# Blockchain in Supply Chain Management

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***Abstract*—For the past few years, the market has changed a lot and it has become dynamic and demanding which has put the market into a competitive environment. The supply chain plays a crucial role to adapt the business to the dynamic environment as it is very reliant on collaboration integration as well as flexibility. The applications related to the supply chain have gotten the attention of many business owners and to improve the flow control of the supply chain many specialized applications are implemented. One of the most important new technological applications in the supply chain is blockchain technology which has garnered the attention of many business owners as it can be quickly adapted to dynamic market conditions and in the business environment. One upon reading this will get to know about the effect of blockchain technology utilization on this field. The results of the research paper recommend that companies invest in blockchain technology so that the supply chain becomes more transparent, flexible, and secure. There is no doubt in the fact that blockchain technology plays an important role in developing trust with the stakeholder of the supply chain. In the end, the research paper has also given some considerations on the implications that are positive as well as the potential of the blockchain in the field of collaboration and integration.**

***Keywords* — Blockchain, Supply Chain Management, Industry 4.0, Smart Contracts, Transparency, Trust, Traceability, Flexibility.**

## I. Introduction

Most global companies have always faced challenges in supply chain management. The company has always devoted a lot of resources which leads to various inefficiencies and to figuring out cost reduction. With the approach of blockchain technology, companies have thought of thinking forward. This technology could help in the evolution of the supply chain. According to analysts, blockchain technology can enhance the contemporary structure of the supply chain by enhancing supply chain efficiency, trust as well as transparency [1]. Moreover, the future of the supply chain is blockchain solutions according to many supply chain leaders. The survey performed by PwC in 2019 has revealed that more than 24% of the industrial manufacturing industry is looking to implement blockchain technology in supply chain management [2]. The 2020 survey of Deloitte global blockchain reveals that more than 55% of the senior executive, as well as practitioners, looked up to blockchain as their top priority [3].

As shown in Fig 1, Fig. 2 and Fig. 3 the industry of the 4.0 era, blockchain technology plays a crucial role because of its distributed secure technology. The technology has garnered attention from both academia and industry [4]. Blockchain is a distributed ledger technology that offers the participant a secure settlement of transactions and transfers at a very nominal cost [5]. Moreover, blockchain is not a new internet infrastructure but it's extremely new in the field of supply chain networks that offer the future of business.

### *1) Definition of blockchain*

It is known to be a string of encrypted data blocks where the blocks have the information that is the data, and the information is locked so that whoever has the key can access the information [6]. The chain contains many files linked with one another and each of the files includes information such as a timestamp that speaks about when the data is created and the historical information about the blocks in the blockchain [7]. All the blocks together are known as the blockchain.

### *2) Blockchain infrastructure*

Blockchain can only be accessed over a computer, laptop, server connected to the internet. All the devices when connected are known as nodes of the blockchain. Blockchain is stored by the nodes and permission is given to certain users that will be discussed in the study of blockchain in the supply chain [8]. A ledger is created when the blockchain is stored across the nodes which are recognized as a system where the data is stored and is shared across various sites, countries, or institutions [6]. Traditional databases are used to contrast the distributed ledger where the digital data is enclosed in a centralized location and in blockchain, the nodes store identical data.

### *3) Adding to the blockchain*

To add data to the block of the blockchain, it is required to send a node out a transition request with the data that is added to other nodes of the network of the blockchain for the creation of the block [7]. It is necessary to agree to the addition of the new block to the blockchain before the block is added to the chain. At the time of the validation of the new block, the node mist confirms that the block is correctly formatted and there is no duplicate transaction in the block [9]. Once the block is validated, an encrypted block is added to the blockchain and in the blockchain network; it is stored by the other nodes.

Due to the encryption nature of the blockchain and distributed ledger format, the data on the blockchain is not hackable and thus there is a lot of trust and confidence in the data that is stored on the blockchain [10].

