

# An Investigation: How Artificial Intelligence can be Used with Supply Chain Management to Improve Business

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**Abstract:** The next stage of development for AI and data science is already exhibiting evidence of being successful. While many industries are still trying to cope with the aftereffects of the pandemic, selected businesses have grabbed the opportunity to extensively apply cutting-edge technologies. One of these industries is the supply chain industry. Recent studies indicate that the application of artificial intelligence in supply chains has resulted in increased industrial efficiency, as well as improvements to dynamic logistical systems and real-time delivery management. In this article, the author does a comprehensive review of the relevant previous research in order to evaluate the effects that artificial intelligence (AI) will have on supply chain management (SCM). This research intends to identify the current and potential AI strategies that may enhance both the study and practise of SCM in order to fill the current scientific gap of AI in SCM. These AI strategies may improve both the study and practise of SCM. The following four subjects were given particular attention: the most common AI approaches in supply chain management; the possible Artificial intelligence techniques for employment in supply chain management; the subfields of supply chain management that have already benefited from AI; and the subfields that have a high potential for AI progression. This article provides comprehension by doing thorough research and making synthesis arguments.

**Keywords:** Supply Chain Management (SCM), Machine Learning, Internet of Things (IoT), Artificial Intelligence (AI),

## 1. Introduction

The management of supply chains is being revolutionized by Artificial Intelligence, which enables increased visibility, efficiency, as well as optimization. These advantages may be experienced by enterprises involved in the supply chain via the use of AI in a variety of different methods, ranging from intelligent models to automated quality checks<sup>[1]</sup>. The use of Artificial Intelligence will be essential to the process of developing the supply chain and adjusting to the issues that exist in the supply chain today.

### 1.1 Optimization Using Artificial Intelligence Simulations

Artificial intelligence excels in data analysis and prediction. AI simulations can improve supply chain processes and AI can identify operational bottlenecks and concerns. Supply chain companies may optimise processes without delays in a simulation. In 2021, Google created an AI-based digital twin technology to optimise supply chains and save money. These tools are great for every supply chain connection. A warehouse manager may digitally duplicate his whole facility<sup>[2]</sup>. He may test optimization ideas on that digital twin using an AI logistics simulation and finds the warehouse's best logistics plan without affecting operations.

### 1.2 Automated Management of Inventory

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The supply chain cannot function without warehouses as essential connections. If a warehouse is not operating properly or is not managing inventory in an efficient manner, it has the potential to generate major ripple effects that extend across the whole supply chain. Artificial intelligence has the potential to assist warehouses in automating their inventory management, which will save both time and money.

### 1.3 Supply Chain Cybersecurity

Supply chains need cybersecurity more than ever. In 2022, ransomware-as-a-service is a new underground market where hackers could purchase malware to quickly attack enterprises. Large corporations are not the only elements of the supply chain that are being negatively impacted by this. To avoid these dangers, supply chain management requires flexible, effective cybersecurity. Classification technique makes AI a powerful tool for this.

### 1.4 Artificial Intelligence Demand Prediction

AI also benefits manufacturers and merchants. These companies can employ Artificial Intelligence data analysis to predict supply and demand in subsequent quarters. Artificial Intelligence schemes can evaluation product demand by analyzing sales and customer data. Demand forecasting reduces supply chain pressure at every point<sup>[3]</sup>. Manufacturers don't need to overorder raw materials if they understand how much they'll need. Manufacturers get retailer orders which may decrease supply chain waste.

### 1.5 Waste as well as Error Reduction

AI can greatly reduce material waste and improve supply chain quality. Machine learning enables computer vision to automate complex tasks. AI and IoT can reduce waste and errors in supply chains quickly. A cardboard box manufacturer could automate quality control. An AI-powered camera may scan boxes as they pass through the production line, discovering flaws quickly without slowing production<sup>[4]</sup>. IoT devices might also track industrial raw material use. AI data analysis systems might utilise this data to determine where the most resources are consumed and wasted. These insights help companies utilise raw materials more effectively and decrease supply chain pressure.

