value in almost all areas of the logistics value chain. It has use cases from logistics planning and warehousing, to transportation and final product delivery.

Below we talk about some areas that have seen significant growth due to AI.

1. AI-powered logistics planning

Logistics companies can improve their supply chain efficiency by using AI for demand forecasting and network planning. AI-powered demand forecasting models can predict the demand for the future based on historical data and other external factors such as seasonality, holidays, etc. This helps optimize the vehicles' capacity and utilization, reduces inventory holding costs, and ensures fewer stockouts, improving customer satisfaction. By predicting market demand for the coming weeks, logistics companies can decide to move vehicles quickly to high-demand areas.

Fig 2: Advantages of using AI in logistics planning

An interesting example is the anticipatory shipping by Amazon. Amazon has substantial valuable data about its customers' preferences and habits. It utilizes this data to predict customers' wants and then automatically ship the products. The packages could wait at the shipper's hub or on trucks until an order for the item arrives. It cuts the delivery time significantly and is very useful during the holiday season.

2. Warehouse automation

Warehouse automation is another area for AI adoption. In AI-managed warehouses, products are positioned next to one another instead of groupings by categories. When an order is received, the first available robot (Automated Guided Vehicles – AGVs) picks up the item that is stored close to its position and conveys it to the human packers at the end of the warehouse. AI system treats the warehouse as a constantly moving entity with constantly changing parameters.

For example, DB Schenker is driving warehouse automation in Sweden by implementing Auto Store to optimize logistics solutions for e-commerce customers.

Automated inventory reconciliation　　**Shortest picking routes**　　**Drone delivery**

Fig 3: Advantages of warehouse automation

Some of the significant advantages of warehouse automation are:
- AI can assist in accelerating the picking process in warehouses by finding the shortest picking routes within the warehouse and allotting them to the employees.
- AI can help in inventory reconciliation, reducing the mundane work of inventory counting and data-entry errors.
- AI-powered drones can record items and their storage positions and compare this data to that in the warehouse management system (WMS).
- WMS can utilize AI technologies to issue instructions to warehouse employees to improve their workflow, react to short-term changes and give instructions for events arising from specific situations. It can also incorporate weather data and demand fluctuations.
- AI can help in damage detection and predictive maintenance. It uses computer vision technology to identify damages in products, determine the depths of the damages, and correspondingly recommend further actions.
- AI can predict potential machine failures in the facility by analyzing real-time data collected by IoT sensors.

3. Smart transportation

Another AI use case is AI-powered route optimization in transportation. An AI/ML-enabled route optimization solution can provide information on the optimal number of vehicles required and the shortest routes they must take to deliver packages within the delivery time window. At the same time, the system can daily learn from the already-made deliveries and continue to refine itself, meeting maximum delivery windows while optimizing transportation costs.

A few logistics companies have started pilot projects with drones for last-mile deliveries of parcels. AI technologies can also predict delays and ETA by leveraging data about historical patterns, weather, social events, traffic congestion, etc.
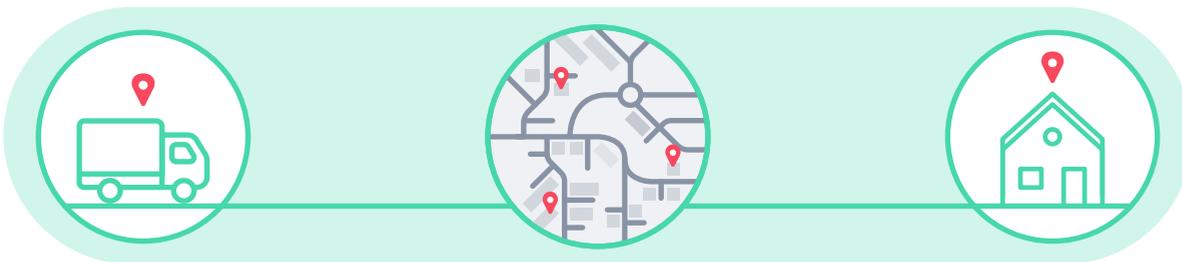

Fig 4: AI-powered shortest route optimization

4. Back-office operations automation

AI technologies can significantly impact back-office operations in the logistics industry. Logistics companies have started realizing this, and we expect to see a lot more adoption of AI in mainstream logistics.

- With Robotic Process Automation (RPA), AI can automate various manual tasks and improve productivity. AI-powered software can process contract agreements and identify risky clauses. Using natural language processing, AI can parse unstructured emails (received for transportation booking) and create booking requests automatically by integrating with the booking services. AI can also classify emails based on inquiry reasons and correspondingly create responses or provide recommendations.
- AI, along with OCR (Optical Character Recognition), can automate data inputs, error reconciliations, and document processing of various documents like invoices, bills of lading, and rate sheets.
- AI-powered chatbots can handle many call center or customer support tasks such as delivery requests, order amendments, shipment tracking, responding to frequently asked questions, and scheduling load pick-ups/ drops.

5. AI-enabled container optimization and positioning

In shipping logistics, an AI based solution can optimize container positioning to use the available space best.