Submitted on August 29, 2022.
Published on October 14, 2022.
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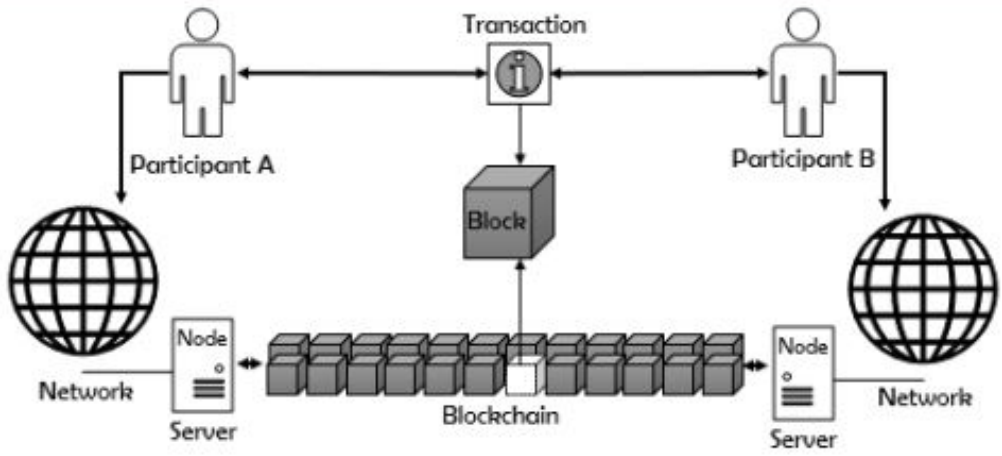


Fig. 1. Blockchain Concept [8].

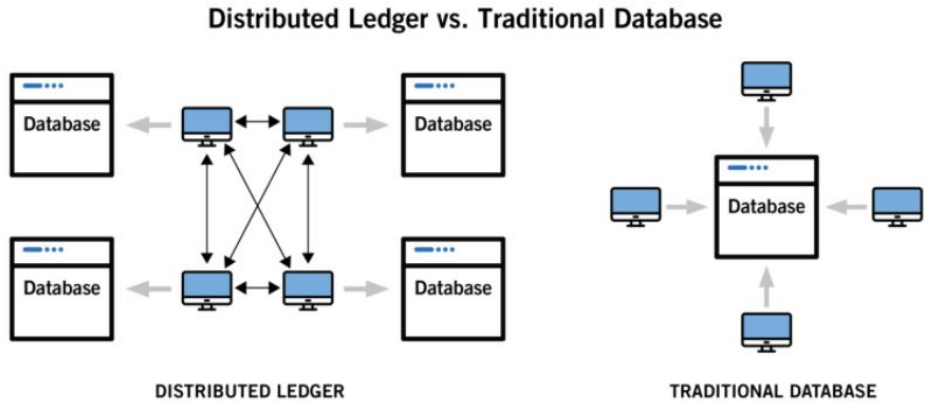


Fig. 2. Blockchain Infrastructure [6].

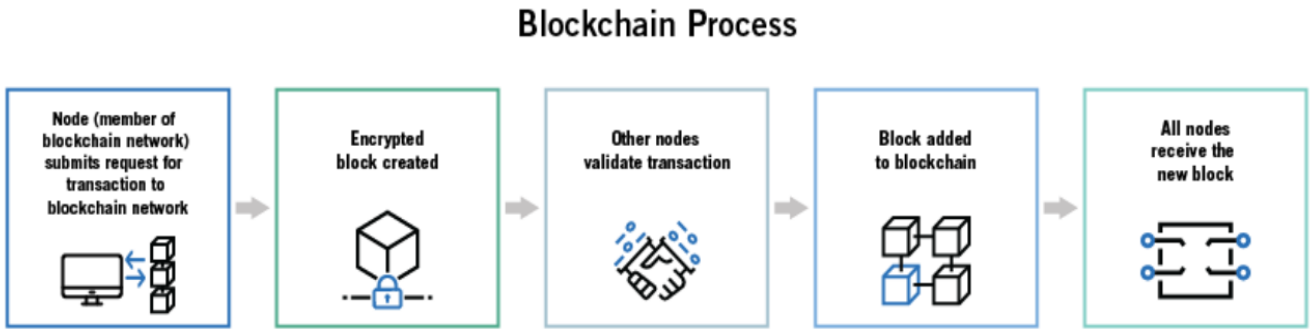


Fig. 3. Blockchain Process [7].

### *A. Research Objective*

The purpose of the research is to discuss blockchain technology and how it can help logistic companies. Blockchain technology is a new technology, and most people are not familiar with this innovation however the paper has helped the readers to know about the introduction of blockchain technology and how it can help in supply chain management.

