Research Article

# An Analysis of the Impact of AI on Supply Chain Management: A Case Study of Amazon

Bhawni Talwar[1], Naresh Sachdev[2]

[1]Assistant Professor, Department of Business Management, PCTE Group of Institutes, Ludhiana, Punjab
[2]Prof. cum Director, Department of Business Management, PCTE Group of Institutes, Ludhiana, Punjab

## I N F O

## A B S T R A C T

The worldwide level of competition has increased significantly with the growth and development of information technology. Numerous businesses have predicted that the introduction of artificial intelligence (AI) will cause significant changes in supply chain management (SCM) and operations in the future, including planning, scheduling, optimisation, and transportation. In terms of supply chain management, people will become increasingly interested in AI, machine learning, and other intelligent technologies. This specific research study gives a general review of the concepts of AI and SCM in this context. After that, the emphasis shifts to the timely and critical analysis of supply chain applications and research driven by AI. The developing AI-based business models of many case companies are examined in this exploratory study. Their applicable AI solutions and associated business values are also assessed. Consequently, this study pinpoints multiple domains of value generation for the integration of artificial intelligence inside the supply chain. Additionally, it suggests a method for creating business models for supply chain AI applications.

**Keywords:** Artificial Intelligence, Supply Chain Management, Operations Management

## Introduction

Supply chains have been as products/ services around us for a very long time. The complex supply chain includes all manufacturing and distribution routes, from suppliers to manufacturers, distributors, and consumers. Supply chains aim to meet consumer demand, improve responsiveness, and connect various stakeholders. The supply chain network is becoming more scattered, varied, and transparent in regard to organisation, tasks, and stakeholders.[1] For many companies, the fundamental issue is poor internal information and supply chain visibility.[1] Thus, supply chain management (SCM) seeks a complete system competitive advantage, digitalises corporate processes, and integrates stakeholders and assets to suit consumer expectations.[2]

Traditional IT systems like PPC, MES, ERP, SCADA, and others support logistics and supply chain operations.[3] For supply chain manufacturing, advanced technology has computerised most operations.[4] Due to the dynamic supply chain, changing consumer needs, unstructured decision-making challenges, and changing business processes, these disconnected solutions are not "intelligent" enough for the present SCM. All primary supply chain operations and business flows must be efficient to create intelligent, fast, and efficient business response systems. Thus, multi-level, highly variable industrial process digitalisation concerns require advanced IT solutions.[1]

Recently, many companies have concentrated on AI.[5] AI lets machines learn from experience and make decisions like people on a sequence of actions.[6] Due to developments in mathematical optimisation techniques used in operations

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research, constraint programming, deep neural networks, convolutional neural networks, and numerous numerical methods, artificial intelligence (AI) is a fast-growing computer science field These advances let computers do human work. Russell and Norvig (2016) state AI seek "to create rational agents who can perceive and act such that some objective function is optimised." Machine vision, natural language processing, pattern recognition, decision support, and learning systems are examples.

"Advancing the scientific understanding of the mechanisms underlying thought and intelligent behaviour and their embodiment in machines" is how the Association for the Advancement of Artificial Intelligence, or AAAI, defines artificial intelligence. This definition demonstrates how adaptable and even agnostic AI may be toward various technologies. AI is defined as the intelligence of computers and software, a field of computer science that aims to produce this intelligence, according to a widely used textbook by Russell and Norvig (2016).[7] The goal of artificial intelligence is to comprehend sentient beings.[8]

From a technological perspective, artificial intelligence's qualities can facilitate the development of novel functionalities for information systems that manage operations and logistics. The following fields can use AI by looking at prior studies and cases:

1. Learning systems that are able to[9-10] modify their behaviour in response to dynamically observed data;
2. Situation-aware systems that are able to recognise and comprehend the current environment and modify behaviour in accordance with modes and circumstances;[11,12]
3. Decisions can be executed by autonomous decision-making systems, as opposed to conventional Decision Support Systems (DSS)[13,14];
4. The capacity to handle data types such as unstructured text, streaming photos, video, and audio.[15,16]

Since the 1960s, the AI research community has been involved in DSS and other operation management techniques like scheduling and planning.[17,18] AI currently affects SCM holistically. For technological reasons, SCM is where most intelligent technologies, including machine learning, begin to evolve. The commercial case for integrating AI into SCM is that it may boost customer happiness and consumer goods and services while also improving supply chain visibility and transparency.

