# Digital Supply Chain Management Using AI, ML and Blockchain


**Anil Kumar Gupta, Gaurang Vivek Awatade, Suyog Sanjay Padole, and Yash Santosh Choudhari**

**Abstract** Supply Chain Management (SCM) is a kind of network in which each phase of product development is tracked right from gathering raw materials till the delivery of the product. Developing a product, distributing it to suppliers, delivering to customers, collecting feedback, etc., all are tracked and maintained using supply chain management. A secured supply chain should be held to ensure that fake products do not enter into the market. For example; if counterfeit drugs enter the market, then it will have various side effects on patients as well as it will affect the pharmaceutical companies. Hence, a secure supply chain is a must. The significance of SCM has increased as it plays a vital role in the decision-making process. Hence, a proper supply chain should be maintained along with a technology which will also help in the decision-making process. One such technology is Artificial Intelligence (AI). AI is the technology in which machines are programmed to think like humans and perform an action accordingly. Machine Learning can be used in detecting fake products that enter the market. Also, there are various algorithms in AI which can be used in the decision-making process. As the digitalization of SCM is significant, similarly, its security is also worthwhile. SCM can be implemented as a Drug Supply chain Management system, which Blockchain can be integrated to counter the supply of counterfeit drugs into the market by tracking. This chapter discusses Digitalized and AI-based Drug Supply Chain Management. With Supply chain analytics tracking each step of the inventory process: from the loading dock to the supply cabinet, to the patient's hospital room, Hospitals can expect massive Supply chain analytics are used to measure, monitor, and improve individual business processes as well as the overall performance and health of the supply chain. Drug supply chain analytics will enable demand visibility, inventory visibility and Freight analytics.

**Keywords** Blockchain · Digitalization · Artificial intelligence · Supply chain management · Security

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# 1 Introduction

Supply Chain Management (SCM) is a network in which each phase of product development is tracked right from gathering raw materials till the delivery of the product. It is a process that involves planning, controlling and implementing the operations of the supply chain to satisfy customer requirements effectively and efficiently. The subareas of a supply chain comprise of Forecasting, Procurement, Logistics, Operations, Inventory Management, Transport, Warehousing, Distribution, Customer Service etc. Developing a product, distributing it to suppliers, delivering to customers, collecting feedback, etc., all are tracked and maintained using supply chain management. One should maintain a secured supply chain to ensure that fake products do not enter the market. For example; if counterfeit drugs enter the market, then it will have various side effects on patients as well as it will affect the pharmaceutical companies. Hence, a secure supply chain is a must.

The significance of SCM has increased as it plays an essential role in the decision-making process. Therefore, one should maintain a proper supply chain along with a technology which will also help in the decision-making process. One such technology is Artificial Intelligence (AI). AI is the technology in which we program the machines to think like humans and perform an action accordingly. Another branch of AI is Machine Learning (ML) which we can use in detecting fake products that enter the market. Also, there are various algorithms in AI which we can use in the decision-making process. As the digitalization of SCM is significant, similarly, its security is also worthwhile. Blockchain is a revolutionary technology which is used in safety and can be efficiently implemented in SCM. Blockchain is no longer confined to transfer of funds between two accounts as it crawls its way into diverse fields such as IoT, Healthcare, Real Estate and also SCM. In Healthcare, SCM can be implemented as a Drug Supply chain Management system using blockchain, which could counter the supply of fake drugs into the market by tracking.

## *1.1 Chapter Overview*

This chapter contains the introduction of Supply Chain Management and discusses each phase of SCM. It explains the working of various phases of SCM. The need for maintaining a SCM and why it is necessary to maintain a proper SCM in order to track and control each activity in the phases of SCM are also discussed in this chapter. Section 1.5 contains the features of SCM along with the advantages of SCM listed in Sect. 2.

Section 3 lists and explains various applications where SCM is maintained for better experience. Section 4 introduces to various Digital Supply Chain tools which are useful in different stages of SCM along with their functionalities. Section 5 contains the features of digital SCM as well as explains the application of artificial intelligence (AI) and blockchain in digital SCM. The last section contains a Case

Study on "Blockchain-based Drug Supply Chain Management System" where the implementation of Blockchain in SCM is discussed.

## *1.2 Motivation*

The existing Supply Chain Management System faces many challenges such as increase in consumer demand, assuring good quality of products, in-time delivery, etc. Therefore, to overcome these challenges, evolution of SCM to Digital Supply Chain Management is needed. This can be achieved with the help of various technologies like Blockchain, Artificial Intelligence, Cloud Computing, Machine Learning, Internet of Things (IOT), etc.