### *B. Research Question*

How can technology help to find a solution to some of the supply chain challenges?

### *C. Research Motivation*

In the field of the supply chain, there are a lot of products that deliver to the customer that comprises independent farms. Because of these reasons, the business fails to compete as isolated companies, but they are also a part of the huge supply chain network [11]. Moreover, the companies are also encountering uncertainty challenges because of the globalisation and high expectation of the customer. There is also a huge market competition and complex supply chain that demands cooperation across the supply chains. Supply chains are fragmented because of internal competition and limited information exchange. Apart from this, these constraints also have a huge influence on business performance and give rise to challenges and constraints like

high operation costs and capacity storage that can be easily resolved by blockchain technology [12].

### D. Research Gap

Blockchain technology offers a lot of benefits but it's not a comprehensive solution in the supply chain management field. There are many problems with blockchain-based technology and other related technologies. The project must realize challenges in the supply change domain and the supply chain system that a blockchain-based system requires various legislative resolutions. Moreover, the present blockchain platform fails to meet the high level of transaction throughput requirement of the supply chain system. The supply chain comprises diverse participants. Hence, it is necessary to provide incentives like efficiency gains to improve liquidity as well as data security so that the participants are well motivated. Other important issues related to blockchain are security and privacy [13]. There are concerns with data of the IoT and the present IoT system is created on the central model where the IoT devices are figured out, connected as well as validated. Thus it is necessary to think about the transformation for the detection of blockchain technology.

## II. Literature Review

### A. Blockchain in Supply Chain Management

#### 1) Blockchain Technology definition and its boundaries

It has been discussed above that blockchain is a distributed ledger database that consists of records or transactions or various digital incidents that are executed by the participants. Some articles have been published to a clarification on blockchain technology and how it works in the recent past [14]. Cryptocurrencies are one of the most popular examples of blockchain technology has been also named Bitcoin. Apart from these cryptocurrencies, there are also human implications of this blockchain such as supply chain, financial services, and manufacturing. This research paper has focused on the implementation of blockchain in supply chain management rather than concluding the technical mechanism of the blockchain technologies [15]. The paper has not talked about blockchain technology's key aspects like the protocols, algorithm, wallet signature and hash function.

#### 2) Supply chain management definition and its boundaries

The definition of supply chain management is not the same for all others; however, according to [16], supply chain management is a process of handling the entire integrative flow of materials ranging from a raw material supplier to production warehousing and transportation to the users. There are various methods involved in supply chain management and it is important to identify its boundaries [12]. In this research paper, all the supply chain activities ranging from supply to manufacturing, distribution and the activities related to customers has been discussed. Apart from this, supply chain management also discusses the management of the entire chain in the study.

#### 3) Blockchain-based supply chain

There is uncertainty about the adoption of blockchain, globally as well as logistically [17]. The reason is the immaturity of blockchain, and it is looking to transform the SC activities by helping enhance as well as accountability. According to [18], transparency is a crucial factor in the traceability level. However, [19] has come up with 3 types of transparency in an SC. They are a range of transparency products, transparency, and participation transparency. Thus to implement blockchain-based SCs, it is necessary to analyze the SC transparency factor and to correlate it with the opportunity as well as list perspective analysis so that it could help in assessing the mystery gains or losses.

To understand blockchain technology in the supply chain, it is necessary to consider interdisciplinary investigation so that theories can be built and designed for blockchain technology [20]. Moreover, the firms can be benefited from blockchain-based social sustainability and responsibility to extend visibility and assure due diligence. It has been found that there is a lack of experience in understanding and knowledge about blockchain technology and there is also a labour skill gap with this technology that is required to be fixed. Moreover, according to [17], blockchain technology for technology and business needs to be addressed properly because there is a lot of expectation from this technology that can lead to the field adoption of this technology in the industry.

Blockchain technology can assist in achieving the seven objectives of SCM: their cost, quality, speed, dependency, risk reduction, sustainability as well as flexibility [21].

