Role of artificial intelligence in the enabling sustainable supply chain management during COVID-19

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Abstract: The purpose of the paper is to investigate the functions of artificial intelligence in supply chain management. In recent years, artificial intelligence framework has accomplished human-like performances in various previously considered computationally impossible tasks. Better access to large amounts of information, improved algorithms, and advanced hardware systems have led to artificial technology development. Artificial technology has supported business organisations to enhance their data collection abilities with the rapid advancement of different tools. If a product depends on supplies from multiple suppliers, disruptions can have subsequent effects. Organisations must redesign supply chains, improve flexibility, and re-evaluate the relationship with suppliers to reduce systematic risks. The methodology used in this study is a critical review of previous literature related to this topic. We searched the articles in the English language by following general research procedures. We manually searched different relevant articles from EBSCO, ProQuest, Emerald Insight, Science direct, Taylor & Francis, Wiley, JSTOR, and IEEE. The findings present the significant functions of artificial intelligence on sustainable supply chain management in the COVID-19 scenario. Future research perspective is also discussed.

Keywords: supply chain management; COVID-19; organisations; pandemic; sustainability; risks.

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1 Introduction

In recent years, artificial intelligence framework has accomplished human-like performances in various previously considered computationally impossible tasks. Better access to large amounts of information, improved algorithms, and advanced hardware systems have led to artificial technology development. Improvement in real-world growth, especially in supervised learning, is due to evolution in image detection, speech recognition, enhanced games, and many more areas. Technology plays a vital part in the organisational, cultural, educational, political, and social sectors in this dynamic world. Automation has remarkably modified the business world (Došilović et al., 2018).

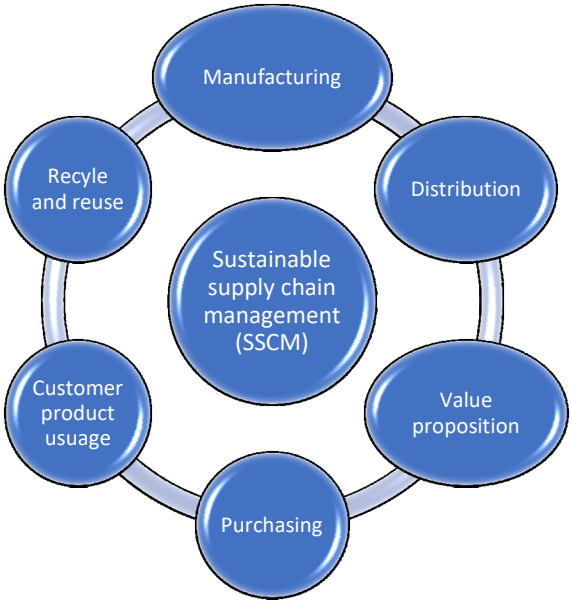
Artificial technology has supported business organisations to enhance their data collection abilities with the rapid advancement of different tools. The emergence of advanced human-machine interaction can help to achieve more efficient data processing. It improves data processing speed with enhanced reliability and consistency (Lee et al., 2019). The artificial intelligence technologies with improved computer vision help to work more rapidly with the implementation of advanced knowledge and enhanced computational methods (Liu et al., 2020). Artificial technologies such as deep learning, chatbot, machine learning are reforming organisational procedures (Wamba-Taguimdje et al., 2020).

Various operational management elements such as product development, supply chains and manufacturing, information, and artificial intelligence are the most critical factors in this digital era (Grover et al., 2020). Artificial intelligence helps them in enhancing the supply chain procedures in the following ways:

- it helps in the simultaneous planning
- it supports in selecting strategic options
- making strategic decision to manage supply chain.

There are still some difficulties in adopting technological support in supply chain management procedures, from start to end, because fewer skills stop its usage for a more significant scope. A framework of core functionalities of sustainable supply chain management is presented in Figure 1 to understand better the role of artificial intelligence in sustainable supply chain management. Different supply chain elements are distributed among the core functionalities, including manufacturing, distribution, value proposition, purchasing, customer product usage, recycle, and reuse. Artificial intelligence enhances the core functionalities of sustainable supply chain management to be adaptable during the COVID-19 scenario. It is considered an innovative technology that can help organisations cope with the COVID-19 pandemic, especially in the supply chain management sector. It is considered a technology that fights against the impacts of COVID-19 to maintain sustainable supply chain management. It helps to manage global pandemics by implementing social distancing measures. The framework of artificial intelligence with core sustainable supply chain functions are shown in Figure 2. Artificial intelligence shapes massive data during the different core functionalities of sustainable supply chain management.

Figure 1 SSCM core functionalities framework (see online version for colours)



Different automated intelligent algorithms find patterns among the different functions and combine the information automatically. As the outcome of artificial intelligence processing, the real-time data can be used to make vital strategic decisions during the COVID-19 pandemic. The users do not need to have complex knowledge of the channels and policies. The artificial intelligence will automatically select the right authorisation path for the sustainable supply chain management. Artificial intelligence helps to easily adapt to the changes that connect to various aspects of business and real-time decision making. However, a global pandemic has a specific implication for supply chains. Compared with an epidemic limited to a specific location, disturbing small industrial disruption levels, a pandemic is limited to specific areas or countries.