Amazon, Walmart, Philips, eBay, and other digital giants have tried to use AI in supply chain management (SCM).[19] Due to our limited understanding of AI in supply chain management (SCM), there are few in-depth investigations despite the abundance of fresh research. To expand knowledge of AI in SCM, this study will address two research issues: what

are the potential uses of AI in supply chain and operations management, and what are the commercial implications? AI and SCM are examined in this study using these research questions. It shows how to use AI and emerging technology in operations. Together, they make supply chain solutions cheaper and provide top decision-makers more visibility. This paper also examines how AI-powered SCM improves process optimisation and automation. We investigate data from four industry leaders and their supply chain AI integration strategies to answer our study questions. The report also evaluates SCM AI. Understanding how AI technology is changing supply chain management is the ultimate goal.

## Theoretical Implications

### Technology Acceptance Model

Theoretical implications of theories such as TAM or the technology acceptance model talk about the infiltration of technology or AI to see a social shift towards technology from the previous decade. There is a huge surge of interest and systematic review with respected social media analysis. The social media analysis with TAM is still questionable and needs more explanation. According to Al-Qaysi et al. (2020), this model's objective is to watch the ongoing social media studies and analysis. There are many external factors such as preventing critical mess, independence, subjective norm and enjoyment, connectedness, and some security and trust effects on social media. The result of a systematic review based on a better understanding forms an essential reference for research and other purposes. According to Kamal et al. (2020), the technology acceptance model is a very trending research process to deal with learning management systems. In this area, a plethora of research studies are being done. Different theoretical implementations and knowledge and discussions serve as hybrid models of advanced psychological and behavioural constructions driven by various theories.
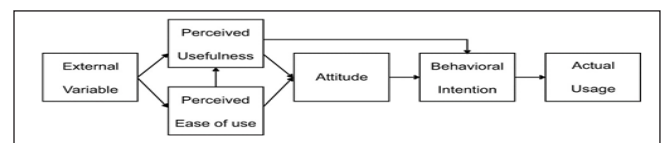


Figure 1.Technology Acceptance Model

(Source: Park, 2020)

### The Stakeholder Theory and Artificial Intelligence

The stakeholder theory with artificial intelligence used by Amazon deals with potential value creation, risk, and multi-stakeholder points. This theory talks about shareholders, stockholders, financial advice, customers, employees, and supply chains with consideration. Nowadays, artificial intelligence is an umbrella term for superfast computers to provide superfast responses and solutions to their customers.

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According to Güngör (2020), artificial intelligence with humans like hearing, seeing, reasoning, and learning and assistance with automation to provide business applications and automatic solutions with high digital data analysis. The measurable benefit of AI is the exploration of the value-created process and multi-stakeholder perspective. According to Gupta et al. (2020), artificial intelligence has huge potential to transform the industry into a more caregiving industry for humankind. This theory's aim is to create an overview where nothing has escaped from artificial intelligence, and even this theory is not also far from it. The new abilities of machines to perform any task very fast with human-like behaviour driven by factors and advancement is intimidating.
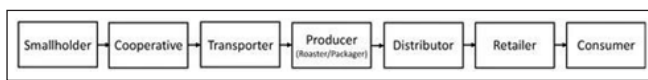


Figure 2.The Stakeholder Theory and Artificial Intelligence

(Source: Kramer et al., 2021)