[21] has discussed blockchain as a capability to break down data silos and provide one data source in digitization with the help of real-time data control that is required for all trusted partners in the network. With the help of blockchain trust and security can easily be enhanced and apart from this, there also exist business values that would help in building trust with the help of blockchain by improving efficiency, reputation, and responsiveness [17]. It can be easily concluded that the blockchain has a huge impact on the performance of the supply chain however when it comes to operation management, the blockchain provides a lot of advantages over the existing systems. According to [22], enterprise resource planning, radio frequency identification, and the blockchain are regarded as complementary technologies and it is extremely important to analyze their best combination so that we can maximize effect and impact.

According to [20], there are four barriers to blockchain development-enabled SCs are interested-organizational organizational, technical as well as external variables. There is no doubt that despite these barriers, blockchain technology is extremely useful as the driver of digitization in the SC [20].

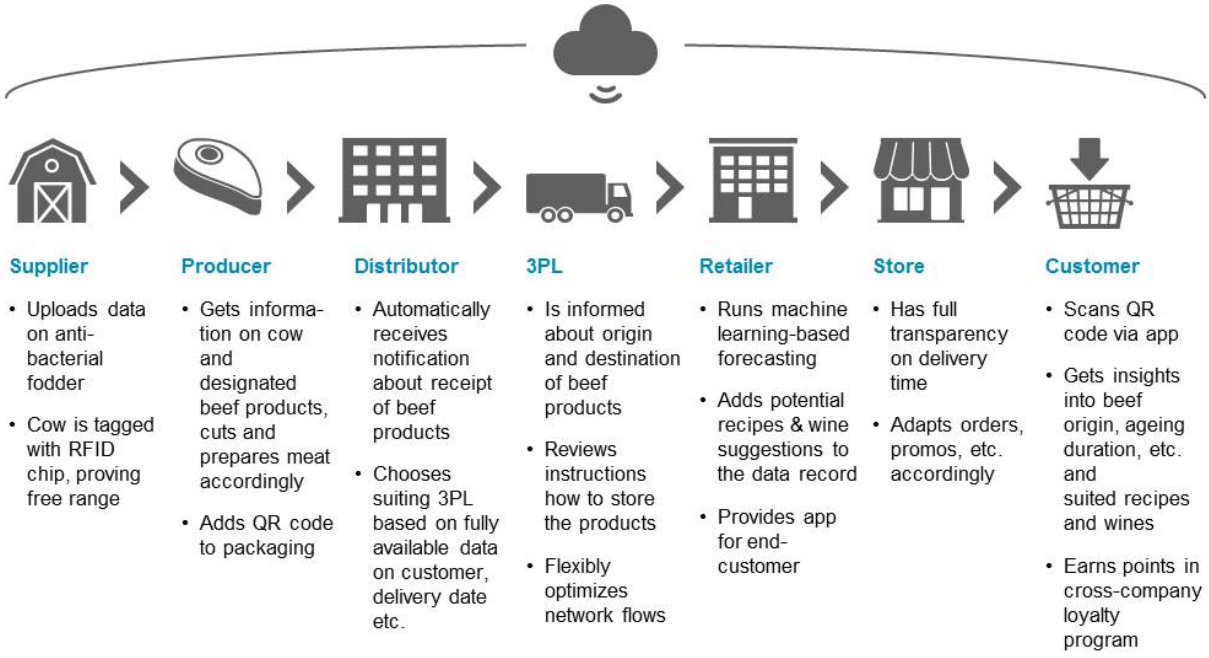


Fig. 4. Blockchain-based supply chain management [1].