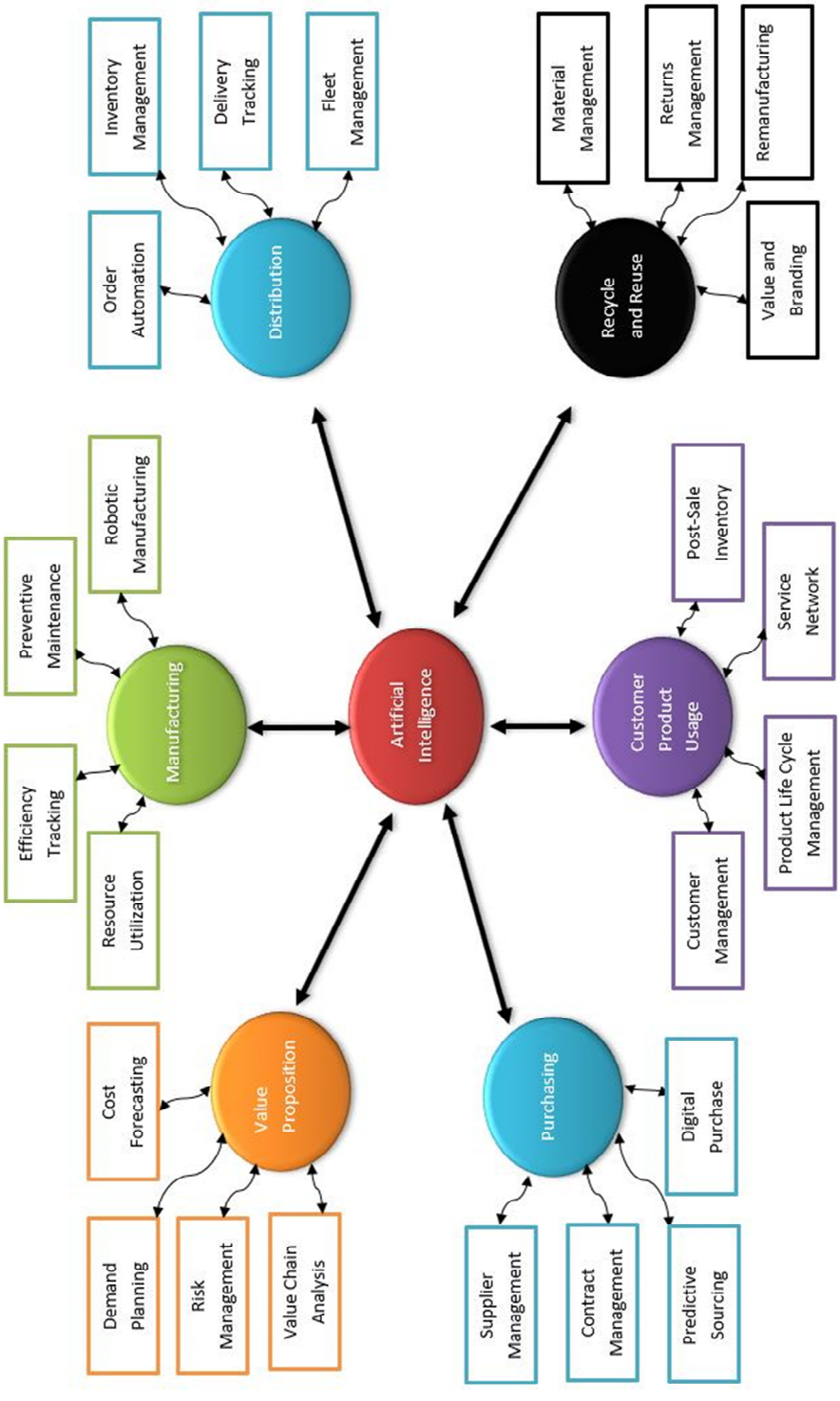
The paper starts with a detailed analysis of the literature review based on the questions mentioned below:

Q1 What are the functions of artificial intelligence in supply chain management?

Q2 How can organisations carry out supply chain procedures in the COVID-19 crisis?

The organisation of this paper is formulated in six sections. Section 1 involves the introduction of the main components of this topic. Section 2 is based on the analysis of previous literature. Section 3 explains the methods used in the paper to develop conclusions. Section 4 interprets the findings of this paper. Section 5 explores the discussions based on the findings of this paper. Section 6 involves the future recommendations and conclusions of this paper.

Figure 2 Artificial intelligence and core sustainable supply chain management framework (see online version for colours)



2 Literature review

2.1 What is artificial intelligence?

The major influential factor in an industry is technology. The employees have been replaced with robots since the 19th century. In 1970, the internet and personal computers entered the working life, and machines replaced human labour. Artificial intelligence and machine language are being adopted in the organisation in this digital era, which will help the business world to transform. Artificial intelligence is also perceived as smart agents that act according to the environment's requirement, maximising successful goal achievement chances (Hamori and Kume, 2018). Artificial intelligence is defined as an intelligence illustrated by machines, compared with natural human intelligence. Artificial intelligence was introduced in 1956 for the first time. It helps in several business functions by reducing the workload and pressure on the work environment's employees. Frequent business changes require a fast response (Lee et al., 2019). Machines can recognise human language and understand the goals and problems because of artificial intelligence programming advancements. Some scholars define artificial intelligence as placing the human mind inside computers (Pan, 2016). Organisations can adopt artificial intelligence to enhance daily performances. Business pressures are increasing, so managers understood the significance of artificial intelligence in the workplace. Recently, artificial intelligence entered into all the systems of an organisation, and one of the areas is the supply chain, where using artificial intelligence helps manage a large amount of data (Yawalkar, 2019).