The Digital SCM would completely eliminate paper-based record storage method and eliminate the manual data entries as everything will be updated automatically at each phase. Also, retrieving the data would be easy. With the help of sensors and tracking facilities it is possible to track the shipment of all goods during manufacturing, transportation and logistics processes at real-time. Quality and Transaction information can be recorded with RFID technology [1]. Various tools can be used to manage the processes with less human interaction. Resource planning, Inventory management, Process planning, etc. can be efficiently managed with digital supply Chain.

## *1.3 How Does SCM Work?*

Supply Chain Management (SCM) is a key process for many of the companies so that their supply chain will work efficiently and effectively [2]. A company makes use of five steps to transform the unprocessed materials into completed products. Figure 1 shows the working of Supply Chain Management in a cyclic format [2]. It involves five essential modules of supply chain management. Let's see each of them in detail.

- **Planning**
  The first and the main stage of the supply chain process is the planning stage in which a plan is to be developed to verify that that the products and services which we are providing to the customer will satisfy their requirements. During this stage, the focus should be given on maximizing the profit margin.
- **Development**
  The second step consists of developing and sourcing. During this stage, the main focus is given on building a strong bond with the suppliers of the raw materials which are required for production. This stage focuses mainly on identifying dependable suppliers who will provide appropriate material for the production


**Fig. 1** Steps in SCM

purposes and as well as for determining some different planning methods for shipping, delivery and payment of the respective product.

- **Making**
  The third step consists of manufacturing and making of the products as per the demand of the customers. During this stage, the products are designed, manufactured, checked, wrapped, and synchronised for delivery.
- **Delivery**
  The fourth stage is known as the delivery stage. In this stage, the products are delivered to the customer at the given location by proper supervision. This stage is the logistics phase, where customer orders are accepted, and the delivery of the goods is planned.
- **Return**
  The final stage of supply chain management is the return stage. In this stage, the customer returns the damaged and defective goods. In this stage, the companies need to deal with queries which have been raised by the customers and as well as they have to give answer to their complaints. This stage is many times called the most troublesome stage of the supply chain for many of the companies. The planners of the supply chain have to look out for better options and solutions to handle these defective and damaged products which are received by the customers in return.

## *1.4 Why Is It Necessary?*

There are various reasons that SCM is necessary for retailers and many similar kinds of businesses. SCM helps in boosting customer service, reducing operating charges, and for improving a company's financial position in the market [3].

- **Client Satisfaction**:
  The most important thing in any business is to know whether their clients are satisfied with them. The correct product and quantity must be delivered to the customer on time and efficiently to ensure that they are satisfied. SCM can guarantee that the customers are happy at all times, which can eventually improve the business of that respective company.
- **Reduction in Operating Charges**:
  Supply chain management decreases the gross supply chain charges as most of the manufacturers depend heavily on supply chain managers for creating networks such that customer service goals are met at the most affordable rate. Retailers also require supply chains to ensure the delivery of expensive products on time to limit inventory.
- **Improves Financial Position in the Market**:
  SCM increases profit margin since supply chain managers help to maintain and reduce the cost of the supply chain, which increases the company's profit drastically. Supply chain managers also decrease the use of plants, warehouses, and vehicles within the chain so that most of the assets will remain safe with the company. Finally, SCM can increase your business's cash flow, given that customers can receive their products faster thanks to supply chain managers.

## *1.5 Features of SCM*

- **Connected**
  For the supply chain to work efficiently, the mutual connection between all components is essential. We can use technologies like cloud, Internet of Things (IoT), RFID, to establish this connection. Real-time data of processes carried out should be visible in a well-connected supply chain. Transparency in the supply chain provides a bigger picture which allows the managers to deploy solutions to problems without any delay.
- **Automation**
  Routine tasks should be automated so that employees can spend a significant amount of time on more critical functions which in turn will generate more revenue [4]. Organisations can involve AI and ML to automate other tedious tasks as well.
- **Secure**

SCM must be protected from cyber-attacks, viruses, malware. Blockchain is one groundbreaking technology which provides security which cannot be compromised. Antivirus software is also used to protect the system from any possible threats or data loss.

