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

Volume - II

Editors in Chief

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ROLE OF ARTIFICIAL INTELLIGENCE IN SUPPLY CHAIN

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Abstract

The last century brought significant changes to the automotive industry and represents a significant economic and technological force in the life of countries connected to the industry. Digitalization, automation, Internet of Things, Big Data applications are forming the current business models and challenging the companies to adopt to the new ERA. From Industry 4.0 grow out the Logistic 4.0 or Supply Chain 4.0. Logistics 4.0 - much more than having the right products at the right time and in the right place. The different AI use cases and solutions review will present the complexity of the Supply Chain and Logistics

Keywords: *Supply Chain Management, Artificial Intelligence, Industry 4.0, supply chain 4.0, Machine Learning, inventory*

Introduction

The concept of digitizing everything is becoming a reality. Automation, artificial intelligence, IoT, machine learning and other advanced technologies can quickly capture and analyze a wealth of data that gives us previously unimaginable amounts and types of information to work from. Our challenge becomes moving to the next phase—changing how we think, train and work using data—to create value from the findings obtained through advanced technologies." Brian Householder, President and Chief Operating Officer, Hitachi Vantara. Industry 4.0 is defined by connectivity. In an Industry 4.0-capable factory, devices are connected to one another and to human interfaces and provide real-time data from a large number of sensors. People can "connect" to this data at any time. Today, most automotive manufacturers and suppliers have voluntarily embarked on the journey to Industry 4.0, and that journey will lead them to higher profitability. According to Automotive World, the sensors have been very useful in the supply chain. As an example, Bosch has achieved a 25% increase in production for its automatic brake stabilization (ABS) and electronic stability program by simply introducing smart, interconnected wires.

Objectives

- To identify the categories of AI solutions and techniques.
- To analyze the role of AI in supply chain management.
- To understand the various applications of AI in supply chain operations.

Categories of AI Solutions and Techniques

As common the use of AI is today, understanding AI and AI terminology can be a challenge as terminology is used interchangeably or even incorrectly. Defining what AI stands for is more than ever important in order to better understand and objectify the hype. AI can be defined as a discipline that applies advanced analysis and logic-based techniques, autonomous learning, to

interpret events, support and automate decisions and take actions. Depending on the techniques used, multiple subfields can be identified under the umbrella of the AI field. The different subfields are now than buzz word in the industries and organizations as real use cases in numerous corporations and industries can be found. The most common used subfields are the following:

Machine learning

Machine learning is used in applications or solutions to learn from data and improve their accuracy and efficiency over time without being programmed to do so. Machine learning uses algorithms that are trained to find data patterns in significant amounts of data in order to facilitate decision making or predict outcomes. The better the algorithms and the more trained they are, the more accurate decisions can be made.

Rule-based systems

Rule-based systems are used to extend the implicit and explicit know-how and knowledge humans. These techniques translate knowledge in a structured manner into human-made rules to store, sort and manipulate data. They use triggers to initiate action and interaction between systems. Rule based systems mimic human intelligence but contrary to machine learning they won't correct or enhance algorithms on its own, and a system will not 'learn' from its mistakes.

Robotics

Robotics has emerged over the last years as a very interesting subfield of artificial intelligence. Robotics Process Automation (RPA) determines the design, implementation, operating, and usage of software robots for executing tasks that might be labor intensive for humans or difficult to repeat steadily with quality. RPA doesn't make people redundant but act as virtual assistants to whom simple and repeatable tasks can be offloaded and hence free up time for more value added activities

Language Processing

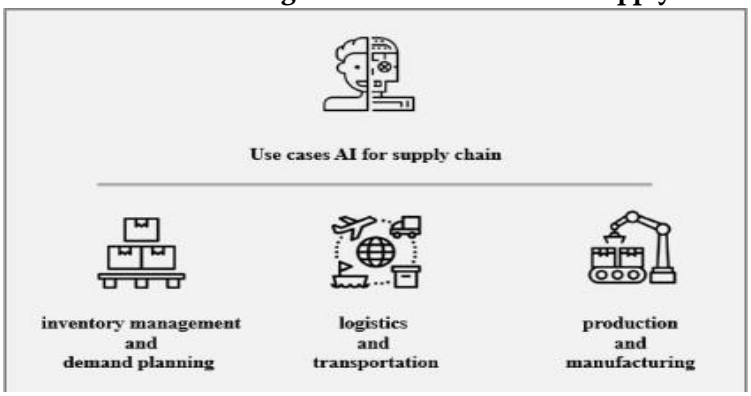
Language Processing is the part of computer science and AI and help communicating between computer and human by use of natural language. The system will be able to process human language and a computer to read and understand data by mimicking human natural language.

AI plays a significant role in modern supply chain management

- **Demand Forecasting & Planning**
  - AI analyzes historical sales data, market trends, and external factors (weather, economic conditions) to predict demand accurately.
  - Helps in **inventory optimization** to prevent overstocking or stock outs.
- **Inventory Management**
  - AI-powered **real-time tracking** ensures better stock control.
  - Reduces waste and storage costs by optimizing stock levels.