2.2 Branches of artificial technology

Artificial intelligence can be divided into different branches, for example, smart agents, NLP, fuzzy logic, heuristics, computer vision, and fuzzy logic (González García et al., 2019).

2.2.1 Computer vision

This field allows computers to learn to recognise an image and the features of this image. The objective of computer vision is that computers can understand the world. Machines should recognise the components by their image and understand what they are all in a quick way (Lemley et al., 2017).

2.2.2 Fuzzy logic

Fuzzy logic helps solve traditional logic problems because traditional logic could only deal with the binary numbers (zeros and ones), whereas some problems need dealing with many more digits. Some decisions are based on more information than binary values and represent an intermediate value between truth and falsehood. Generally, these states are defined as 'linguistic variables', which can represent features as 'size' that can have three possible values: 'big', 'medium', and 'small' (Jian et al., 2020).

2.2.3 Natural language processing

Natural language processing is also termed computational linguistics. It is also a branch of artificial intelligence that helps resolve natural language using machines. It allows users to communicate with the machines in a significant way with the use of natural language as humans communicate with each other (Guo et al., 2020).

2.3 Advantages and limitations of artificial technology

Human intelligence is restricted to an individual or a team in an organisation. Artificial intelligence technology can provide the organisation 'permanency' to prevent the data from being lost when a particular human or group is no more available to the organisation. Artificial intelligence also helps to develop learning capability, which can enhance the relevance of the application. The wide scope of artificially intelligent applications occurs when reliability has been established; artificial intelligence has ensured its reliability in various applications. Artificial Intelligence has also allowed the reduction of costs because it reduces the time consumed by employees. The number of employees can be reduced by adopting applications based on artificial intelligence applications for the decision-making process (Panichayakorn and Jermsittiparsert, 2019). Humans require more time to perform computational operations, whereas artificial intelligence can automate the decision-making process by providing a faster solution to complex tasks. Like any other technology, artificial intelligence technology also has its limitations. Black boxes are considered difficult in investigating the link between input and output variables based on the data training sets. It increases the concerns regarding the tools' capability to handle the situations that were not incorporated in the dataset. The second limitation of artificial intelligence-based search methods, like genetic algorithms, as they never ensure the optimal solution (Naudé, 2020). When artificial intelligence is used to eliminate a problem, there is difficulty exploring the basis of the problem and its reasoning. When artificial intelligence techniques are adopted to resolve a problem, various techniques are available, making it difficult to choose the best one (Liu et al., 2018; Almentheri and Tariq, 2020).

2.4 Others disruptive technologies

Disruptive technologies are modifying the way organisations work. The possibility of employees bringing their technological gadgets helps structure modification in the organisation due to IT advancement associated with e-education, e-supply chain system, e-tourism, creative and industries (Bublitz et al., 2019; Albufalah and Tariq, 2020). The new business should focus on coordinating several existing organisational activities and innovation as innovation allows a growth-oriented market by providing opportunities to expand the organisational activities in the latest ways under financial sustainability (Sousa and Rocha, 2019).

2.5 The business perspective on artificial intelligence in supply chains

The organisation's idea of supply chain management is to sustain its position in the market by increasing profits through the supply chain. Smart supply chain management can help to reduce the overall costs by increasing efficiency. Three major digital drivers

are involved in future supply chain management, such as interconnected, intelligent, and instrumented (Di Vaio et al., 2020).

2.5.1 Instrumented

The transaction process is involved in the instrumented, managed by the latest sensors' latest technologies, global positioning systems to reduce the costs and risks, enhance visibility, and overcome complexities. Big data and artificial intelligence can automate the process with software and hardware controlling and processing a massive amount of data manually (Jain and Gohil, 2020).

2.5.2 Interconnected

The internet technology helps directly connect with suppliers in which real-time consumer feedback is involved using social media platforms. It helps in developing follow-up routines and decision-making procedures. The modification of supply chain infrastructures explains the context of interconnectedness with the influence of the latest technologies like IoT and big data by combining production according to specifications suggested by customers (Acharya et al., 2020).

2.5.3 Intelligent

Advanced technologies can help to enhance the simulations of the performances of the supply chain. It explains the concept of intelligence. Visual scenarios can be generated in advance based on upcoming situations that end in effective control of supply chains and help discover and remove the risks and outline several future scenarios' effects. It helps at operational levels like production and warehouses. The drivers explained above are based on developed technology, and future supply chains adopt them with fully modified and digitally reliable interfaces. Digitalisation's future depends on the development and modifications that would act as a success factor (Ghadimi et al., 2019). The main areas of technological development are Procurement 4.0, integrated planning and execution, perspective analytics of supply chains, adopters of smart supply chains, productive management of raw inventory, and logistics related to business to consumers. With the increased interest in digitisation within the management of supply chains, there is an increased requirement to implement reasonable strategic models in the organisations. Trust levels between the buyers and sellers can be enhanced with real-time communication (Alhammadi and Tariq, 2020).