## Institutional Theory with Artificial Intelligence

The institutional theory talks about two perspectives, which are collaboration with any opportunity and having the simple practice of comparison and operation for continuous movement. This study explores the orientation and adoption in the industry with capabilities to explain the theoretical framework. This institutional pressure will moderate industry relations. According to Du and Xie (2021), products and services that empower artificial intelligence are the talks of the town with wildly spreading in the marketplace. Though consumers have doubts about the rapid use of artificial intelligence from the industry side due to ethical challenges and development issues, it has become an essential part of life in recent times. According to Van de Poel (2020), organisations with high power and a high level of expertise formulated ethical principles and values attached to artificial intelligence. Companies like Amazon or any other conglomerates started adhering to the design of AI with autonomy, fairness, no malware, self-efficient, transparency, and accountability. It is unfortunate that very little responsibility and assurance have reached people on this matter.
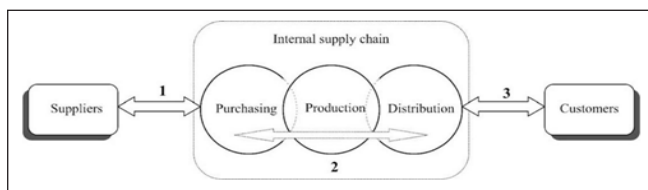


Figure 3.The Institutional Theory and Artificial Intelligence

(Source: Google, 2024)

## Conceptual Framework

### Significance of AI in Supply Chain Management Practises at Amazon

There is a huge potential for bots to do deep learning to serve customers' specific niches and supply management according to that. In this research, Pervaiz (2020) has given an overview and focuses on supply chain management to give an explanation of inventory management or warehouse management. This explanation illustrates that AI is beneficial for supply chain management. The new dawn of AI brings a new beginning for logistics, too. The recent availability of data at the fingertips helps companies give credit to the logistics and supply chain management departments with an open mind. The widespread improvement of computing power and digital logistic applications helps decision-making and supply to the doorsteps of customers. The automatic service of AI felicitates the workflow of any company in this matter. According to Boute and Udenio (2022), though AI has improved a lot in recent years, it cannot augment the human touch as a logistic planner.

### E-Commerce

The massive sale of Amazon comes from e-commerce and doorstep delivery in a minimum amount of time. Voice recognition, face recognition, product recommendations, and huge storage help the customers to identify the product or their need within a minute. According to Bawack et al. (2022), it creates sales or improves analysis based on customer behaviour. The Amazon online shopping portal helped drastically to improve and analyse customer demand based on only focusing on customers' shopping lists. According to Pallathadka et al. (2023.), it is very insightful how the application has provided a better experience through artificial intelligence. It creates rapid buying behaviour in a customer. Amazon has found a huge effectiveness of artificial intelligence through e-commerce.

### Improve Agility and Performance of the Supply Chain

Supply chain management talks about planning, organising, and controlling products, services, or goods in basic terms. Though it is a complicated and complex term, every company looks forward to improving it from the core. Amazon is the pioneer of this. The demand forecasting knowledge of AI helps to analyse sales and produce data according to it to create a specific sale for every customer (Ketokivi and Mahoney, 2020). It even helps to avoid stock out for a big company like Amazon. According to Shoushtari et al. (2021), not only demand forecasting but also transportation, risk management, and inventory management, amazon has used AI just to improve the uninterrupted flow of the supply chain.

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## Creating a Conceptual Framework for the Industry

The industry is highly affected by manufacturing and service-related jobs. The industrial revolution, digital revolution, and AI revolution have taken work to the next level, where everything is available for everyone in any part of the world. According to Demir and Paksoy (2020), swift changes in manufacturing and supply chain can create a huge and good result in profit, and manufacturing also reaches high rocket speed. The newest concepts, such as adaptive robotics and analysis, industrial internet, cyber-physical systems, data analysis, and additive manufacturing, have changed the game in recent times (SHAIJU, 2023). Amazon also works with these emerging technologies to be in the market and create an impact on the industry by creating more complex, automated, and sustainable manufacturing systems.

## Impact of AI on the Organisational Supply Chain of Amazon

### Fraud Detection

Amazon uses AI to do fraud detection, working capital management, and supply chain optimisation. In the last few decades, AI has learned and performed in an ever-changing environment. The diffusion of smart devices has adapted a different combination of technologies and learned to reproduce on its own with a single command. According to Fanti et al. (2022), machine or artificial intelligence is a different combination of advanced technology to enhance pr, produce, or reproduce the cognitive capabilities or human tasks altogether. The main domain of artificial intelligence is to use knowledge to learn and perform specific tasks with accuracy under any command. According to Benzidia et al. (2021), AI started as a scientific aspect, but now it is used in other fields such as academics, mathematics, physics, engineering, neuroscience, and psychology. Amazon used AI for corporate strategies, which are fully data-intensive, to increase power and control without being in location every time.

