

Using Artificial Intelligence in Supply Chain

Emeliane Gogilidze, Natia Gogilidze
Georgian Technical University

Introduction

Advances in technology have significantly increased the availability of the technical and software tools needed to create services based on artificial intelligence. **AI (Artificial Intelligence)** is capable of forever changing almost any job or traditional approach to business process management.

Today's consumers always speak up and defend their rights when choosing brands and products. It's not a limited concept of quality of a particular product, it includes the source of materials, the processing stage and finally the delivery to your doorstep. Unfortunately, traditional supply chains have a very negative impact on the environment and, as emissions, waste and resource scarcity show, are a problem. But is it possible to find a solution that reduces the negative environmental impact of these complex networks while increasing efficiency and reducing costs? - Yes, with **AI** it is possible. This powerful technology is beginning to change **SCM (Supply Chain Management)** and is now seen as a game changer that can change the current business environment and give rise to more sustainable approaches using **AI** in sustainable supply chains.

The use of AI describes a more efficient and productive process by extrapolating data to explain areas of improvement in imperfect systems of value creation, emissions and resource utilization in the supply chain.

AI can help anticipate demand, find shortcuts to suppliers, determine which parts and equipment require maintenance, and find sustainable supplies. It is worth noting that AI helps to reduce the negative environmental impact of enterprises. Thus, it can be much more efficient in logistics for a given level of emissions, lead to increased resource efficiency through smart packaging and material recycling, or even enable closed-loop recycling.

Key words: Supply Chain Management, AI, Intelligent Transportation System (ITS), management of transport systems, payment transport systems, automated control system.

1. Unsustainable practices in traditional supply chains

The expansion of the classical supply chain model (primarily through supply chain efficiency and cost reduction) has had a significant negative impact on the environment. Let's delve into the specific problems caused by these unsustainable practices (Fig. 1):

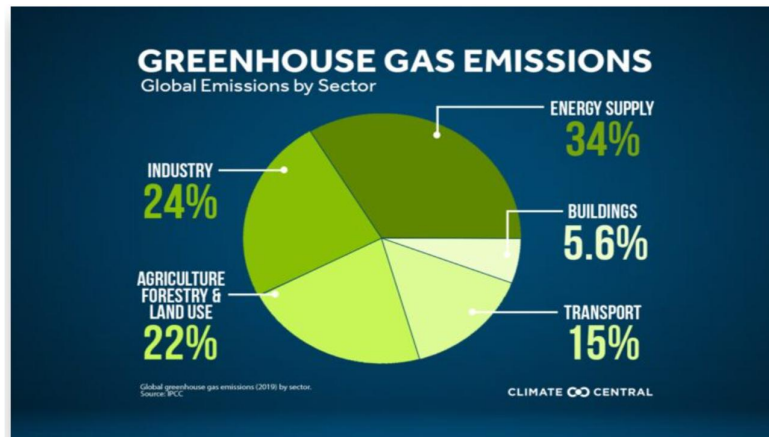


Fig.1. Emissions of greenhouse gases

Supply chains established under traditional practices emit a significant amount of greenhouse gas emissions. These include emissions from:

1. **Transportation:** gas emissions from vehicles, especially those used to transport goods over long distances, such as trucks, ships and airplanes, are another important contributor to air pollution and global warming.
2. **Manufacturing:** large industries use large amounts of energy in their operations, and most of them use fossil fuels, which emit CO₂.
3. **Storage and distribution:** faulty storage, dry terminals and unnecessary transportation from one storage facility to another also contribute to emissions.

2. The potential of AI in supply chains

While several industries are still struggling to overcome the post-pandemic effects, there are a few industries, like supply chain, that took the opportunity to adopt these modern technologies at a large scale [1-6]. With the potential to revolutionize processes, decision-making, and overall efficiency, AI is one of the top advanced technologies that businesses must utilize to stay ahead of the curve. Data from Statista shows that AI for the supply chain solution market has resulted in better inventory management, smart manufacturing, dynamic logistic systems, and real-time delivery controls, which has led to its widescale adoption (Fig. 2):