- **Scalable**
  SCM software should grow or shrink in real-time. As a business grows, its customers increase, transactions increase; this should not affect the system's performance. Allocation of hardware resources should be based on the increase or decrease in the volume of workload.
- **Analytics**
  SCM system should provide analytics tools like Demand forecast, inventory analysis, cost analysis, order processing analysis. These analysis tools help the organization in making decisions and plan further steps.
- **Fault-Tolerant**
  Backup storages should recover any loss of data. Failure in any one component of SCM should not result in crashing the whole system. Other parts should work efficiently till the problem is resolved.

## 2 Advantages of SCM

- **Consumer/Client Satisfaction**
  As the essential task of this management is to make sure that goods reach the client or consumer at the exact time which eventually results in consumer satisfaction, as these days people give more preference towards the quality provided by the company and supply chain management does precisely that, resulting in the client of the company getting satisfied [5]. We all know this thing that a happy customer will not only bring his business but also he will be acting as a spokesperson for our company which will eventually help in the positive growth of the business.
- **Better Collaboration**
  When two or more companies unite with each other, they share valuable information which eventually helps both the companies to grow seamlessly and because of improved access to data supply chain leaders get the information they needed in context to make more informed decisions [5].
- **Improved Quality Control**
  When a company has greater control over not only their suppliers but also with their supplier's supplier, then it is guaranteed that the company will have improved quality control over their products [5].
- **Shipping Optimization**
  The key role of any reputed company is to identify the best shipping method for handling small parcels as well as orders in bulk, for other scenarios, it helps the companies to get orders to their customers by saving time as well as money [5].

## 3 Applications and Use-Cases

- **Automated Shipping and Tracking**
  Logistics is a field which includes warehousing, shipping, cargo, courier services, road or rail transportation, air freight. SCM can be applied here. If a business is manufacturing and shipping their products without the help of any other firm, then this transport management system is included within the existing SCM system.
- **Manufacturing Industry**
  Any large-scale manufacturing organization has the use of SCM. All activities right from procurement of raw material to marketing or delivery of the product. SCM fosters a quality culture and enhances competitiveness in the organization. Figure 2 shows some of the components often found in manufacturing SCM [6]. Better productivity is achieved in manufacturing processes.
- **Blockchain supply chain management**
  Supply chains consist of complex networks connecting suppliers, manufacturers, transporters and consumers [7]. Shared infrastructure of blockchain proves to be a boon in supply chain management which streamlines workflows and no matter how big the size of the network becomes, blockchain can handle it.

  The third-party attacker cannot change data in the system. It improves the consumer experience by providing transparency and traceability. Supply of counterfeit goods in the market can be minimized with the help of blockchain. E.g. using blockchain, the supply of counterfeit drugs in the market can be stopped.

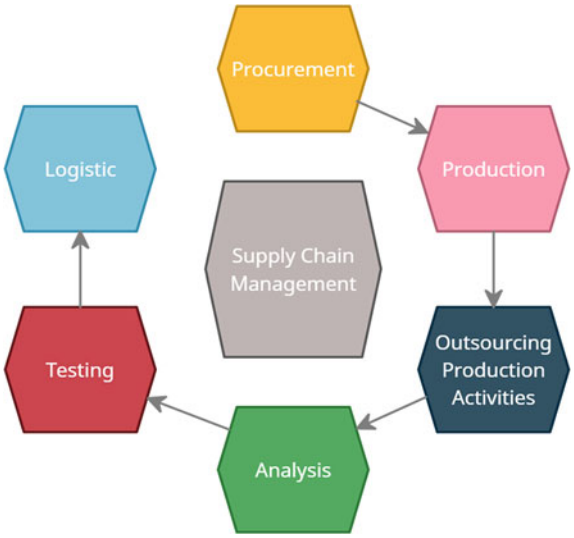


**Fig. 2** Components of SCM in manufacturing

## 4 Types of SCM Tools

Maintaining a supply chain is a task of responsibility, and a single error may lead to a considerable loss of the company. So, if a good supply chain is to be maintained, they should use proper tools. Specialized tools make it possible to manage a supply chain effectively and reduce errors which will ultimately benefit the company [8]. Here are few SCM tools which will help companies in efficiently managing their supply chain.