### Enhancement in Commercial Values

There is a historical moment to be Haron of Alexandria to finally be Alexa. From the deep blue computers to a huge increase in cognitive power with the commercial value of artificial intelligence with learning the algorithm to storage quality and capacity and cloud computing, the programs have learned and experienced and improved. According to Dauvergne (2022), there is a revolution in global production. AI has helped to increase the GDP of the country in the last decades. The output also has increased through productivity, quality, and consumption. With high-quality data, experts in machine learning and AI-driven finance systems helped companies to thrive more in this open industry. Manufacturing, management of risk, and good quality development of goods and products have helped a lot to create an impact of AI in supply chain management at Amazon.

### Sustainability of AI

The most important aspect of AI is its sustainability. The data and solution with logic-centred performance help to serve the framework of continuous performance or sustainability of AI in the marketplace. The main approach of AI is to value and investigate logic through automation and innovation, creating complements and personalisation. AI application in research and business gives propositions and frameworks. According to Cao (2021), artificial intelligence still has its limitations in some aspects, but it is a beneficial tool for business.

### Rational Choices

The practical implementation with analytical work helps to develop some rational choices, best practices, and adaptation of AI. The originality of AI lies in its systematic examination power to provide solutions and guidance. There are great business ideas that are created by AI. According to Toorajipour et al. (2021), another impact of AI is the acknowledgement of constructive comments and suggestions to improve better in the future and create expositions and logical solutions to the imperfectness of still developing bots. The main purpose of AI is to get some benefits from it to use it for time management, better development, creating and maintaining strategies for business, data management, and customer service. Artificial intelligence is used in retail value creation and logic at the same time. AI-related to supply chain and fulfilment management changes the organisational structure to embrace a bigger marketplace and consumers.

## Key Supply Chain Management Challenges by AI Adaptation with a Specific Focus on Amazon

Amazon uses AI for their supply chain management to develop their delivery process, to measure accurate sales, and to attract consumers but the organisation faces lots of challenges by adapting artificial intelligence in their supply chain management system. The issues or challenges that are faced by Amazon's supply chain management system are described below.

### Training Cost

AI needs proper employee training for effective applications and implementations in the supply chain management system. The training requirements negatively affect Amazon's financial statement (Anica-Popa et al., 2021). The supply chain management partner also needs to understand the AI process to handle the smart technology properly. The training process needs a high amount of money to develop the employees in smart technology. Therefore, the annual costs of Amazon company increase

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for the artificial intelligence. Although AI influences the productivity and creativity of the organisation, the costs become a potential hazard in finance. According to Pillai et al., (2020), AI has a requirement in staff training which will increase the overall expenses of Amazon, but the trained employees become capable of producing innovative ideas by which Amazon can develop their business growth, which leads to high annual revenue.

### Data Management Procedure

A "Cross-departmental" partnership is required in the AI procedure of Amazon which is responsible for slow development and lack of resources. Therefore, AI reduces the resources of data management procedure of the Amazon organisation which minimises data quality, validation of data, and data privacy (Boute, et al., 2022). Artificial intelligence scans individuals' potential information such as their location, habits, preferences, and basic information such as age, gender, and nationality which leads to potential risks to individual consumers, stakeholders, and employees. Although Amazon focuses on the data privacy of their consumer there is a chance to reveal all the information to unwanted individuals. Janssen et al., (2020) supported the discussion and said that the consumers, stakeholders, and employees pose a risk to their privacy to reveal which negatively affects the supply chain management procedure of the organisation.