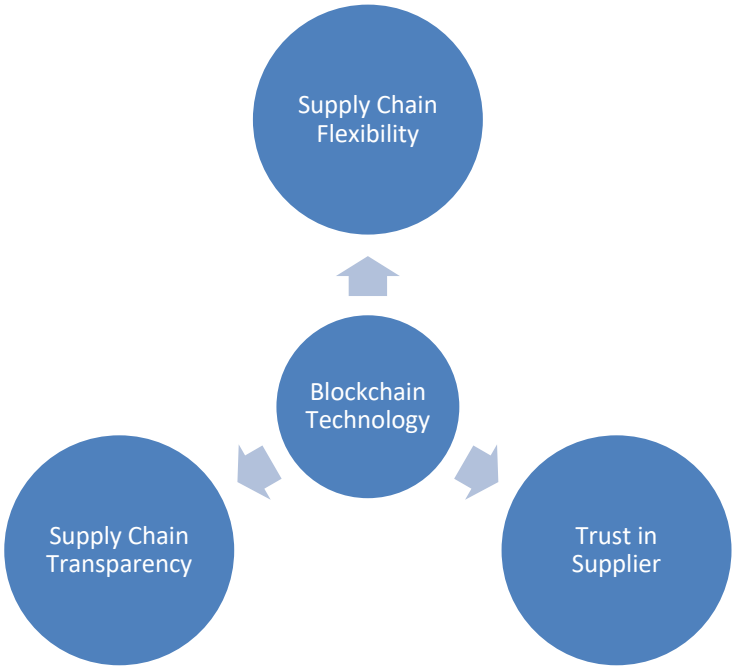


Fig. 1. Blockchain Utilization in Supply Chain [22].

*4) Blockchain Technology and supply chain transparency*

As shown in Fig 4 and 5 the field of the supply chain, blockchain plays a crucial role in solving two major issues based on transparency, traceability, and irreversibility of transaction data. The two major issues of the supply chain are the difficulty and inadequacy in moving and claiming responsibility because of the insufficient information transparency and the inferior product quality that is not easy to be eliminated because of the multizone and long-term characteristics of the logistics [23].

For better tracking and reporting, blockchain plays a crucial role it also allows for better transparency in logistics. Moreover, the company can be benefited by improving the delivery timeline [24]. The wide distribution of supply leads to an increased risk of mismatch conflict and inconsistency related to the old fashion supply chain. To eradicate this issue, blockchain can play a crucial role and the implementation of GPS-based vehicle tracking can be useful by integrating it with blockchain technology. Moreover, blockchain technology is also a good option for logistics as there is the involvement of vehicle Location tracking to reduce cost and increase efficiency [17].

In the field of manufacturing, blockchain technology offers a lot of potential by assuring security transparency as well as stability that has no central data storage Technology [2]. Blockchain technology can prove to be better than traditional

centralized solutions by offering promising results in the organization and economic criteria.

*5) Blockchain Technology and supply chain flexibility*

The present supply chain functions are in a more complex and uncertain business environment than before. Customer expectation is very high because of the product diversity and the short Product life cycles. All these domains require flexibility in the supply chain and if the supply chain is flexible then the company and its supply structure are required to adapt to the changes in the environment [25].

Flexibility in the supply chain is defined as the ability to meet and react to a wide customer base to gain a competitive advantage against competitor. There is no doubt in the fact that the business has experienced a highly ambitious situation because of continuous change [26]. The government can make use of flexibility so that it can adapt and respond quickly to the massive change of the absence of good information. In the supply chain, it is necessary to create a flexible one so that the company can achieve a sustainable competitive advantage in the present environment that calls for dynamism, uncertainty, and unpredictability. Moreover, if there is a flexible supply chain then the company can be assured of an improved delivery process and the product can be easily transported to the market in the required quantities [27]. Moreover, the improved supply chain can help in handling the challenges of the environment because business transactions are becoming much more volatile and global.

When an organization can properly respond to and adapt to disruption and demand then it can achieve flexibility across the total supply chain against the competitor to cater to the customer need. To achieve flexibility in internal and external supply chains, it is necessary to focus on rapid economic and technological development [25]. Companies that have a flexible supply chain will find it easy to respond faster in situations that are not certain. Moreover, a flexible supply change can also enhance the company's ability in presenting the product and services clearly and effectively to the customer and meet their needs [27].

One of the most suitable technologies for achieving flexibility is blockchain technology by facilitates tracking and tracing in the various stages of production. The implementation of blockchain technology in the supply chain lies at specific contact points [28]. Blockchain technology will allow the organization to control data security for all the supplies in transactions. Apart from this it can also enhance the visibility of the supply chain and offer real-time data sharing on the network. Therefore, the blockchain can assist in supply chain flexibility strategies by meeting the various numbers of stakeholders that are affected due to an outage [29]. The technology can also integrate the various supply chain processes and can enhance production and management which would result in a more realistic supply and inventory management. Another advantage of using blockchain technology in the supply chain system is that it can offer the design-related documents that are to be shared and used [24]. All these factors will help the organization to improve decision-making throughout the supply chain as the various documents can be easily provided to all the participants.