- **Real-time Shipping Status Updates**
  Many companies supply their products to customers around the country and even around the world. To know the timely updates about the shipment, they require a tool to track the shipment and provide updates. A real-time alert system provides timely updates about the shipment activities [8]. It provides the updates to all stakeholders so that necessary actions can be taken in time if there's an issue. We can get these real-time alerts on our mobile devices to inform about the status of our supply chain.
- **Order Processing**
  It is an essential phase in supply chain management. It involves various tasks which can be managed effectively with the help of these tools. Such tools support all functions across order processing like order processing, order management, order fulfilment and billing [8]. These tools automate most of the activities that are involved in order processing to capture order data directly. It reduces time and errors as every task is automated.
- **Warehouse management**
  These tools will help to manage the day-to-day functions in the warehouse. It has various capabilities for warehouse management as per the company requires. Some advanced tools have capabilities to handle complex logistics [8]. The company can also use it to bundle multiple products kept at different warehouses.
- **Freight Handling**:
  Along with shipping functionalities, tools provide various freight handling functionalities as per industry requirements [8]. Some products need to be kept at a particular temperature right from the beginning till its delivery; these tools provide such functionalities too. It also helps to maintain good product quality.
- **Supplier Management**
  Maintaining good relations with suppliers is essential. These tools help in understanding the relations with suppliers. But, it is not limited to only this, by analyzing the supplier's performance, the company can figure out how much the supplier has contributed to their business. Also, based on the performance, the company can take decisions regarding supplier relationship management.
- **Analytics and reports**
  Along with analyzing supplier's performance and consumer demand, these tools provide an analytics report on the complete supply chain [8]. It gives the performance of the company as a whole or as an individual sector. Also, it uncovers the sources of delays and issues in order processing. Analysis of transportation

and logistics processes can also be done with these tools. Decision-makers can take decisions to manage various methods that are having issues by reviewing the analysis report.

- **Security features**
  The primary concern that comes into the picture when it comes to data is security. Data theft may cause the company to lose its position in the market as well as it may affect the relations with suppliers [8]. In order to prevent such security failures, the company should implement a secured network which can be achieved by ensuring that only approved personnel have access to specific company data.
- **Transportation and Logistics**
  Transportation and logistics tools assist in managing the movement of materials from one location to another [8]. It helps in planning and tracking of the shipment and if there is an issue, takes necessary actions accordingly.

## 5 SCM via Digitalization and Artificial Intelligence

As discussed earlier, the supply chain involves various tasks like tracking shipment, order processing, warehouse management, analysis, security and many more, managing all these tasks is quite difficult. Therefore, there is a need to take control of these tasks to the next level with the help of some technology that can simplify the workload. One solution to this is to automate these processes by using Artificial Intelligence. Another is to maintain a secured supply chain by using blockchain technology. Also, Computer Vision can be used in quality inspection of various food products [9]. RFID technology can be used in identifying counterfeit products that enter into market [10, 11]. These technologies will help in many aspects like quality management, security, analysis, decision-making process, etc. It has been discussed in brief in the following sections.

### *5.1 Features of Digital Supply Chain*

- We can easily connect and relate data from various sources.
- The generation of data-driven plans via data visualization is also one of the advantages of digital supply chain management.
- One of the most significant advantages is that it provides automation, which eventually increases the efficiency of the system or the platform by eliminating the manual checking for errors and increases the accuracy.
- One more important characteristic of digital supply chain management is a collaboration via which we can connect multiple internal and external systems and people.
- Another advantage of digital supply chain management is data analytics; when such a tremendous amount of data is converted to digital data, one can

quickly identify bottlenecks, point out savings, various patterns and opportunities regarding cost reduction.

## 5.2 Artificial Intelligence in SCM

### 5.2.1 Definition of Artificial Intelligence (AI)

Artificial Intelligence can be defined as the technology where machines are programmed and trained to think like humans and perform actions accordingly.

- Some examples of AI in our day-to-day life are as follows:
- Google Maps
- Voice Assistants like Alexa
- Social Media
- Face Detection
- Spell Check or Autocorrect
- Chatbots
- E-Payment
- Digital Assistants.

### 5.2.2 Digitalization of AI in SCM

Artificial Intelligence (AI) and Machine Learning (ML) have changed the world completely. It has brought everything on our fingertips, and with their help, each and everything has become very convenient. AI in supply chains is helping a lot to deliver the powerful optimization capabilities required for more accurate planning, high quality, better customer satisfaction, lower costs and greater output [12]. AI methodologies can be used in Supply Chain Risk Management (SCRM) [13].