In the past era, technological advancement and communications in the supply chains have helped to emerge the 'fourth industrial revolution (Industry 4.0)'. There is increased competition within the organisations because of the advancement in customers' technology and modified requirements. The organisational environment change will influence operations and management strategies to face the evolved challenges in an advanced business world (Witkowski, 2017). An increased number of organisations have implemented revolutionised technological principles to enhance productivity and performance. The major strength of Industry 4.0 is the influence of many dimensions of society. It has a visible influence in the professional, social, domestic, and industrial sectors. Digitisation acts as a significant component for supply chains to survive in the market in a highly competitive environment (Muñoz-Villamizar et al., 2019). As the

world is suffering from global pandemic 'COVID-19', companies need to implement advanced technologies in their business procedures and control the flow of information in the value chain for efficient management for future generations (Müller and Voigt, 2018).

2.6 AI application in the management process within supply chains

Digitisation has enabled significant modification of manufacturing operations. Industry 4.0 allows the use of data, algorithms, computers, and automation. Thousands of sensors manage the data to maintain the algorithms. The artificially intelligent system complies with data about the costs, delivery schedules, material requirements, suppliers' information (Dogru and Keskin, 2020). Supply chain management supports ensuring a proper way to produce a perfect product in the adequate quantity with the delivery at the right hour in the customers' proposed location at a reasonable cost. Emerging supply chain complexities, sudden technological modifications, speed of supply chain functions, and COVID-19 pandemic are making supply chain management challenges (Baryannis et al., 2019). It is predicted that various algorithms will be implemented to monitor the supply chain management performances by examining more than a trillion bytes of data to evaluate and eliminate risks. With the enormous amount of information, analytical simulation models will help manage supply chains to forecast with reduced errors and adopt measures to highlight any alteration in the forecasted performance. Artificial intelligence has a vital role in upgrading management's decision-making procedures with the improved efficiency of supply chain management (Calatayud et al., 2019).

2.7 AI in the management procedures within supply chains

Digitalisation in supply chain management procedures is defined as the developed interconnected business system, shifting its focus from isolated, single-company, and local applications to wide smart, systemised supply chains. The digitalised industry visually illustrates a tremendous shift in supply chain managerial procedures (Tariq et al., 2020). The main artificial intelligence procedures adopted in supply chain management are data engineering based on artificial intelligence, its roles in making a strategic decision, and artificial intelligence in synchronous planning, artificial intelligence in logistics functions (Saleh et al., 2020).

2.8 COVID-19 background

World Health Organization (WHO) declared COVID-19 a highly contagious virus, as a global pandemic on March 11, 2020. The virus was discovered in Wuhan, China, in the last week of December 2019. The origins of this virus are still mysterious (Vaishya et al., 2020). The disease's seriousness is different in individuals with mild to severe symptoms of high fever, difficulty breathing, and respiratory system problems. Many severe cases have been admitted to hospitals and even death. The mortality rate of COVID-19 was 3.4%, approximately till March 3, 2020. The mortality rate was higher in elderly people with previous ailments. Many organisations' functions have been seriously disturbed as the outburst of virus spread worldwide, affecting organisations' operational functions. Unusual viruses proved that organisations were not prepared for the sudden risks

(Perrotta et al., 2020). The global supply chains have been disturbed by the global pandemic, especially for organisations with globalised supply chain structures. It was disclosed that '94% of the Fortune companies have experienced COVID-19 driven supply chain disruptions'. Organisations have to redesign supply chains, improve flexibility, and re-evaluate the relationship with suppliers to reduce systematic risks (Golan et al., 2020).

2.9 Balancing cost, risk, and agility post-COVID-19

New sets of managerial implications are required for minimising risks by multinationals due to COVID-19. The supply network relies on zero-inventory management and real-time strategies and is exposed to pandemic disruptions (Remko, 2020).

Still, maintaining agility is costly, and it is not practical in organisations to entirely modernise the supply chains to manage unexpected risks such as the latest global pandemic COVID-19 (Remko, 2020).

2.10 Managing sustainable supply management in COVID-19

Organisations should consider adjusting the 'sourcing mix' for risk diversification. When both the suppliers are located close to geographical proximity (dual sourcing strategies), they have to experience more lockdown disruptions. Likewise, organisations with distant geographical diversified networks of multiple suppliers have also experienced supply chain disruptions. If a product depends on supplies from multiple suppliers, disruptions can have subsequent effects (Majumdar et al., 2020). Organisations must investigate which products are exposed to dependency on a single location by adopting suitable risk management strategies. It could also involve inventory over the boundaries, or dependence on the supplies with the risk of disruption must be reduced. It can be achieved with the following methods:

- organisations can prepare an 'inventory buffet' or 'safety stock' of required elements and products
- organisations can maintain a 'time buffer' by slowing down the manufacturing process where there is an uncertainty in demand.

If significant suppliers face any stress, organisations should support them because replacing them is an expensive process. Many organisations are struggling to manage reduced demand, reduced supplies, order cancellation, and reduced capacity accelerated by COVID-19. Business partners in supply chains must support each other to maintain social sustainability (Vieira, 2020). Organisations should quantify the supports for suppliers' recovery and identify where they should be implemented to maximise the benefits. Suppliers should also ensure social distancing and sanitisation requirements in the factories. It is a financial perspective and corporate social responsibility as well (Raj and Aithal, 2020). The risk of total factory shutdown can be decreased with the adoption of social distancing. If the employee is COVID-19 positive, organisations should promptly ask them to work from home with proper treatment. Employees who have been in close contact with the infected person should be asked for two weeks' isolation, or a COVID-19 test should be conducted. If social distancing measures are adopted in a factory, it can send the infected workforce in quarantine instead of the factory's complete

shutdown. Organisations should also enhance safety measures to reduce the risk of spreading the infection (McMaster et al., 2020; Aqab and Tariq, 2020).