- **Logistics & Route Optimization**
  - AI algorithms analyze traffic patterns, weather conditions, and delivery schedules to **optimize routes**.
  - Reduces fuel costs and improves delivery times.
- **Predictive Maintenance**
  - Sensors and AI monitor equipment and vehicles to predict failures before they happen.
  - Minimizes downtime and extends asset lifespan.
- **Supplier & Risk Management**
  - AI assesses suppliers based on performance, reliability, and risks.
  - Helps identify disruptions in the supply chain before they escalate.
- **Warehouse Automation**
  - AI-powered **robotics & automation** speed up order fulfillment and packing.
  - Reduces human errors and operational costs.
- **Fraud Detection & Cybersecurity**
  - AI detects **anomalies in transactions** to prevent fraud.
  - Enhances cybersecurity by identifying vulnerabilities in supply chain networks.
- **Customer Experience & Order Fulfillment**
  - AI-driven chatbots and **personalized recommendations** improve customer interactions.
  - Faster and more accurate order processing enhances satisfaction.
- **Sustainability & Waste Reduction**
  - AI helps optimize supply chains for **eco-friendly logistics** and **waste reduction**.
  - Predicts and reduces excess emissions from transportation.
- **Block chain & AI Integration**
  - AI enhances **block chain-based supply chain transparency**.
  - Ensures **secure & tamper-proof** tracking of goods.

Concrete Cases where Artificial Intelligence could be value to Supply Chain 4.0



AI use cases for supply chain

AI use cases in inventory management and demand planning

Accurate inventory management is a crucial foundation of Supply Chain Management as it has a direct impact on the cash flow and profit margin of a company. Efficient inventory management will prevent over-or-under stock. Inventory management is one of the most typical machine learning use cases in Supply Chain Management. The ability of AI to handle, analyze

and interpret large data sets of real time data will contribute in efficiently forecasting supply and demand. Efficient inventory management has also a significant impact on customer satisfaction. Inadequate stock management can lead to product shortages and increased delivery times, which will negatively impact client relationships. AI can help optimize stock management and managing client demands adequately

AI use cases in logistics and transportation

Combined with IoT, AI can help track goods through the end-to-end logistics process. It can help Supply Chain professionals track the location of goods as well as create visibility on the conditions in which they were handled. The use of sensor technology can provide insights on important factors like temperature or humidity during transportation. By tracking weather and traffic conditions, AI can be used to give real-time route-optimization recommendations and in this way decrease transportation times and costs. Autonomous cars have the potential to transform logistics and decrease the dependency on humans. Companies like Tesla, Google and Mercedes Benz are investing heavily in the concept of autonomous vehicles for years. Autonomous trucks could be the next big thing for the transportation sector although it might take a while to mature. According to BCG estimations, only around 10 % of light trucks will drive autonomously by 2030.

AI use cases in production and manufacturing

AI can be used to identify product quality issues in the early stages of the production process. By the use of computer vision a product can be compared to an ideal mock-up piece and assess the required level of quality before it reaches the client. Audi - for example - uses machine learning to recognize and mark the finest cracks in sheet metal parts— automatically, reliably and in a matter of seconds. With this project, Audi is revolutionizing the testing process in production through AI. Another use case of AI in manufacturing is predictive maintenance of equipment based upon real-time data rather than a predefined maintenance calendar. By improving asset maintenance, Supply Chain professionals can significantly decrease maintenance costs. General Motors – for example - decided to add AI technology to their assembly chains in order to detect component failures and hence maintenance needs upfront.

Conclusion

AI technologies such as predictive analytics and machine learning have significantly enhanced decision-making and operational efficiency in supply chains. Real-time data analysis and optimization of various supply chain processes have improved resource management and reduced operational bottlenecks. AI has introduced significant operational enhancements in logistics and supply chain management by providing real-time monitoring, predictive maintenance, and optimized logistics solutions. As AI technology continues to evolve, its impact on supply chains will only grow, making them smarter, more agile, and better equipped to handle future challenges. Businesses that embrace AI-driven supply chain solutions will gain a competitive edge in an increasingly dynamic and globalized market.

References

1. Adama, Henry Ejiga, Oladapo Adeboye Popoola, Chukwuekem David Okeke, and Abiodun Emmanuel Akinoso. "Economic theory and practical impacts of digital transformation in supply chain optimization." International Journal of Advanced Economics 6, no. 4 (2024): 95-107.
2. Odimarha, Agnes Clare, Sodrudeen Abolore Ayodeji, and Emmanuel Adeyemi Abaku. "The role of technology in supply chain risk management: Innovations and challenges in logistics." Magna Scientia Advanced Research and Reviews 10, no. 2 (2024): 138- 145
3. The Internet Of Things Delivers Value Throughout The Supply Chain; Paul Miller and Michele Pelino/Forrester February 23, 2021
4. Research Overview: Artificial Intelligence- A Guide To Navigating Our AI Technology Research Portfolio; Srividya Sridharan /Forrester May 20, 2020
5. The Future of Commercial Vehicles How New Technologies Are Transforming the Industry; Andreas Jentzsch, Joel Janda, Gang Xu, Peter Wiedenhoff, and Andreas Girisch/Boston Consulting Group October 17, 2019
6. 3 ways AI can help solve inventory management challenges; Chloe Chang /IBM March 4, 2020 Supply Chain 4.0 – the next-generation digital supply chain; Chloe Chang /McKinsey & Company October 27, 2016
7. Ways AI is Impacting the Supply Chain; Lucy Benton / Beyond Supply Chain September 27, 2018 Artificial intelligence in supply chain management: theory and applications; Hokey

Web Sites

1. https://kodiakrating.medium.com/6-applications-ofartificial-intelligence-for-your-supply-chainb82e1e7400c8
2. www.logisticsmgmt.com
3. www.supplychaindigital.com
4. www.dhl.com