### 1.6 Tracking Supply Chain Sustainability

The supply chain now prioritises sustainability. It benefits the environment and supply chain workers. Sustainability measures also reduce waste, which helps supply chains, especially raw materials suppliers. Artificial Intelligence can improve supply chain visibility. AI logistics algorithms optimise route and b by choosing the most effective shipping routes (land or sea) companies may lower their supply chains' carbon footprints. AI and IoT devices may also help companies monitor supplier reliability. AI algorithms can monitor a product's supply chain elements<sup>[5]</sup>. This would raise awareness and help firms identify sustainability issues. A manufacturer may use hazardous colours. AI helps businesses pick more sustainable suppliers.

### 1.7 Building a Smarter Supply Chain With AI

In the future, artificial intelligence will play a crucial role in the process of developing supply chain procedures in order to construct a supply chain that is more effective and sustainable. AI may be used by businesses at every stage of the supply chain in order to automate procedures, enhance operations, boost security, as well as make better use of raw resources. Any company involved in the supply chain may adapt to the problems of the modern-day if it has the appropriate technology available.

## 2. Literature Review

This section of the study covers the results of prior research as well as a literature review pertaining to artificial intelligence with SCM. The drive of this part is to offer some basic knowledge about the concept of the subject area. The first section provides a concise summary of SCM's background material. After that, the reader has an understanding of the primary aspects of SCM and is able to concentrate on outcomes while armed with information. The second section covers several areas of artificial intelligence in order to provide a foundational understanding of this topic. When searching for literature

pertaining to SCM, the terms "supply chain," "supply chain management," and "operations management" were used as search terms. The search results were evaluated by looking at the most recent editions and materials that were connected to the subject area. In light of the fact that material pertaining to SCM is readily accessible, a quick overview of the relevant literature will be provided<sup>[6]</sup>.

For the literature section, the books "Operations Management in the Supply Chain by Schroeder and Goldstein (2016) and Operations and Supply Chain Management" by Jacobs and Chase (2018) both include a significant amount of relevant material. Additionally, the decision levels of SCM are taken into consideration by making use of the many research papers and studies that are accessible on it. The paper by Krichen and Ben (2016) titled "Supply Chain Management and its Applications in Computer Science" was the one that was carried out as the research. The results of this research provide a computational viewpoint that will be useful for this study, which will explore decision levels in SCM. Wassim, who contributed in another study that was employed, provided a metaphorical grasp of decision levels and elements in general for the study<sup>[7]</sup>.

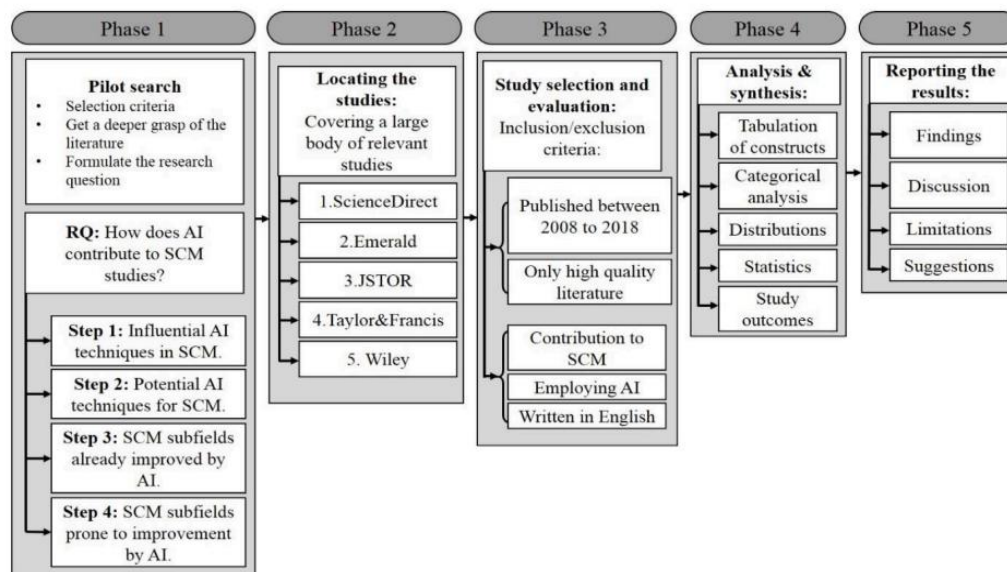
Researcher looked for articles and books on the subject of AI in SCM by utilising keywords and phrases that were pertinent to the discussion at hand. As an example, use the phrase "artificial intelligence in supply chain management." The study has to make it clear that the evaluation of AI capabilities uses the same criteria for judging all of the outcomes. The outcome of this investigation was a publication by Min titled "Artificial Intelligence in Supply Chain Management: Theory and Applications" (2010). Among the goals of Min's study are the elucidation of many sub-fields of artificial intelligence expertise and the investigation of the most appropriate methods for SCM to achieve greater levels of productivity. In addition to this, it provides a concise summary of recent developments and investigates possible applications to SCM. Despite the fact that the study was written and published a decade ago, it still provides a solid foundation for this study and important data thirteen on applications that may be employed in Supply Chain Management. This study may be used since the theory and applications of artificial intelligence relate mostly to the same basis today. The work by Min investigates the integration of AI with SCM, which provides a helpful new viewpoint for the present investigation<sup>[8]</sup>.