## 5.3 Applications of AI in SCM Activities

### 5.3.1 Chatbots for Operational Procurement

A chatbot is a program which simulates or translates human conversation through voice commands or text messages [12]. This requires access to robust and intelligent data sets and so that AI plays a significant role over here. For daily tasks, Chatbots can be utilised for:

- Speaking with suppliers during trivial conversations
- For setting as well as sending actions to the suppliers regarding governance and compliance materials

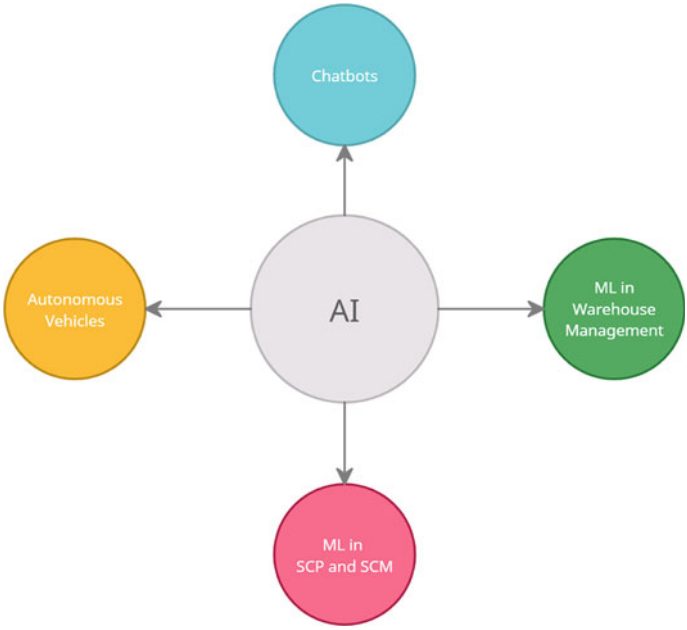


**Fig. 3** Applications of artificial intelligence in SCM

- For the placing purchasing requests
- Receiving or filling of invoices and payments or order requests.

Figure 3 shows the different areas of the supply chain, where Artificial Intelligence can be used to simplify the tasks.

### 5.3.2 For Enhancing the Experience of Customer

By the use of AI and ML, the relationship between the buyers and the suppliers has got much better [12]. The best example of it is Amazon Alexa which helps the customers to track their respective order.

### 5.3.3 Machine Learning for Supply Chain Planning

The supply chain is an important activity within Supply Chain Management strategy. In today's business world, there is a need for smart and intelligent tools. When it is applied with Supply Chain Planning, it could help in forecasting within the inventory, demand and supply. If ML is used correctly through SCM work tools, then it could revolutionize the agility and optimization of supply chain decision making.

#### 5.3.4 Machine Learning for Warehouse Management

After having a closer look towards the domain of SCP, its success is heavily dependant on proper warehouse and inventory-based management [12]. But if these things are ignored, then it can prove a massive disaster for the company because proper warehouse management is essential.

#### 5.3.5 Use of Autonomous Vehicles for Shipping

Use of Intelligence in logistics and shipping has gained the focus within the supply chain management in recent years [12]. Faster and more accurate shipping reduces transportation expenses, reduction in labor cost, it also adds more environment-friendly operations, and more importantly widens the gap between the competitors.

#### 5.3.6 Machine Learning for Supplier Selection and Supplier Relationship Management (SRM)

Supplier Selection and selecting the right supplier for sourcing is crucial for a sustainable supply chain [12]. If at all anything goes wrong while choosing the supplier, then the entire business can suffer. Machine Learning and Intelligent Algorithms can help in predicting the right supplier selection and risk management, during every single supplier interaction, by analyzing data sets generated from SRM actions. With the help of this technique, we can use this data for the betterment of the business.

## 6 Supply Chain Management Using Blockchain

Blockchain has emerged as a secured network in financial services and is gaining considerable attention for addressing supply chain management issues. Due to the entry of counterfeit products into the market, the importance of the quality of products and management of the supply chain has increased. Blockchain has characteristics such as decentralization, security, immutability and smart contracts that can bring significant benefits if used properly [14]. Blockchain can also be used to manage the transport and logistics processes [15].

### *6.1 Decentralization*

It is different from the traditional transactions that need to be approved by central authorities [14]. Decentralization eliminates the central powers and allows direct transaction between users. All details can be recorded about the product, suppliers,

and customers along the whole supply chain. Multiple stakeholders have a copy of records which can be retrieved anytime. Producers can also make sure that the raw material quality meets requirements.

### *6.2 Security*

Due to the decentralization feature, failure of a single node will not lead to the failure of the whole network, which can reduce the chance of hacking [14]. When applied to the supply chain, blockchain can keep data safe, reducing the risk of hacking and data stealing. If any user wants to add or update a block, it is first verified and approved by other members, and then the transaction is performed.