3 Methodology

This qualitative approach focused on the articles related to the artificial intelligence and business models implemented in the supply chain management system. We investigated the critical topics assessed in the literature to explore the studies conducted on artificial intelligence and the idea of safety measures for surviving through the COVID-19 pandemic. We searched for various articles in the English language by following general research procedures. We manually searched different relevant articles from EBSCO, ProQuest, Emerald Insight, Science direct, Taylor & Francis, Wiley, JSTOR, and IEEE. The methodology is designed in the following stages (Figure 3). Firstly, relevant articles were selected and assessed. In the second stage, we analysed the selected research papers. The first phase was designed in the following steps. We selected the articles from online library databases in the extraction step; after this, we recognised the important papers in the identification step. Thirdly, a manual localisation of most cited studies was conducted, and lastly, we recognised various significant research papers related to our topic. Most significant studies were assessed to gather information about directions for the research in the second phase.

Besides, to recognise all the papers required for our study, we used combinations of two search string sets. Articles related to artificial intelligence and supply chain management in the first set; the second set included articles about artificial intelligence, sustainability, and business procedures. We used various keywords related to the objectives of our research. We combined 'artificial intelligence', and 'supply chain', 'sustainability', and 'supply chain'. Then these words were combined with different keywords like 'business models', 'COVID-19', 'supply chain risk management', and 'global pandemic'. Till the second phase, the critical articles and the material of each article were investigated. The strings were modified based on the different databases for inclusion or exclusion of keywords. Initially, 567 articles were identified based on the keywords from 2012–2020 due to the majority of new articles emerging during this time. The articles were then selected based on the quality that included only conferences and peer-reviewed published papers. All articles were reviewed again to ensure relevance to the research area and the contribution of AI to the supply chain field. 120 abstracts of each article were read in detail to ensure their importance with the study. The results of the selected articles were compared and discussed for in-depth analysis. The information from the abstracts helped us to analyse their link with the research topic. The result of the abstract analysis reduced the articles to 43. The results are shown in Table 1, having the articles during the initial database search and after article's processing. The first number represents the initial search, and the second number represents after processing results shown in (initial search), (after processing) format. For searching the related articles, the same outlines were used. All the collected articles were analysed separately and highlight the important and related aspects of this paper.

Figure 3 Research methodology (see online version for colours)