Min titled "Artificial Intelligence in Supply Chain Management: Theory and Applications" (2010). During this phase of conducting a literature review, a great number of articles, studies, and research papers were looked over. A comparison of information that is valuable

and information that is not valuable was carried out by taking into account the following factors: relevancy, quality, researcher background, research date, resemblance with the subject area, rationality, and numerous other elements. The primary literatures were reviewed, and in order to maintain a critical stance towards the sources that were picked, it was necessary for those materials to be recent, informative, trustworthy, and of great quality<sup>[9]</sup>.

### 3. Research Methodology

In order to get beyond the identified limitations of a systematic evaluation or an professional valuation with ad hoc literature choice, the technique used by this research was to conduct a systematic literature review that was evidence-informed. Researcher followed the five-step procedure, which included conducting a pilot search during the first phase of the process in order to obtain a deeper knowledge of the current literature, build the standards for literature range, as well as originate the study questions and the various steps. As an outcome of this, the method of systematic review that researcher used may be broken down into five distinct stages, as shown in Figure 1.



**Fig. 1.** Research procedure of methodical literature review.

#### 3.2 Locating the studies

Designers choose search engines and keywords to find relevant research. ScienceDirect, Wiley Online Library, Taylor & Francis, Emerald Insight, and JSTOR were chosen since they include a lot of peer-reviewed literature relating to our study subject. These databases were searched for topic-related contributions. Rowley and Slack (2004) advise being precise with search strings. This research searched "artificial intelligence" and "keyword". Boyer and Stock's complete SCM definition

#### 3.1 Pilot search in addition to research interrogation

As mentioned above, they did a pilot search to better understand the area and literature. A specified search string in several publishers' e-databases yielded literary sources as shown in Table 1. Researcher utilised the pilot search to determine the standards for addition and elimination of works, as indicated in above Section. A well-defined, answerable question drives a comprehensive literature review. The most important and challenging component of research design is creating a research topic, which leads to choosing research techniques and procedures. A pilot search brought them to the research question: how can AI help SCM studies? Researcher broke this topic into 4 sub-research questions to address it: List SCM studies' most common AI methods. Identify SCM research AI methods<sup>[10]</sup>. List AI-improved SCM subfields and jobs, determine which subfields and tasks AI can enhance. Both analyse the literature to provide researchers and practitioners a detailed understanding of current knowledge and highlight research as well as practical improvement gaps to provide a study guide.

utilised "supply chain," "production," "marketing," and "logistics" as keywords (2009). To cater for the search algorithms of each database, every search engine made modest adjustments to the search procedures<sup>[11]</sup>. Emerald Insight, ScienceDirect, and Taylor & Francis searched the title, summary, and keywords, but not the abstract. "Artificial intelligence" AND "keyword 1" yielded results for Wiley Online Library and JSTOR. NOT "keyword 2", "keyword 3", or "keyword 4".

