ARTIFICIAL INTELLIGENCE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT ETHICAL IMPLICATIONS IN AUTOMATION, TRANSPARENCY & SUSTAINABILITY

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ARTIFICIAL INTELLIGENCE IN LOGISTICS

Dr. M. Jeeva
Assistant Professor in B.Com – Banking and Insurance
NGM College, Pollachi
mjeevacademic@gmail.com

Abstract

Artificial Intelligence (AI) is a technology that is rapidly transforming the logistics industry. It refers to the use of algorithms and machine learning to automate and optimise various logistics processes and is already being used to automate routine tasks and provide insights that were previously impossible to achieve.Artificial intelligence is particularly well-suited for logistics due to the industry's extensive networks.

Predictive maintenance is a critical area in which Artificial Intelligence is transforming the logistics industry since downtime can be costly in delays and lost revenue. Predictive maintenance is a proactive approach to maintenance that uses data analysis and machine learning algorithms to predict when maintenance is required, helping logistics companies to identify problems before they occur. AI can streamline fulfillment in several ways. One way is by automating repetitive and time-consuming tasks, such as sorting, labeling and packaging, which can save valuable time and reduce errors. Route optimisation is a critical aspect of logistics, as it determines the most efficient route for goods to travel from one point to another. In logistics, this is done by considering various factors such as distance, traffic conditions and delivery schedules. Inventory management is a critical function for any ecommerce business. The success of an ecommerce business depends partly on how effectively it manages its inventory. Demand forecasting is a crucial aspect of supply chain management, especially for ecommerce businesses. Accurate demand forecasting can help ecommerce businesses optimise their inventory levels, improve their supply chain planning and minimise the risk of stockouts and waste.

Keywords: *Predictive maintenance, streamline fulfillment, Route optimization, Inventory management, Demand forecasting*

Artificial Intelligence in Logistics

Artificial Intelligence

Artificial Intelligence (AI) is a technology that is rapidly transforming the logistics industry. It refers to the use of algorithms and machine learning to automate and optimise various logistics processes and is already being used to automate routine tasks and provide insights that were previously impossible to achieve!

Artificial intelligence is particularly well-suited for logistics due to the industry's extensive networks. By analyzing data, AI can predict future production and transportation volumes, leading to more efficient resource utilization. Consequently, tasks are being delegated to self-learning digital systems at an increasing pace.

Challenges in AI adoption

Despite clear benefits of implementing AI throughout the logistics journey; from demand forecasting and supply chain management through to fulfillment and last mile, many businesses face several challenges that can be barriers to adopting AI technology.

These challenges present themselves across strategic and operational hurdles, process clarity and governance structures, deciding what to focus on using AI and ensuring necessary data types and interfaces (APIs) are established.

Cost of implementation and maintenance

Firstly, implementing AI technology often requires significant investment in hardware, software and infrastructure, which can be costly. Research shows that in 2023, companies will spend an average of 267 euros per employee on software, meaning businesses must make careful considerations around employee expenses and company overheads.

Additionally, ongoing maintenance, updates and training may be required to ensure that the AI system is functioning properly and providing accurate results, which can also add to the overall cost. For smaller companies or those with limited budgets, these expenses may be prohibitive and prevent them from fully adopting AI technology.

Lack of resources

Since AI is a relatively new technological phenomenon, many businesses lack the necessary technical expertise or resources to implement and manage AI systems effectively.

All the way back in 2011, a study by McKinsey & Company estimated that by 2018, the United States alone would face a shortage of 140,000 to 190,000 people with deep analytical skills, rendering aspects of AI pointless if the big data it yields is incomprehensible. They also estimated that 1.5 million managers and analysts would lack the know-how to use the analysis of big data to make effective decisions.

Clearly, education is a core barrier to entry since the cost of hiring and training employees who are skilled in AI technology, further increases the overall cost of implementation and maintenance mentioned above.

"People must therefore be trained on how to use the respective solution in everyday work." - Digital Business.

Concerns around privacy and security

When using AI systems to handle sensitive customer data, historical cybersecurity breaches have left businesses lacking in confidence when it comes to technology solutions. In this case, it's important to consider if AI is appropriate to embed - some processes may lend themselves to other forms of automation.

For example, in April 2021, drinks giant C&C Group subsidiary shut down IT systems following a security incident. Despite Bulmers' IT team reacting quickly, shutting down all IT systems, as per the cybersecurity response plan, the operational impact was astounding. The company was left fulfilling orders manually over phone calls whilst it restored its online capabilities!

Ways to use Artificial Intelligence in Logistics

1. Predictive Maintenance and Artificial Intelligence

Predictive maintenance is a critical area in which Artificial Intelligence is transforming the logistics industry since downtime can be costly in delays and lost revenue. Predictive maintenance is a proactive approach to maintenance that uses data analysis and machine learning algorithms to predict when maintenance is required, helping logistics companies to identify problems before they occur.