The solution can determine the chances of fitting a given set of packages into the container based on parameters like size and shape. Then it evaluates the existing storage configuration to identify the most appropriate space for the new container.

This results in the best possible utilization of container space, reducing costs. It bundles boxes with minimum volume loss and arranges packages using a heuristic algorithm.

6. AI-enabled customer support and service

AI can reduce response time, enabling more efficient customer support/service and increasing customer satisfaction. Here are some examples of how ChatGPT is used:

Chatbot-based customer support: ChatGPT can be trained to provide real-time customer support and service through chatbots.

These chatbots can answer frequently asked questions, provide updates on delivery status, and even help customers track their shipments. ChatGPT can also handle a large volume of queries simultaneously, reducing the workload for human customer service representatives.

Natural Language Processing (NLP): ChatGPT is trained in natural language processing, which is used to analyze and understand customer queries and provide personalized responses.

This can help improve the accuracy and relevance of responses, leading to higher customer satisfaction.

Image recognition: ChatGPT can be trained in image recognition technology to automatically detect and classify items in images, making it easier for customers to track their shipments and identify any issues with their orders.

Future of AI in the logistics industry

The growth of the B2C e-commerce logistics industry has been on an upward trajectory, driven by the increasing demand for online shopping and the globalization of trade.

This growth has created opportunities for the transportation and logistics industry to advance smarter digital transformations – resulting in faster, more efficient, and cost-effective supply chains.

However, the future is complex and challenging due to rapid industry consolidations, new technology acceleration, and ever constant regulatory changes. The logistics industry must ultimately adopt AI to secure its future.

One company that has already adopted AI in its operations is Amazon. The service speed from Amazon for B2B space is as resilient as that in their B2C – with instant quotations, real-time order tracking, and personalized messaging.

In the coming 3-5 years, AI will allow T&L companies to process historical trends more quickly. This will help forecast and manage inventory, and address variable demands across supply chain operations. Data from past operations can help AI algorithms conduct primary operations automatically, reducing human error in the supply chain. Sophisticated AI-driven predictive models can predict revenue or operating margins.

Beyond the next 8 years, the future of AI looks even more promising – new vehicle technology drives smart infrastructure, and autonomous driverless trucks/ships/drones ships move cargo. The Internet of Things (IoT) continues to connect everything – from courier drivers wearing smart uniforms and smart watches to driving smart vehicles, smart roads with intelligent signage, and every container/pallet/package is connected to AI and IoT sensors.

These new capabilities are changing how stakeholders make decisions, take routes, manage fleets and flow of packages, products, and cargo.

The Deloitte and MHI report provides insight into the potential impact of AI in supply chain management and logistics. AI continues to support ongoing supply chain and logistics improvements and has a 36% potential to create competitive advantages in upcoming years.

Technology	Potential to disrupt or create competitive advantage	Potential to create competitive advantage	Support ongoing improvments	Little to No impact
Robotics and Automation	17%	41%	32%	12%
Predictive and Prescriptive Analytics	11%	41%	36%	12%
Sensors and Automatic Identification (e.g., RFID, voice, barcoding)	12%	38%	39%	11%
Autonomous Vehicles and Drones	13%	37%	31%	19%
Artificial Intelligence Technologies	13%	36%	36%	15%
Inventory and Network Optimization Tools	9%	38%	43%	10%
Industrial Internet-of-Things (IoT)	11%	34%	39%	16%
Wearable and Mobile Technology (e.g., glasses, headsets, mobile…)	8%	34%	42%	16%
Cloud Computing and Storage	8%	31%	45%	16%
Blockchain and Distributed Ledger Technologies	9%	27%	41%	23%
3D Printing (Additive Manufacturing)	6%	23%	39%	32%