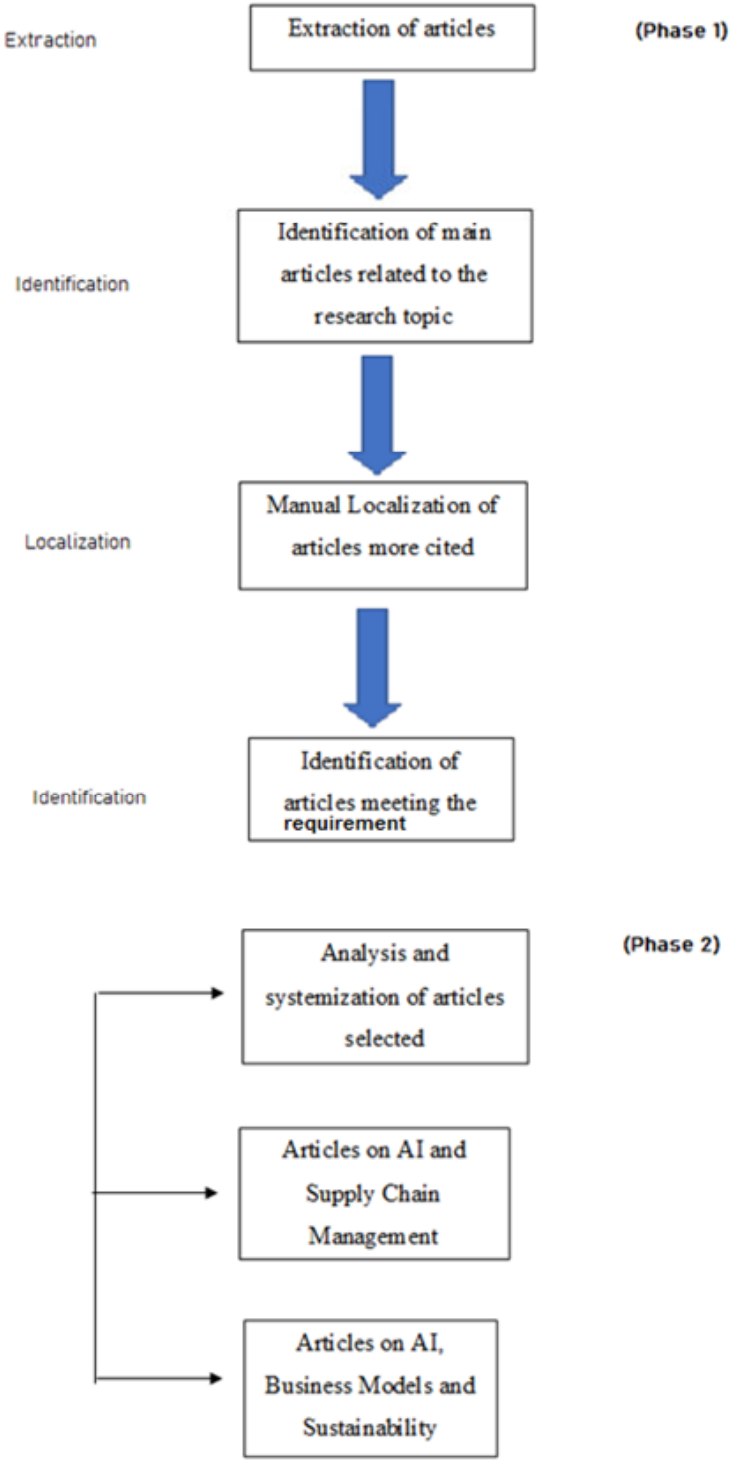


Table 1 Database search and processing results

	EBSCO	*ProQuest*	*Emerald Insight*	*Science Direct*	*Taylor & Francis*	*Wiley*	*JSTOR*	*IEEE*	*Total*
	Artificial intelligence								
Supply chain management	16.1	12.0	14.1	10.1	13.1	12.1	11.1	8.0	96.6
Supply chain sustainability	12.0	9.1	8.1	3.1	12.2	15.1	23.2	5.1	87.9
Supply chain risk management	13.0	9.0	8.1	19.1	12.0	11.0	21.1	3.1	96.4
Supply chain and covid-19	12.1	14.0	10.2	10,.1	9.1	12.1	8.1	7.0	82.7
Supply chain business models	11.0	7.1	13.0	23.1	16.1	21.1	39.1	9.0	139.5
Supply chain and global pandemic	10.1	5.1	12.2	9.2	11.1	6.1	11.2	3.2	67.12
Total	74.3	56.3	65.7	74.7	73.6	77.5	113.8	35.4	567.43

4 Findings and analysis

The investigation of previous studies present in our database proved that the term which is frequently used is ‘organisations’ following ‘artificial intelligence’, ‘supply chain management’, and ‘COVID-19’. When these terms were combined, they identified a relatable need for coordination and commitment in the supply chain management functions. The study’s findings are presented with statistics and tabulations to provide the overall summary of reviewed literature discussing research questions. Figure 4 provides the number of articles over the period selected for review sourced from peer-reviewed conferences and journals.

Figure 5 provides an overview of the distribution of articles from the database search. 85% of the literature was from journal articles and 15% from conferences.

Table 2 summarises the artificial intelligence methods relevant to sustainable supply chain management for 43 finalised articles.

A variety of AI methods is used in the supply chain management sustainability based on the implementation of a wide range of methods. Most articles use the neural network methods as the highly used method with 25, decision trees ranking as second with 22, decision support system as third with 14, and simulations as the fourth-highest ranked method with 10. Some articles have used more than one methodology, so the method’s total frequency is greater than the number of articles. Figure 6 shows the overall summary of the methodology used by the articles. Twenty-three articles have used a single method, 11 articles have used double methods, and nine articles have used multiple methods approach.

Table 2 AI method usage with SSCM

	Artificial intelligence methods
Supply chain management	Automation (4) Neural networks (3) Decision trees (4) Modelling (2) Clustering (1) Support vector (3) Natural language processing (2)
Supply chain sustainability	Automation (3) Expert systems (1) Neural networks (5) Decision trees (2) Modelling (3) Simulations (2) Clustering (2) Fuzzy logic (4) Natural language processing (1)
Supply chain risk management	Decision support system (3) Modelling (1) Simulations (5) Automated planning (1) Heuristics (1) Neural networks (5)
Supply chain and COVID-19	Expert systems (1) Neural networks (3) Decision trees (9) Genetic algorithms (2) Image processing (1) Fuzzy logic (2) Decision support system (4) Natural language processing (2)
Supply chain business models	Agent-based system (1) Expert systems (1) Modelling (1) Neural networks (3) Decision support system (5)
Supply chain and global pandemic	Simulations (3) Decision trees (7) Neural networks (6) Genetic algorithms (1) Image processing (1) Fuzzy logic (3) Decision support system (2) Natural language processing (1)

Table 4 provides the frequency of the analysed literature articles in terms of a unique outcome that shows the importance of using artificial intelligence in sustainable supply chain management during the COVID-19 pandemic.

Figure 4 Period for identified articles (see online version for colours)

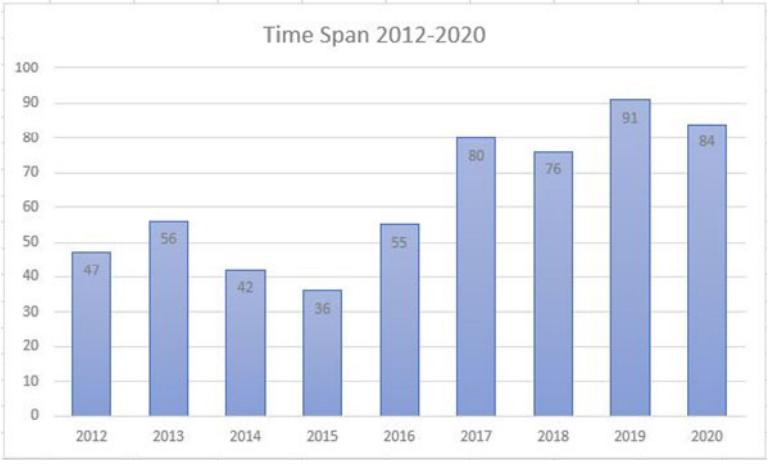


Figure 5 Article distribution (see online version for colours)