It is a technique used to predict when maintenance tasks, such as equipment repairs or replacement, are required. This is done by analyzing data and identifying patterns that indicate when maintenance is likely to be needed.

By combining historical data and current data, businesses can make intelligent decisions, address problems before they become serious and cause downtime. It's highly cost-effective, saving roughly 8% to 12% over preventive maintenance and up to 40% over reactive maintenance (according to the U.S. Department of Energy).

AI is used in predictive maintenance to analyze large volumes of data and identify patterns that are not easily recognizable by humans. For example, AI can be used to analyze the data from machines such as conveyor belts or forklifts to identify patterns that indicate when maintenance is required. This could include changes in the machine's temperature, vibration, or other factors that may indicate a problem is developing.

By using AI to analyze this data, businesses can identify issues before they become serious and take preventative action that minimise business disruption. Not only can predictive maintenance save physical machinery, but it can be a valuable approach for updates and maintenance of IT infrastructure, ensuring optimal performance and minimizing downtime. By leveraging AI and predictive analytics, businesses can proactively monitor and assess the health of their IT systems and infrastructure components.

This involves collecting and analyzing data from various sources, such as system logs, performance metrics and historical patterns to identify potential issues or anomalies that may lead to system failures or performance degradation.

Benefits of AI in Predictive Maintenance

The use of AI in predictive maintenance is changing the logistics landscape and has numerous benefits for businesses, including:

Reduces Downtime: By identifying issues before they become serious, AI can help businesses avoid unplanned downtime of machinery and systems, which can be costly in terms of lost productivity and revenue.

Identifies Problems before they occur: AI can detect patterns and identify issues, helping to avoid equipment failure, unsafe working conditions and emergency repairs/replacements, which can be significantly more expensive than predictive maintenance itself. AI could also be used as a warning mechanism if addresses or other data points are not indicated correctly.

Improves Equipment Lifespan: By identifying maintenance needs early, AI can help businesses extend the lifespan of their equipment, reducing the need for costly replacements and improving the overall efficiency and effectiveness of logistics operations.

The use of predictive analysis in the logistics sector is becoming increasingly important as businesses seek to reduce costs and improve efficiency. By using AI to analyze data and predict maintenance needs, businesses can address issues before they affect operations and productivity.

2. How AI Streamlines Fulfillment

AI can streamline fulfillment in several ways. One way is by automating repetitive and time-consuming tasks, such as sorting, labeling and packaging, which can save valuable time and reduce errors.

AI can also optimise order picking and routing, reducing the time it takes to fulfil orders and improving delivery times, as well as analyse customer data to predict demand and optimise inventory levels, reducing overstocking and understocking.

Benefits of AI in fulfillment

By streamlining processes, businesses can improve their efficiency across the following areas:
Order Processing: receiving orders, verifying them and updating inventory systems. AI comes into play early on in the process for error identification in order data, with the ability to identify, for example, if an order has an unusual combination of items or an incorrect address. By detecting patterns and anomalies that may indicate potential errors in future orders, this can help reduce errors in order fulfillment, which can result in better customer satisfaction and fewer returns or complaints.
Picking and Packing: locating the items ordered, packing them and preparing them for shipping. Here, automated methods can reduce human error and optimise warehouse efficiency by collecting products that are shelved in the same location at the same time, even across multiple orders.
Shipping: AI is used in shipping to optimise carrier selection, transportation routes, labeling parcels, arranging transportation and sending the products to the customer, as well as to monitor shipment status and identify potential delays or issues.
Delivery: delivering products to the customer. We'll dig into this one in the next section...

3. AI and Route Optimization

We've all used Google Maps to find the most efficient way of traveling from A to B. Is it the most fuel-efficient route? The most economic route? Does it avoid tolls or motorways? This sort of route optimization has become second nature when we jump in our cars and head off to a new destination.

Route optimisation is a critical aspect of logistics, as it determines the most efficient route for goods to travel from one point to another. In logistics, this is done by considering various factors such as distance, traffic conditions and delivery schedules. By using AI to analyze large volumes of data, logistics companies can optimise their delivery routes to reduce fuel costs, improve delivery times and enhance driver safety.

AI is used in Route Optimisation

AI algorithms can process data from various sources such as traffic sensors, GPS tracking, and weather forecasts to determine the best possible route. For example, AI can be used to analyze real-time traffic data to identify the fastest route for delivery vehicles, considering both manually driven and autonomous vehicles. This includes considering factors such as road closures, accidents and congestion. AI can also be used to optimise routes based on weather conditions, taking into account factors such as rain or snow.

Benefits of AI in route optimisation

The use of AI in route optimisation has numerous benefits for logistics companies, including:
Reduces Fuel Costs: By identifying the most efficient routes, AI can help businesses reduce fuel costs, which can be a significant expense in logistics.

Improves Delivery Times: By selecting the fastest and most efficient routes, AI can help businesses improve delivery times, which can enhance the overall customer experience.
Enhances Driver Safety: AI can be used to optimise routes based on factors such as road conditions and weather, which can help enhance driver safety.