#### 3.3 Study selection and evaluation

To identify publications using diverse taxonomies, main search keywords were wide. 758 items met the pilot search parameters. Since most articles and many new trends as well as applications related to this issue were published between 2008 and 2018, the first criteria is the literature's temporal range. The second criteria are relevance and quality: just peer-reviewed journal, as well as conference papers, as well as conference papers were evaluated, as chapters, case reports, talks, and news pieces. Each manuscript was read by two authors to excluding book reviews, to verify quality. Another set of criteria eliminated irrelevant papers. Researcher created a custom article inclusion methodology to analyse titles, keywords, including abstracts of research to prevent missing relevant papers and establishing judgements that affected their relevance assessments<sup>[12]</sup>. Two reviewers examined an early sample of 50 abstracts, ensuring inter-code reliability to ensure selection criteria correctness. The articles were evaluated to the criteria, debated, and resolved if necessary. These criteria narrowed the analysis and synthesis list to 64 publications.

#### *3.4 Analysis and synthesis*

Researcher divided the 64 articles into sections based on features related to our study topic to analyse them. The SCM field; the subfield; the artificial intelligence technique; the results and conclusions; and the industry the research intends to enhance are these features. They identified and described characteristics' relationships for synthesis.

### **4. Result and Discussion**

As globalisation continues, businesses are focusing their attention on improving the flexibility and efficiency of their supply chains. This maintains the pressure on business sectors to rise, as well as the pressure on businesses that are not yet witnessing the benefits of adopting artificial intelligence. Many people in the manufacturing section are already experimenting with the artificial intelligence miracle, and others are concerned in integrating it in their work. This section discourses how artificial intelligence is having an impact on flexible chain executives due to record inspection subjective investigation tactics.

#### *4.1 AI in SCM*

Many companies use automated logic to link the board. Siemens and Amazon use smart automatons and AI

mechanical autonomy in their flexible chain frameworks. Most AI involves mechanical autonomy, and elegant chain programming is being developed. AI's potential is often discussed, yet there is no guidance on using it. Researchers know not all companies can innovate. While using AI, managing numerous flexible chaining activities is difficult.

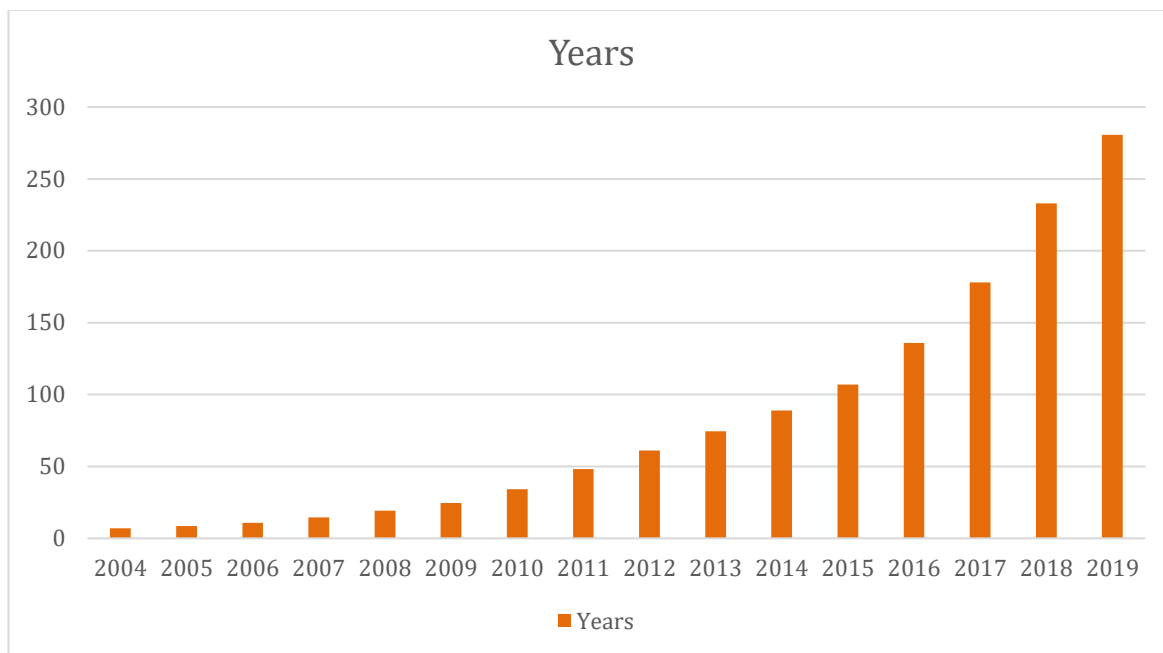
The management of actions to reduce costs and increase customer value is referred to as flexible chain management. Automation and augmentation are enormously useful for their respective applications in efficiently chained processes thanks to an understanding of computer programmes that use artificial intelligence<sup>[13]</sup>. Artificial intelligence (AI) has the potential to automate several processes, including demand, inventory, and supply, with just minimum involvement from humans. It will analyse weather and traffic data to boost demand and supply. AI may help plan and promote product lines. It is very necessary to possess these pre-essentials in order for an endeavour to be successful and for artificial intelligence to be implemented into a flexible chain board.