### *6.3 Immutability*

Along with data security, it also ensures the record's originality and authenticity [14]. This means historical data cannot be changed without informing other members. It allows companies to trace back along the supply chain to identify if there are any issues and take actions accordingly.

### *6.4 Smart Contract*

It is another essential feature of blockchain, which is a digitalized contract and operates once certain agreements are met [14]. It can speed up the transactions and enhance trust. For example; automatic payments can be made once the materials are delivered successfully. It can save paperwork and also minimize errors as compared to the traditional supply chain.

By implementing all these features in the supply chain, we can achieve maximum digitalization. It improves efficiency, saves processing time and provides security. Figure 4 shows the interconnected network of supply chain services using blockchain technology [16].

## 7 Benefits of Using Blockchain in SCM

Benefits of using blockchain technology in SCM are:


**Fig. 4** A supply chain integrated using blockchain [16]

## *7.1 Traceability*

It can be defined as the ability to trace back along the supply chain of a product when required [17]. It helps in checking the safety and quality of the product at any time. If there are any issues in the supply chain, it can be traced easily by referring to the information stored during each phase.

## *7.2 Digital Identity*

Blockchain networks can store various types of information and provide a digital identity. It will provide unique identity and security to products. Hence, it will work as a primary construct for stakeholders in the supply chain [17].

## *7.3 Anti-counterfeiting*

The supply of counterfeit products into the market is increasing, which affects both customers as well as the company. Hence, we must use a proper mechanism to identify the original products. By scanning the barcode, all information about the product can be viewed. With this, the supply of counterfeit products can be reduced.

# 8 Case Study: Drug Supply Chain Management Using Blockchain

The emergence of Counterfeit drugs in the market cause tremendous loss to the pharmaceutical industry and the government [18]. An enormous amount of money is spent by the government to put a check on these counterfeit drugs. These fake drugs do not heal the patient but may have other dangerous side effects. It is difficult to identify and separate fake medicines as they cannot be segregated through their appearance. Sophisticated labs are required to test the authenticity of the drug. So, it isn't easy to separate fake medicines once they are in the market with authentic other medicines. The only way to make sure that counterfeit medicines do not enter the market is to track the medicines from the beginning of their supply chain, and only those medicines should be sold which are from a well-known licensed company. One of the possible solutions that can be proposed to this problem is to track the delivery of drugs in each phase right from raw material procurement from supplier, manufacturing stage, distribution stage, pharmacies, and clinics and to consumers finally [19].

## *8.1 Proposed Solution*

Blockchain-based Drug Supply Chain Management system can be maintained using the smart contracts to track the products in each phase.

## *8.2 Workflow of the System*

The diagram that is shown in Fig. 5 depicts that the users (supplier, manufacturer, distributor, doctors and pharmacies) can manage the whole system. Each user can perform transactions on the Blockchain network through a web-based application provided to them, which acts as an interface between the users and the network. All members of the network can view and update the status of the system and the data stored in it. Whenever an action takes place, like an authorized supplier supplied raw materials to manufacturer; a transaction in blockchain is issued by the supplier that he has supplied the raw materials. On receiving this raw material, Manufacturer will confirm that the consignment is received. This same process will take place between manufacturer-distributer and distributer-pharmacies/hospitals. In this way drugs from non-authorized suppliers can be prohibited. Patients, on the other hand, can stay relaxed as they can track the source of the medicine, its price, expiry date, manufactured by, etc. they are consuming. The medical staff may not use visualization of data in the system, but academicians might use it for their projects, and research.