### Operational Expenses

Artificial intelligence in supply chain management needs AI-operated networks and AI-operated equipment such as machines to handle the smart technology. All of that equipment needs to be repaired and followed by AI expertise (Pervaiz, 2020). Therefore, the Amazon organisation needs lots of investment in the AI operating costs. The electrics that are used by AI is a huge amount which indicates a lot of electrical expenses. All those expenses negatively impact the financial statement of Amazon Company and increase their overall expenses. Pillay et al., (2021) highlighted that Amazon suffers from an overload of operational expenses but they also have various opportunities to reduce their overall operational expenses by providing excellence in their supply chain management and by attracting consumers and stakeholders to invest in their organisation.

### Technology

AI has a requirement in the smart infrastructure of technological initiatives and Human resource groups to understand the smart technology and hire employees that are capable of operating the AI. Helo et al., (2022) stated that Artificial intelligence improves business growth, but the hiring process of Amazon became difficult because of their technologies which lead to more employee dissatisfaction rates. Attaran, (2020) opined that AI needs smart

technological components which became one of the major issues of Amazon, but the smart technology enables the supply chain management system to provide quality services among the consumers.

## Strategic Solutions to Improve AI Implications to the Organisational Supply Chain Management at Amazon

### Decision-Making Strategy

The decision-making strategies of Amazon's supply chain management system measure the best solutions to improve AI implications by analysing the plans and communicating with other employees. The decision-making strategy in supply chain management helps to gather each employee's opinion for their business plan and find a great solution to develop the AI implications (Schmidt et al., 2022). This strategy can assist the organisation in producing more valuable insights into market trends and consumer preferences and make the leaders capable of improving smart strategies, analysing the method, and generating market position. On the other hand, Stone et al., (2020) stated that AI influences the decision-making procedure of an organisation's supply chain management system. AI applications move the objectives from operational to a tactic that introduces a competitive nature of various decisions and affects market trends, market position, and consumer behaviour.

### Analysis Strategy

According to Blanchard, (2021), the analysis strategy helps to identify the proper usage of AI in the supply chain management system of Amazon by which the firm can recognise the huge data sets and recognise the potential insights for their business. The analysis strategy helps the firm to develop its organisational performance, and consumer satisfaction rate and can generate "data-driven decisions". Mustak et al., (2021) supported the discussion and stated that analysis strategy can assist the organisation to develop AI implications in supply chain management by which organisation can achieve their goals and develop their financial condition. Analysis strategy provides the operating knowledge of AI which must be needed for the supply chain management system of Amazon.

### Automation Strategy

Vishwakarma et al., (2022) opined that by implementing an automation strategy, AI can simplify the difficult work such as budget recording, payroll generating, developing inventory management, and improving the consumer support team to provide excellent consumer service. This strategy to develop AI implications in the supply chain management structure of Amazon will assist the organisation in developing its financial condition by improving consumer service and by providing excellent quality services. On the

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other hand, Ribeiro et al., (2021) argued that there is no need for AI to implement automation methods as it already focuses on the data management procedure, consumer care, budget control, payroll, and data-driven. He also stated that AI was invented to increase the sales growth and financial condition of a business by maintaining strong customer care policies, payroll management, and budget control. Therefore, no more requirements are needed in the automation method.

**Personalisation Strategy**

According to Toorajipour et al. (2021), the personalisation strategy allows the AI to customise the services and products of the organisation to fulfil the needs and demands of consumers. Personalisation strategy will help the Amazon organisation to develop their AI implications and boost engagement with consumers. By fulfilling the criteria of consumers, Amazon can increase customer satisfaction rate, and maintain strong bonds with consumers as well as with stakeholders which leads to great financial statistics. Kankanhalli et al. (2021) encouraged the discussion and opined that the personalisation strategy surely assists AI in developing the supply chain management system of Amazon by maintaining good relationships with consumers and by fulfilling their demands about products and services.

## Conclusion

Artificial intelligence improves supply chain management by producing quality delivery processes and consumer satisfaction rates, but it also negatively affects the Amazon organisation. The research study provides theoretical implications to evaluate the impact of artificial intelligence in the supply chain management system of Amazon. The study introduces the significance of AI in supply chain management practises at Amazon, AI affects the organisational supply chain of Amazon and the supply chain management challenges by AI adaptation of Amazon. The research study also points out the solutions to develop the Artificial intelligence implications for the organisational supply chain management system at Amazon.

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