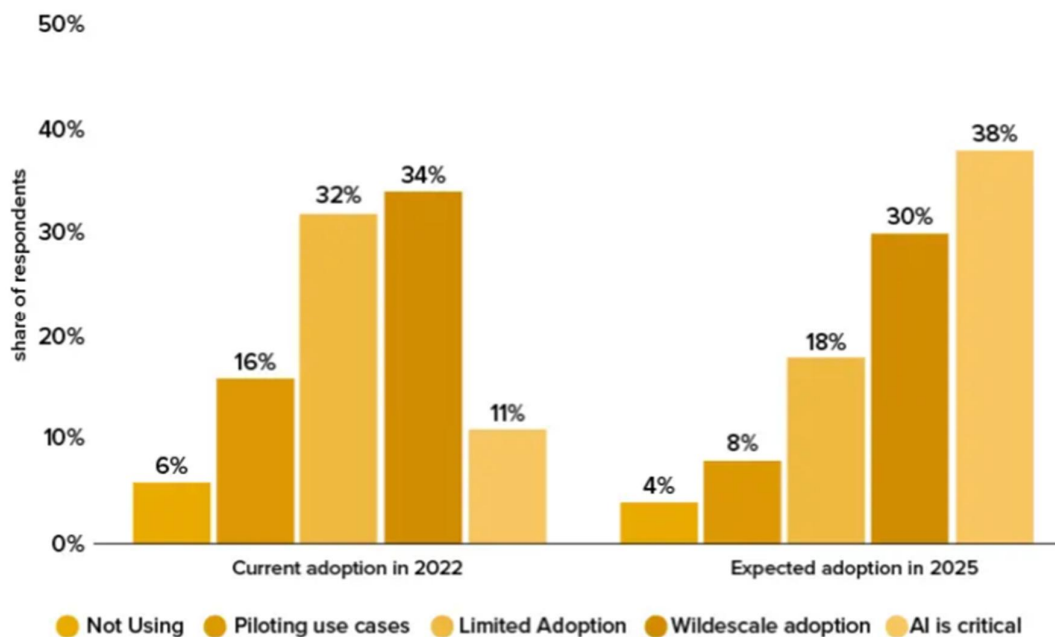


Fig.2. AI adoption rate in supply chain globally

The main objective of using AI in the supply chain and logistics is to increase efficiency and productivity. This introduction of AI in supply chain management has led to more sustainability, making every enterprise wonder if digital transformation can benefit their supply chain business [7-10].

A recent study conducted by McKinsey says that implementing AI in logistics and supply chain management has led to significant improvements. This demonstrates the potential of artificial intelligence in supply chain management to revolutionize the industry and its importance in the modern business landscape.

3. Understanding the Role of Data Analytics in Supply Chain Management With Examples

Using AI and data analytics for supply chain using advanced algorithms and machine learning techniques, businesses can extract valuable insights that help in making informed decisions. Enterprises that use supply chain data analytics solutions can aim to make the supply chain business more:

- **Instrumented** – machine-generated data flowing out of IoT devices.
- **Intelligent** – more accurate and competent assumptions with the help of data analytics and modeling.
- **Interconnected** – extensive connectivity for better decision-making (Fig. 3):

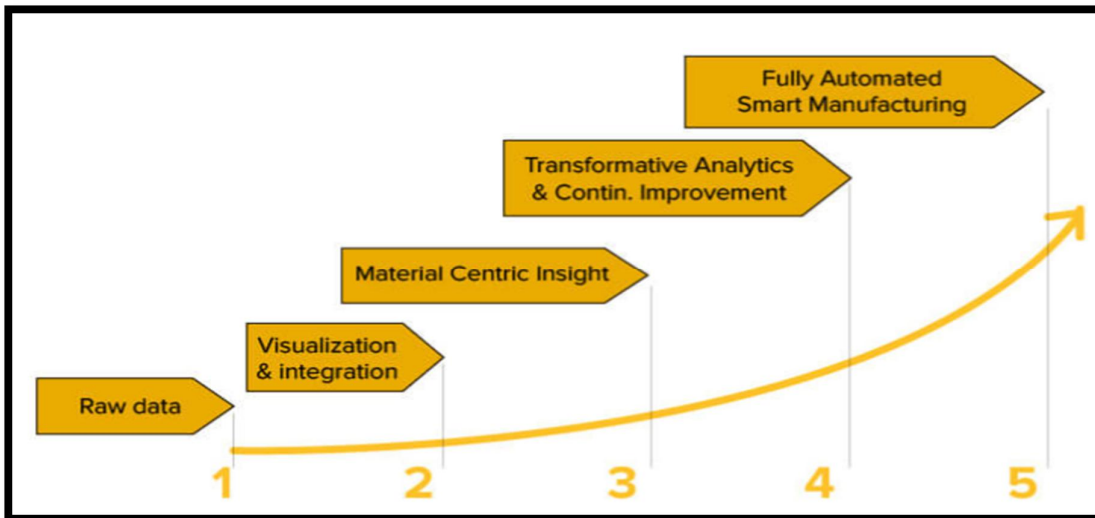


Fig.2. AI driving the smart supply chain management

The supply chain data analytics solutions help optimize the workflow where large amounts of data can provide forecasting, identify inefficiencies and drive innovation. Here are some of the top supply chain data analytics examples that you can follow to make insightful data-driven decisions for your supply chain business [11-17].

1. Predictive Analytics - predictive analytics is a technique that leverages the power of statistical modeling and regression analysis to identify and understand trends from historical data in order to make predictions about future trends. This helps supply chain companies predict the most likely future outcome and its business implications. For instance, using predictive analytics to mitigate risks and disruptions.