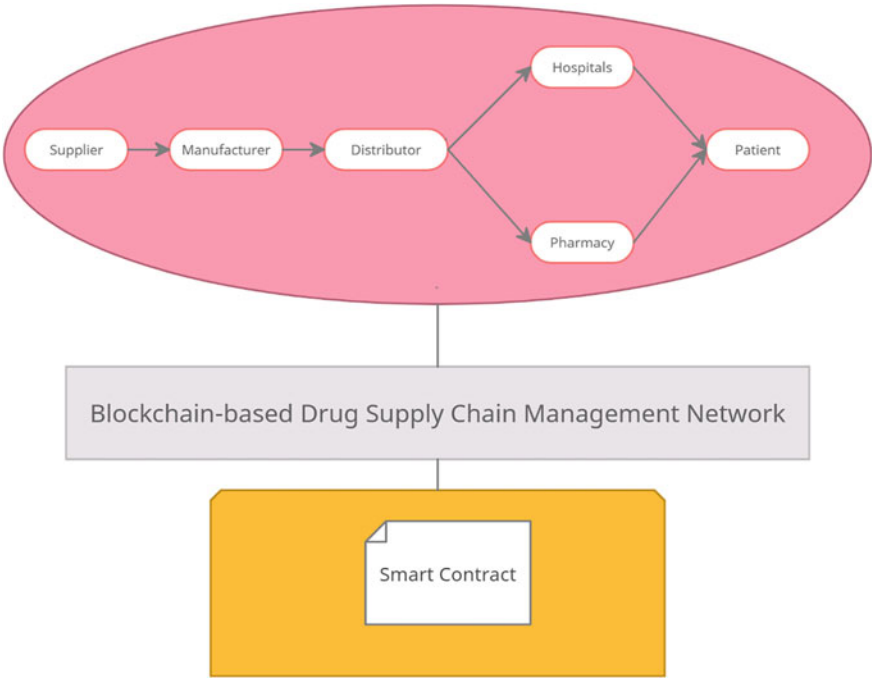


**Fig. 5** Overview of blockchain-based DSCM system

Let's consider a scenario: A manufacturer needs some raw material to manufacture medicines. He then places an order for raw-material to the supplier. The supplier validates his transaction, and it is added in the blockchain. Similarly, when the supplier supplies the raw materials to manufacturer he adds the details like material name, quantity, cost, etc. into the system. Similar kind of procedure takes place when manufacturer supplies the drugs to distributor and adds the manufacturing details like manufactured by, date of manufacturing, date of expiry, etc. as shown in Fig. 6. Same procedure is followed by the distributors, hospitals and pharmacies. As all transactions are stored in the Blockchain, they can be tracked during the process and after the process as well.

Let us consider another scenario as shown in Fig. 7 where manufacturer requests raw materials to the supplier by adding the details into the system. Similarly, when supplier supplies the requested raw materials to manufacturer respective block will be added into the system.