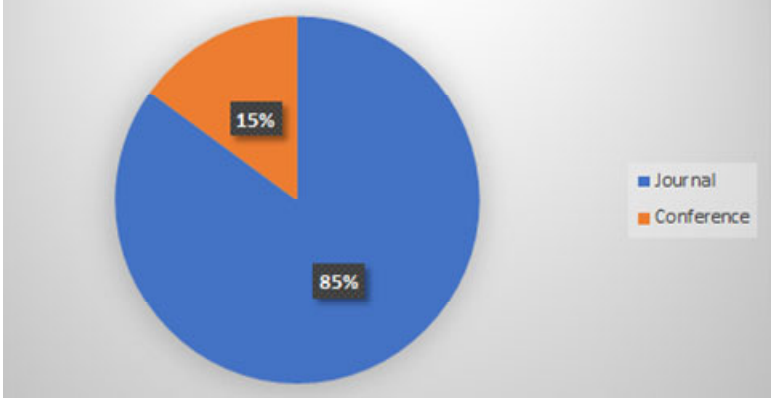


Figure 6 AI methods used in articles (see online version for colours)

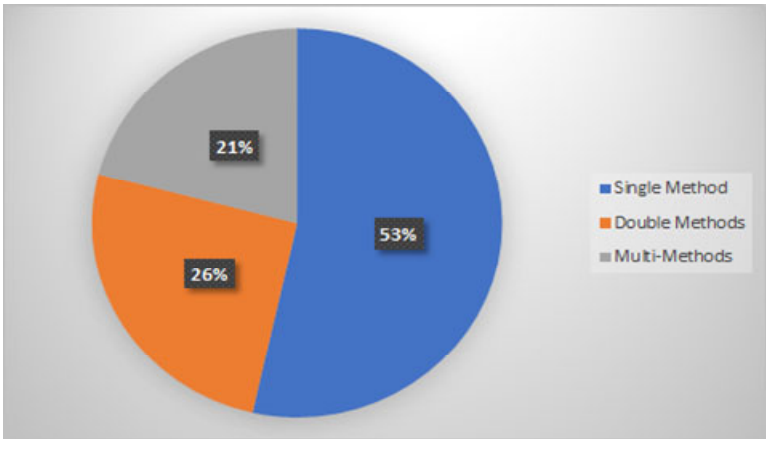


Table 3 Provides the frequency of the total AI methods used

Method	*Frequency*
Neural networks	25
Decision trees	22
Decision support system	14
Simulations	10
Fuzzy logic	9
Automation	7
Modelling	7
Natural language processing	6
Clustering	3
Support vector	3
Expert systems	3
Genetic algorithms	3
Image processing	2
Heuristics	1
Automated planning	1
Agent-based system	1

Table 4 Frequency of unique outcomes

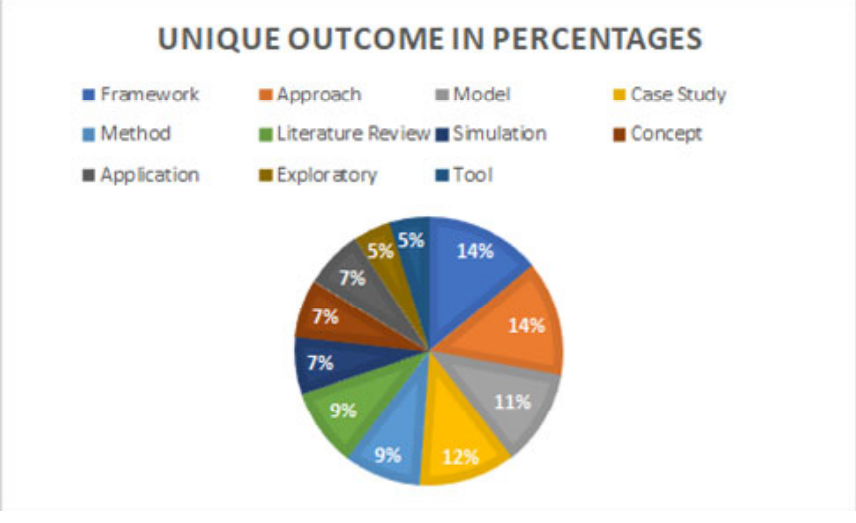
Unique outcome	*Frequency*
Framework	6
Approach	6
Model	5
Case study	5
Method	4
Literature review	4
Simulation	3
Concept	3
Application	3
Exploratory	2
Tool	2

Figure 7 shows a summary of the purpose of the analysed literature in terms of a unique outcome. Most articles have an outcome as a framework and approach as 14% at the top spot each of the total. Whereas model and case study is the second spot with 11.6% each of total, method and literature review as the third spot with 9.30% each of total, concept, application, and simulation at fourth spot having 6.98% each, and lastly exploratory and tool with 4.65% each.