#### *4.2 The influence of AI in SCM*

Reasoning that is entirely artificial has been developed and used in a variety of domains, most notably the management of supply chains. owing to the fact that everyone in the area of SCM has been inspired by AI. The use of artificial intelligence in the management of supply chains has resulted in a significant increase in efficiency for companies like Amazon and Amer Sports. This section will look at the data that Amazon and Amer Sports, two firms that use artificial intelligence in their supply chain management, have collected. Amazon is one of the most well-known names in online retailing, while Amer Sports is a well-known retailer of athletic products.

##### *4.2.1 Amazon*

Various areas, most notably the management of supply chains, have benefited from the development and use of artificial intelligence. As a result of the fact that AI has dazzled everyone working in SCM. Both Amazon and Amer Sports have found that using AI in their SCM has resulted in a significant number of positive outcomes for the companies. Using artificial intelligence in their supply chain management<sup>[11]</sup>, the organisations Amazon and Amer Sports' data will be compared and contrasted in this chapter. Amer Sports is a firm that sells athletic gear, and Amazon is a massive online retailer.



**Fig 2.** Sales of Amazon from 2004 to 2019.

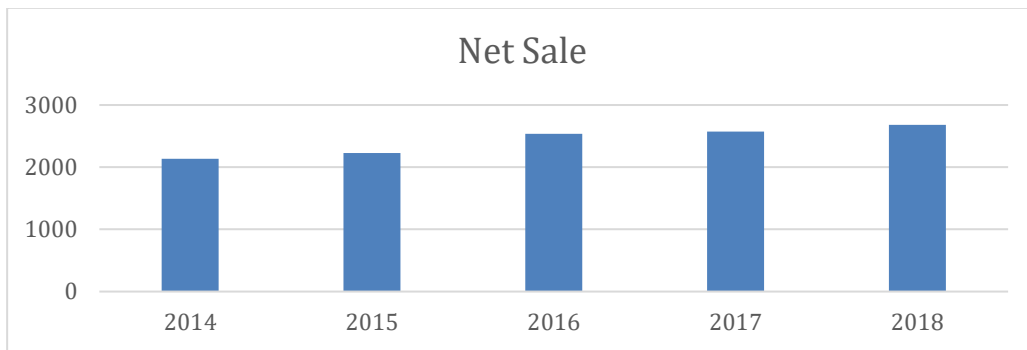
Amazon's co-ordinations will use man-made thinking and autonomy, but when is uncertain. AI-powered machines will perform most of the labour. Amazon distribution centre automation is at least 10 years away, according to Scott Anderson, head of application autonomy satisfaction. (2019) Most companies are coordinating their distribution centre duties to improve efficiency and save costs. Robotic distribution centres are productive, flexible, fast, and sturdy. To maintain the optimal material flow, such systems must restrict, transport, and recover data. (2019) The organisation just uncovered another way to use robots in labour tasks formerly done by humans<sup>[14]</sup>. Amazon Robotics, a subsidiary of Kiva Systems that Amazon acquired for \$775 million, began sending robots to its transport hubs in 2014. Amazon has 100,000 real-world robots. (2017) AI recognition is heavily investigated in warehouse automation. Research and industry want to automate warehouse tasks like bin picking using AI and robots. Amazon holds a "bin picking challenge" to motivate university teams.