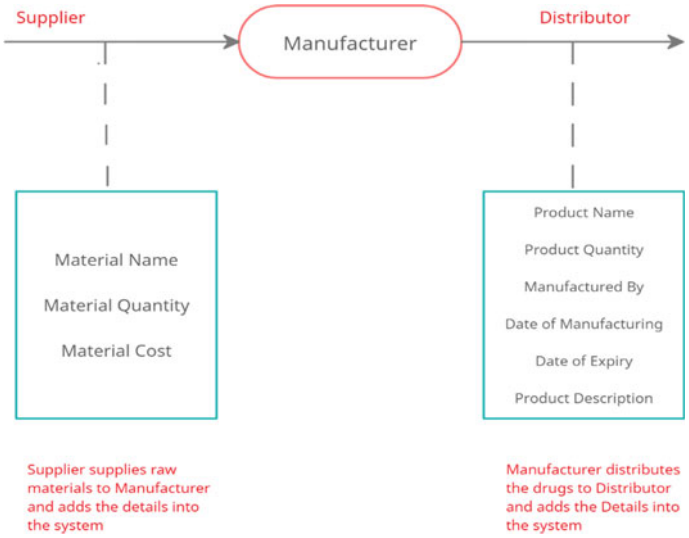


**Fig. 6** A scenario of manufacturer receiving raw materials and adding manufacturing details after distribution

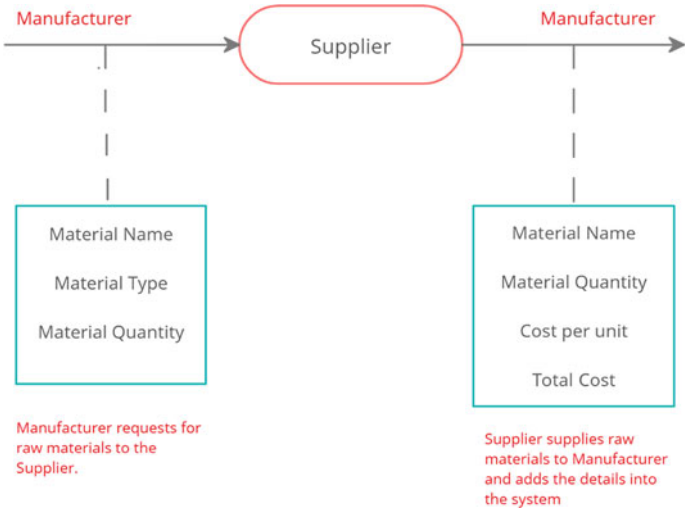


**Fig. 7** A scenario of manufacturer requesting raw materials to Supplier and receiving it

## 9 Conclusion and Future Scope

Various technologies can be used for tracking and analysis purpose such as Machine Learning, Natural Language Processing, Blockchain, IoT and so on. With the help of these technologies a secure and efficient SCM can be maintained. Blockchain-based Drugs Supply Chain Management can be used to track and maintain each and every phase of a SCM efficiently. It will also help in identifying the fake drugs that enter into market. Therefore, the emergence of fake drugs into market can be reduced to a greater extent. This system is not only limited to only Drugs SCM but, can also be used in various types of SCM systems such as Food Supply Chain Management where the product's quality is main objective and hence a proper SCM should be maintained. With the ability of Traceability organization can trace back through each phase and figure out the problem in case of any issue occurs during the further processes. Hence, to overcome the challenges in existing SCM, one solution can be Digitalized or AI-based SCM. In future, along with these technologies IoT can also be used for better efficiency where RFID tags can be used for real-time tracking of shipments and sensors can be used of quality management.

## References

1. Chen, S., Shi, R., Ren, Z., Yan, J., Shi, A., Zhang, J.: A blockchain-based supply chain quality management framework (2017). https://doi.org/10.1109/ICEBE.2017.34.
2. https://www.tutorialspoint.com/supply_chain_management/supply_chain_management_process.html
3. https://www.yourarticlelibrary.com/retailing/why-scm-is-required-5-needs/48284
4. https://www.zoho.com/blog/creator/8-essential-features-of-an-effective-supply-chain-management-solution-by-david-rogers.html
5. https://www.letslearnfinance.com/advantages-disadvantages-supply-chain-management.html
6. https://www.business-software.com/article/key-features-of-supply-chain-management/
7. https://www.supplychaindigital.com/supply-chain/how-ensure-truly-connected-end-end-supply-chain
8. https://www.selecthub.com/supply-chain-management/13-essential-supply-chain-management-tools/
9. Patel, K., Kar, A., Jha, S., Khan, M.: Machine vision system: A tool for quality inspection of food and agricultural products. J. Food Sci. Technol. **49**, 123–141 (2012). https://doi.org/10.1007/s13197-011-0321-4
10. Chowdhary, C.L.: Growth of financial transaction toward bitcoin and blockchain technology. In: Bitcoin and blockchain, pp. 79–97. CRC Press (2020)
11. Coustasse, A., Arvidson, C., Rutsohn, P.: Pharmaceutical counterfeiting and the RFID technology intervention. J. Hosp. Mark. Public Relat. **20**, 100–115 (2010). https://doi.org/10.1080/15390942.2010.493369
12. https://www.manipalprolearn.com/blog/6-ways-ai-making-supply-chain-more-seamless-supply-chain-aka-logistic-industry
13. Baryannis, G., Validi, S., Dani, S., Antoniou, G.: Supply chain risk management and artificial intelligence: state of the art and future research directions. Int. J. Prod. Res. (2018). https://doi.org/10.1080/00207543.2018.1530476

14. Duan, J., Zhang, C., Gong, Y., Brown, S., Li, Z.: A content-analysis based literature review in blockchain adoption within food supply chain. Int. J. Environ. Res. Public Health **17**(5), 1784 (2020). https://doi.org/10.3390/ijerph17051784
15. Pournader, M.: Blockchain applications in supply chains, transport and logistics: a systematic review of the literature. Int. J. Prod. Res. **58** (2019). https://doi.org/10.1080/00207543.2019.1650976
16. Mukri, B.: Blockchain technology in supply chain management: a review (2018)
17. Paliwal, V., Chandra, S., Sharma, S.: Blockchain technology for sustainable supply chain management: a systematic literature review and a classification framework. Sustainability **12**(18), 7638 (2020). https://doi.org/10.3390/su12187638
18. Jamil, F., Hang, L., Kim, K., Kim, D.: A novel medical blockchain model for drug supply chain integrity management in a smart hospital. Electronics **8**(5), 505 (2019). https://doi.org/10.3390/electronics8050505
19. Abbas, K., Afaq, M., Ahmed Khan, T., Song, W.-C.: A blockchain and machine learning-based drug supply chain management and recommendation system for smart pharmaceutical industry. Electronics **9**(5), 852 (2020). https://doi.org/10.3390/electronics9050852