- Potential to disrupt or create competitive advantage
- Potential to create competitive advantage
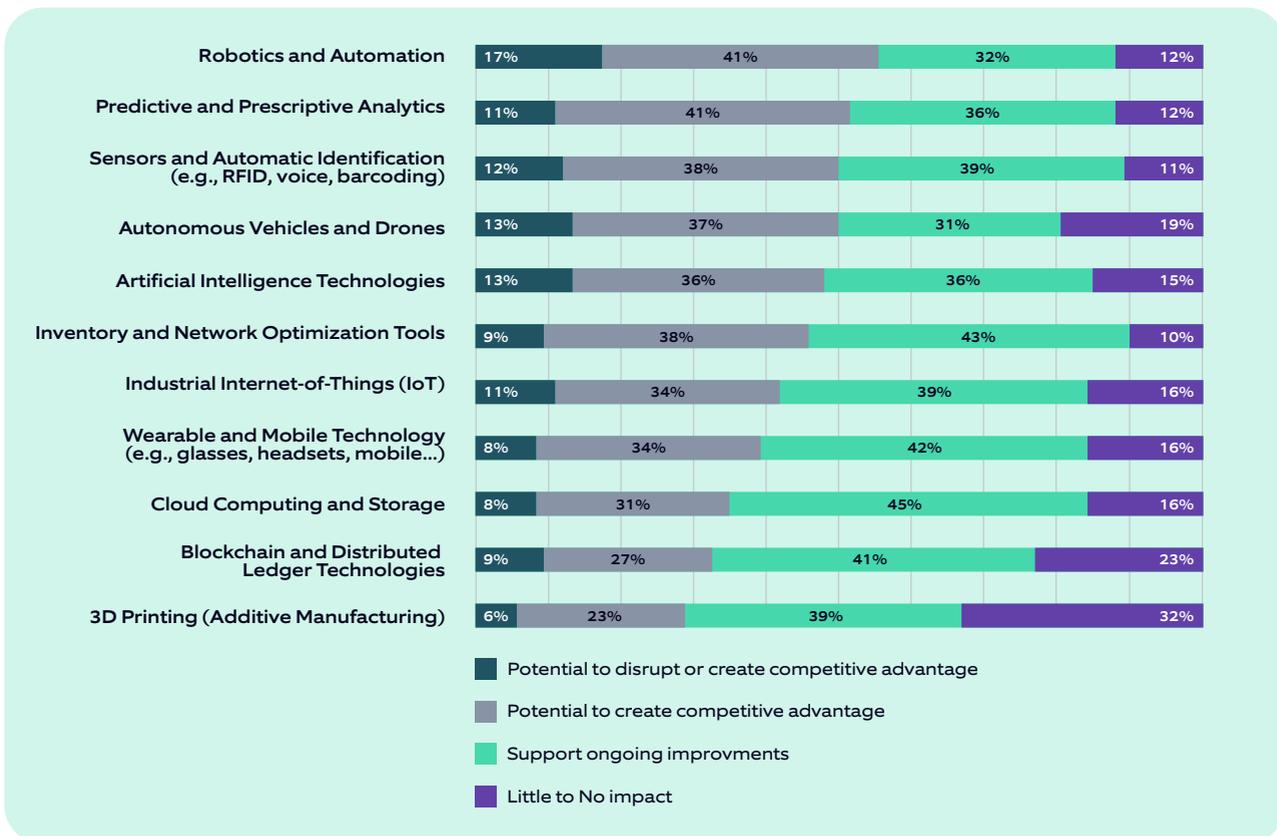- Support ongoing improvments
- Little to No impact

Fig 5: Impact of technologies on supply chain

Nagarro's solutions for the logistics industry

Nagarro has extensive expertise and client experience in the AI/ML and logistics domains. Based on that, we have developed innovative solutions for the logistics industry. Some of them are:

AI-enabled route optimization

Nagarro has developed AI-enabled route optimization accelerator for last mile delivery. Our solution allows the route planner to configure input parameters such as vehicles' capacity, drivers' availability, and deliveries. It targets to achieve maximum delivery time SLAS while reducing the total distance driven and increasing route density and drop size by clubbing deliveries based on location, proximity, delivery time window and order specifications. It also helps achieve better load utilization by optimizing the number of vehicles needed and utilizing their capacities.

Cargo packing decision support

We have also developed a cargo packing decision support system, which optimizes space utilization in a ULD (unit load device) for air cargo companies. It is a ML-based solution with intelligent arrangement of packages into the container using a 3D best fit heuristic algorithm satisfying several constraints. If the packages can not be fitted, the likelihood of fitting the packages is calculated using utilized space of ULD and packages. The solution leads to reduction in cost and efficient capacity planning.

AI-assisted cargo booking

We also have an AI-assisted cargo booking accelerator, which simplifies the task of cargo booking agent who receives huge number of unstructured emails every day for cargo booking. The accelerator utilizes natural language processing and machine learning capabilities for parsing incoming emails, provide recommendations, and integrating with booking services to automate the booking process, thereby reducing the manual interventions.

Intelligent inventory planning

Nagarro's AI-based intelligent inventory planning accelerator facilitates intelligent inventory planning to avoid overstocking and understocking scenarios and be faster to the market without blocking the working capital. It utilizes machine learning model to predict the future sales based on past sales and exogenous factors. Output of the ML based forecast model (forecasted future sales) becomes an input for the Reinforcement Learning model which further decides whether to place an order to fulfill the forecasted sales. RL model works on the state of parameters such as current Inventory, GIT (goods in transit, lead time, etc.). Further, this model learns correct action by minimizing the total costs (holding cost, order cost and out of stock cost) and improve continuously.

Endnote

Artificial Intelligence (AI) gives a competitive advantage to supply chain businesses with beneficial and affordable transformation. It improves company processes and accuracy, driving cost-effectiveness.

The transportation and logistics sector is already moving towards smart infrastructure and transportation with new vehicle technology and autonomous driverless trucks/drone ships. We feel in the next 5-7 years, AI can fully evolve this sector and add significant economic value.

Do you think AI can add value to your business? Let's talk!
You can email us at explore.tnl@nagarro.com

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About Nagarro

In a changing and evolving world, challenges are ever more unique and complex. Nagarro helps to transform, adapt, and build new ways into the future through a forward-thinking, agile and caring mindset. We excel at digital product engineering and deliver on our promise of thinking breakthroughs. Today, we are 19,000 experts across 34 countries, forming a Nation of Nagarrians, ready to help our customers succeed.

For more information, visit www.nagarro.com.