Alexa, Amazon Echo's virtual shopping assistant, offers shoppers the latest shopping entertainment and experiences. The request is activated by recognising customers' voices. Statistic Portal shows Alexa users are happier. From 2016 to 2018, Alexa and online shopping have grown from 130 skills to over 80000. (2018) Most shoppers use Mona. Artificial Intelligence, big data, and human knowledge were used to make the app most

helpful<sup>[15]</sup>. The software requires email access to look at e-commerce receipts and learn preferences, size, style, and other characteristics to make them more relevant. Customers may provide further criticism if they dislike a brand, colour, or other aspect. 2017 Masters blog Programming's virtual assistant uses the interface to interact with humans. This product expert completes tasks for clients. These unimportant assistants are often referred to as chatbots.

#### 4.2.2 Amer Sports

Amer Sports is a manufacturer of athletic products. Its brands are well-known and well-recognized on a global scale. Dynamic athletic equipment, footwear, apparel, and accessories from the company improve performance and increase enjoyment in outdoor sports and activities. Due to its products and varied selection of sports and events in every single key market, Amer Sports' business is stable. The Amer Sports viewpoint places a best on exquisite customer-driven product innovation. Amer Sports attempts to advance innovative and better outdoor goods that appeal to clients and its trade clients via constant research and development. Items are suggested to enhance competitors' presentation, support them in achieving their goals, and provide them with more enjoyment in the decision-making process. Amer Sports' net agreements amounted to EUR 2,678.2 million in 2018. By the conclusion of the year, the company employed 9,489 people.



**Fig 3.** Sales of Amer Sports 2014 to 2018 (Amer Sports 2020).

Amer Sports optimises their supply chain using machine intelligence. The integrated data infrastructure syndicates customer and sales data, making it easier to research, envision, and share the supply chain vision. Amer Sports hypothesised that customer data and ERP sales data might automate demand forecast. Once clients record online purchases, Amer Sports can follow the supplier chain. The data estimates how many products each retailer has remaining and when they will be exchanged. Amer Sports may use demand projections to improve sourcing, manufacturing, shipping, and sales. Microsoft/PwC (2018) The data platform will inform sellers and suppliers whether Amer Sports watches are being sold well at a local sports store<sup>[16]</sup>. The shop contacts a seller when needed to provide additional items. 37 creates more sales and ensures product availability, which boosts net revenue.

Amazon-Amer Sports future Amazon is revered, feared, and innovative in IT. It's grown during the last decade. It achieved the highest level of success in web-based company by successfully doing the tasks that competing businesses claim to complete. Amazon places a priority on satisfying its customers and is open to making mistakes and gaining experience. The standing of the firm will be beneficial to its success in the 2020s. In the year 2019, Amazon launched eight Amazon Go locations in two US cities<sup>[17]</sup>. Amazon Go is a physical shop without checkout. Amazon Go shops utilise sensor fusion, deep learning, as well as computer vision to check customers' bags. Amer Sports has callous goals. Amer Sports brands have received widespread market acknowledgment. Amer Sports is a top three worldwide sports gear brand in many market areas.

## 5. Conclusion

To summarise, AI is reshaping the supply chain, particularly within the automobile sector. AI is helping businesses optimise their operations, plan production, manage supply risk, decrease supply chain disruption, enhance customer service and quality control, remove language barriers, and increase demand forecasts. In spite of these advantages, businesses will have to contend with

a significant number of obstacles in order to get the most possible profit from the innovative technology. A lack of computational power, high costs, a lengthy execution plan, the intricacies of language and social cues, an absence of data scientists as well as other analysts, the lack of sharing information, system architectures, and concerns regarding security are some of the most significant challenges that are currently being faced. More applications of artificial intelligence will be created as this technology continues to improve and flourish, while the difficulty of the problems will continue to increase. The sooner automotive firms begin to apply AI, the sooner they will be able to begin optimising procedures, increasing the efficiency with which they produce, and save money in a variety of different sectors of the company. Companies will work to enhance customer service, which will result in strengthened ties between consumers and original equipment manufacturers (OEMs), which will drive repeat business from existing customers. It is possible for the original equipment manufacturer (OEM) and their suppliers to build stronger relationships, which supports cooperative development and growth altogether. This new technology will have an effect on every facet of a company; therefore, find a comfortable spot, buy some popcorn, and also get prepared for the next step in the development of technology.

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### Declarations

Author declares that all works are original and this manuscript has not been published in any other journal.

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