Some researchers have discussed that artificial intelligence enhances organisation's productivity and efficiency levels (Wang and Siau, 2019). The adoption of artificial intelligence results in reduced labour and reduced organisational practices (Agrawal

et al., 2019; Hussien et al., 2020). So, the implementation of technological advancements with artificial intelligence tends to an essential change in the models adopted in business, which specifies its goal is to react to socially enduring issues (Lee et al., 2019). Adopting artificial intelligence in organisational, operational procedures reduces organisational costs (Mendonça and Dantas, 2020; Casabayó et al., 2015). These findings also show that artificial intelligence technology has advantages, as productivity, profitability, and efficiency are increased by reducing costs (Lee et al., 2012). It explains that technological applications have altered operational functions (Hui et al., 2020). The business models have been redesigned after the COVID-19 pandemic (Crick and Crick, 2020). Artificial intelligence technology in logistics allows suppliers and organisations to maintain their competitive market position. Artificial intelligence technology lessens human's involvement during operational procedures, enabling social distancing measures. Artificial intelligence depends on the analysis of various datasets, which helps to improve decision-making procedures. According to our analysis, researchers are increasing interest in artificial intelligent in the factors analysed.

Figure 7 Unique outcomes summary (see online version for colours)



5 Discussion

Our research focused on the relevant previous literature referring to artificial intelligence in the operations department, mainly in the supply chain sector. Even though artificial intelligence technology is considered an innovative solution to enhance the supply chain sector's productivity and effectiveness, its significant role is recognised. On the other hand, artificial intelligence helps the supply chain sector help the organisation carry out its operational functions by existing close locations to primary responsibility and sustainability. According to our literature review, the organisation's role in the modified environment after the global pandemic is considered significant (Kayikci, 2018). However, some scholars still have some issues with the responsibility factors of organisation in this global pandemic. Our results follow the previous literature; there is

still a research gap in the adoption of artificial intelligence technology to achieve sustainable development goals. The success of organisations depends on their capabilities to adopt innovative techniques, products, and services. Even if some human resource is reduced machines can upgrade the working of the organisations. Two research questions are presented in this paper:

Q1 What are the functions of artificial intelligence in supply chain management?

The industry needs to maintain cooperation between different functions involved in the supply chain. These functions can still be well-defined depending on the types of products/ services and business types. The coordination in all the procedures may have complexities according to the demand and supply. Artificial intelligence includes a progressive shift in the operational level. There is a significant global transformation in the business industry after advancements in the internet and digitalisation. These transformations are considered revolutionary improvements in the operational procedures (Tjahjono et al., 2017). Artificial intelligence has transformed the supply chain into intelligent supply chains. Nowadays, the techniques supported by artificial intelligence help supply chain procedures to enhance the organisation's commercial and economic performances. The artificial intelligent systems can be used to perform supply chain transactions in real-time, which would reduce the time usage, costs, and fluctuations in the outer environment. It would help in increasing the productivity and efficiency of the organisations. Different artificial intelligence techniques enhance the advanced supply chain system's productivity like artificial neural network, machine learning, fuzzy logic, and genetic algorithm. The adoption of artificial intelligence systems has revolutionised the business world from different business functions, tasks, and procedures to business models and management styles, which can be witnessed worldwide. The impact of artificial intelligence can be noticed in:

1 the enhancement of business efficiency and productivity

2 the modification of business in the way people create, control, organise and supervise an organisation.

Artificial intelligence improves the supply chain's performance by using an online platform for sharing information with the suppliers. It enables information to flow in real-time by properly tracking the order procedures to maximise profits and efficiency (Alzoubi, 2018).

Q2 How can organisations carry out supply chain procedures in the COVID-19 crisis?

The backbone of organisational development is an appropriately managed supply chain department. This development can be witnessed in cooperation and feedbacks. Due to globalisation, supply chains are maintained at a global level. Organisations have to maintain good international relations to enhance their relevance with the supply chains. Due to the global pandemic COVID-19, the operational functions and economy worldwide have become paralysed (Ivanov, 2020). Different strategies can be adopted to fight back in the COVID-19 crisis. For example, different risk mitigation inventory levels can be considered while preparing pandemic plans. The complexities can be resolved by involving some elements such as back-up suppliers, regional sub-contracting, and timely reservations. In this way, some complexities can be reduced (Allaoui et al., 2019). The outburst of COVID-19 has infected millions of people around the globe. So, the

organisations should follow the social distancing measures and SOPs issued by the government and medical centres to avoid the disease's spread in the workplace. The suppliers should also ensure the adoption of safety measures to stop the complete shutdown of factories. The demand for face masks, sanitisers, and medicines has also increased. Organisations and factories should ensure the availability of the required quantity of medical equipment, face masks, and sanitisers. Organisations should also provide COVID-19 testing services and work from home opportunities to their employees to enhance their productivity. In this global pandemic, organisations, factories, and government have to work together by developing appropriate safety procedures to improve the countries' economy and efficiency worldwide.

6 Conclusions and future research recommendations

Digital technologies can help to redesign operational procedures, increasing productivity, reduced cost, and increased efficiency. According to the sustainable perspective, the response to our research question is that the role of artificial intelligence within the supply chain management procedures (Singh et al., 2020). Organisations can enable social distancing measures and help the suppliers in this COVID-19 scenario; this answers our second research question. The protection of employees must be the foremost step of organisations to sustain in this global pandemic. At the global level, organisations, suppliers, and researchers present principles based on increasing economic efficiency with artificial intelligence technologies. Many of the latest alterations in the organisational framework are in the purchasing attitude, which may affect later also (Koonin, 2020). This research's fundamental limitation is that the investigation is only based on the combination of specific keywords to analyse our research objective. This limitation also opens the doors for future researches for a new approach to the adoption of artificial intelligence in other operational functions of organisations about the latest COVID-19 scenario.

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