2. Descriptive Analytics - descriptive analytics is a form of data mining that involves the analysis of large datasets to identify patterns and generate summaries that allow users to gain insight into a given situation. This type of analytics utilizes historical data to uncover trends and draw conclusions that can be used to inform decision-making. Descriptive analytics is another example that can help you understand the importance of data analytics in the supply chain. This helps provide visibility and certainty to all kinds of internal and external data across the supply chain management.

3. Prescriptive Analytics - prescriptive analytics is a powerful tool for supply chain operations, allowing for the exploration of how specific changes will affect outcomes. Through this, potential improvements can be identified and recommended, providing a valuable resource for optimizing supply chain operations.

This includes collaborating with logistic partners to reduce time and effort for maximum business value. One popular reference is the use of SRM (Supplier Relationship Management) as a prescriptive analytic approach.

4. Cognitive Analytics - if you wish to understand advanced analytics in supply chain management, cognitive analytics is the way to go. This is best used in enhancing customer experience and

relationships. The feedback data received through AI-driven systems is analyzed and executed in reports and dashboards to answer complex questions.

3. Solution: AI for sustainable development

Artificial intelligence can be a key tool for building smarter resource consumption, reducing and better managing waste, and creating a more inclusive and socially just society. However, moving to the next level of technology development will require joint work between governments, non-governmental organizations, philanthropic foundations, technology companies and organizations that collect or generate significant amounts of data. Analysts highlight a number of potential challenges associated with improving AI systems. For example, how effective AI turns out to be depends on the correctness of the data collected, methods of "training" the neural network and the level of data bias.

Experts from McKinsey Global Institute note that AI can both offset biases inherent in humans and reproduce and scale them. Biases "get" into AI algorithms in the process of training - they are contained in the information in the network on which the model is trained, or the specialist training the neural network selects data in such a way that they reflect his vision. To smooth out such inaccuracies, machine learning experts are trying to develop various "honesty" metrics that will allow the algorithm to remain neutral towards different social groups. However, the authors of the paper emphasize, this is a complex work that also includes revisiting the factors that influence complex decision-making by humans themselves.

In order to create the most honest AI possible, experts advise:

1. Understand where AI can mitigate biases and where it can exacerbate them;
2. Implement processes and practices that will help identify and mitigate biases;
3. Engage in dialog about potential biases in human decisions;
4. Seek the best ways for machines and humans to interact;
5. Invest more in bias research, provide more data for research, take a multidisciplinary approach;
6. Invest more in diversity in the AI field as a whole (Fig. 3):



Fig.3. Optimizing logistics and supply chains with AI

In 2019, the European Commission published guidelines for trustworthy AI, the authors of which highlighted three main aspects:

- legality: AI must comply with all applicable laws and regulations;
- ethics: AI must be guaranteed to follow ethical principles and values;
- reliability both in technological and social terms, since even when used with good intentions, AI can cause harm [18-20].

4. Biases in AI models:

One of the facts about AI algorithms is that they can learn from the data entered into them. This means that they will have assumptions or biases built into them about the data entered into them, leading to unfair or unstable results:

- Supplier selection bias: this is evidenced by the way modern artificial intelligence systems work by providing historical data in favor of suppliers and making cost the sole determinant. Diversification of the dataset and elimination of systematic errors are needed to build the model.
- Environmental impact bias: there's evidence that some processes may need more detail on their environmental impacts. Focusing on fuel use may obscure other important aspects such as water abstraction or waste production. Thus, data collection should be methodical and systematic.

5. Conclusion

The sustainability imperative is no longer an option, but it is a must on any business' list of strategic needs. Traditional supply chains have a big impact on the environment and customers are starting to realize this. Recently, artificial intelligence has become an important tool in this change and is key to a more sustainable future.

In this way, AI strengthens supply chains and makes companies more sustainable, including by minimizing the use of resources. The application of artificial intelligence in supply chain management improves some operations such as logistics and closed loop systems. The case studies we reviewed demonstrate measurable returns as businesses are now empowered to utilize AI in sustainable supply chains.

In essence, AI improves business sustainability because it increases efficiency and eliminates wasteful protocols. This means less environmental impact and a smarter solution for supply chain management.

I believe that the future of supply chains is in deep learning algorithms. They will be able to analyze a combination of different factors, determine which products are at risk, and develop risk minimization strategies that will help the organization gain a competitive advantage by providing customers with reliable goods and services at the lowest price.

To achieve this level of maturity, it will be necessary to build a high level of interaction with partners. This will ensure that the necessary information is collected in a timely manner and loaded into a deep learning model. This is the model that analyzes and proposes a supply chain management plan. While this technology is still in development, there are many arguments in favor of participating in its development right now. Companies that decide to take this step will be able to use the opportunities of deep learning in supply chains to their maximum advantage in the future.

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