Overall, the use of AI in route optimization is becoming increasingly important in logistics. By using AI to analyze data and optimize routes, businesses can save time and money, while improving the overall delivery experience.

4 Inventory management with AI

Inventory management is a critical function for any ecommerce business. The success of an ecommerce business depends partly on how effectively it manages its inventory. However, inventory management can be a challenging task, especially for businesses that deal with a large number of SKUs (Stock Keeping Units).

Inventory Management

Inventory management is the process of managing and tracking the goods that a business has in stock. It involves managing inventory levels, ordering and restocking products, and ensuring that inventory is managed efficiently.

AI is used in inventory management

AI-powered inventory management systems can help ecommerce businesses make better inventory decisions by automating many of the manual processes involved. Traditionally, these manual processes include tasks such as physical counting of inventory, manual data entry for tracking inventory levels and manual reordering of items when stock levels run low. These processes can be time-consuming, prone to human error, and may not provide real-time insights into inventory levels and demand patterns.

On the other hand, AI can be used to analyze large volumes of data and provide insights into inventory levels, demand and supply in real-time. This includes analyzing data from point of sale systems, historical sales data and supplier data.

It can also be used to predict demand for products (more on this later), helping businesses to adjust their inventory levels and avoid overstocking or understocking. This can help etailers to reduce the costs associated with holding inventory and improve order fulfillment times.

Benefits of AI in inventory management

The use of AI in inventory management has numerous benefits for logistics companies, including:
Reduces Overstocking and Understocking: By analyzing data and predicting demand for products, AI can help businesses to avoid overstocking or understocking warehouses, which can result in increased overheads for storage or lost revenue for items in demand but not in stock.
Increases Accuracy: AI can be used to improve the accuracy of inventory data as it removes human error. This can help businesses to make better-informed decisions about inventory levels and order fulfillment.
Improves Order Fulfillment Times: By accurately predicting demand for products and managing inventory levels, AI can help businesses to improve order fulfillment times through faster picking and packing, identifying bottlenecks and optimising delivery routes, enhancing the overall customer experience.

As businesses seek to reduce costs, improve efficiency and provide better customer service, AI is an ideal solution for analyzing data and managing inventory levels.

5 AI in demand forecasting

Demand forecasting is a crucial aspect of supply chain management, especially for ecommerce businesses. Accurate demand forecasting can help ecommerce businesses optimise their inventory levels, improve their supply chain planning and minimise the risk of stockouts and waste.

However, demand forecasting can be a complex and challenging task, especially for businesses dealing with a large number of products and market segments. This is where artificial intelligence (AI) can make a significant difference.

Demand Forecasting

Demand forecasting is the process of predicting the future demand for a product or service. In ecommerce, demand forecasting is critical for businesses to optimise their supply chain operations and ensure they have enough inventory to meet customer demand, especially in peak seasons.

AI is used in Ecommerce Demand Forecasting

AI-powered demand forecasting systems can help ecommerce businesses make more accurate sales predictions and optimize their inventory levels, resulting in improved supply chain efficiency and better customer satisfaction. By analyzing vast amounts of data from various sources, including historical sales data, social media activity and market trends, AI can provide accurate predictions of future demand.

AI can also be used to identify patterns and trends in customer behavior, which can help businesses to adjust their marketing strategies and product offerings to better meet customer demand.

Benefits of AI in Demand Forecasting

The use of AI in demand forecasting has numerous benefits for ecommerce businesses, including:

Improves Accuracy of Sales Predictions: AI can provide more accurate predictions of future demand, helping businesses to better plan their inventory levels and supply chain operations.

Enables better Supply Chain Planning: By accurately predicting future demand, businesses can optimise their supply chain operations to ensure they have enough inventory to meet customer demand while minimising waste and stockouts.

Helps Reduce Waste and Minimize Stock outs: AI can help businesses to avoid overstocking or under stocking, eliminating the risk of lost revenue or increased costs.

Overall, the use of AI in demand forecasting is transforming the way ecommerce businesses operate. By leveraging AI to analyze data and predict future demand, businesses can optimize their supply chain operations, improve customer satisfaction and increase revenue.

Research shows that "successfully implementing AI-enabled supply-chain management has allowed early adopters to improve logistics costs by 15%, inventory levels by 35% and service levels by 65%, compared with slower-moving competitors." According to DataRobot, "AI can reduce costs and minimize supply chain challenges by driving more informed choices across all aspects of supply chain management."

References

1. https://en.codept.de/blog/5-ways-to-use-artificial-intelligence-in-logistics
2. https://spd.tech/artificial-intelligence/ai-in-logistics-transforming-operational-efficiency-in-transportation-businesses/
3. https://transportlogistic.de/en/industry-insights/detail/artificial-intelligence-revolutionizes-logistics.html
4. https://www.oracle.com/in/scm/ai-in-logistics/
5. https://www.eliftech.com/insights/ai-in-logistics-explained/
6. https://throughput.world/blog/ai-in-transportation-and-logistics/