*6) Blockchain technology and trust in the supply chain*

There is no doubt in the fact that in modern society the trade network has become much more complex and the various forms within the network are forced to interact with companies that they are not well aware of. Thus it is necessary to develop trust between the firms to call for supply chain success and there is a necessity for optimum information success to ensure trust [30]. The supply chain stakeholders look to get rid of uncertainty risk by information sharing. This leads to dealing with ethical noncompliance, lack of communication, and infidelity. To get rid of the possibility of trust being damaged in the field of the supply chain the two things that are required to be assessed are connectivity and vulnerability. One of the most important steps is the risk assessment process where one needs to figure out the supply chain partner [31]. This is followed by the supply chain map that showcases the relevant information flows and how it is created. By identifying the floors one can predict the potential bottleneck as well as studies and attack levels.

The information sharing in the supply chain process has many important factors that drive bloat blockchain technology; development is regarded as the most crucial factor as demonstrated in Fig. 6 and Fig. 7. In blockchain technology, the transactions are identified in a time-stamped and observable manner and then confirmed, there is no point in changing the transaction once the right parties approved the name. Talking about data integrity and security, blockchain technology is much more secure, traceable, efficient, and transparent in the field of supply chain transactions [32]. There is no way of changing the record on the blockchain hence the supply chain members' transactions and decisions are properly recorded and documented on the blockchain technology.

As shown in Fig. 8 the supply chain members are well aware of the transaction accuracy and the activities. If any situation arises where it can lead to controversial business results, the members of the supply chain can easily monitor the name and take necessary action and adjust the activities accordingly at the time of finalizing the future transaction [33].

A smart contract is another part of the blockchain that creates trust in the supply chain process. The application of blockchain as well as smart contracts can be implemented in various areas ranging from insurance returns to financial transactions as well as corporate transactions [33]. Just because of this reason the various numbers of blockchain and smart contract applications has increased over time. The smart contract feature of the blockchain can be easily applied in the supply chain that comprises multiple tiers of suppliers as well as subcontractors [34].

Things that can negatively affect the trust between buyer and supplier are the conflicting goals [17]. With the implementation of blockchain, this thing can be easily resolved and the negative impact on this conflict can be mitigated by enhancing trust in the supply chain.

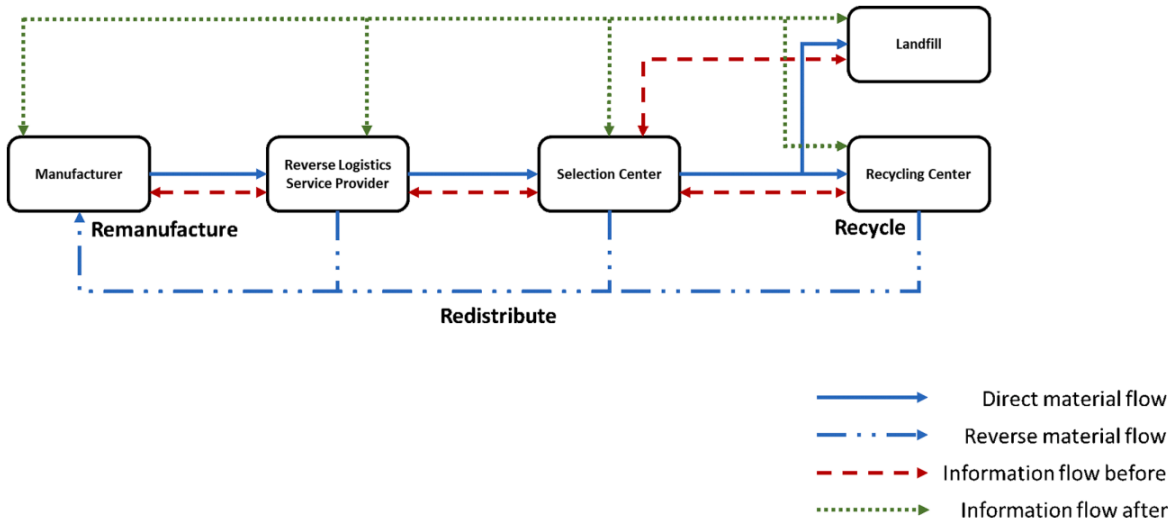


Fig. 2. Blockchain technology for bridging trust, traceability and transparency in circular supply chain [26].

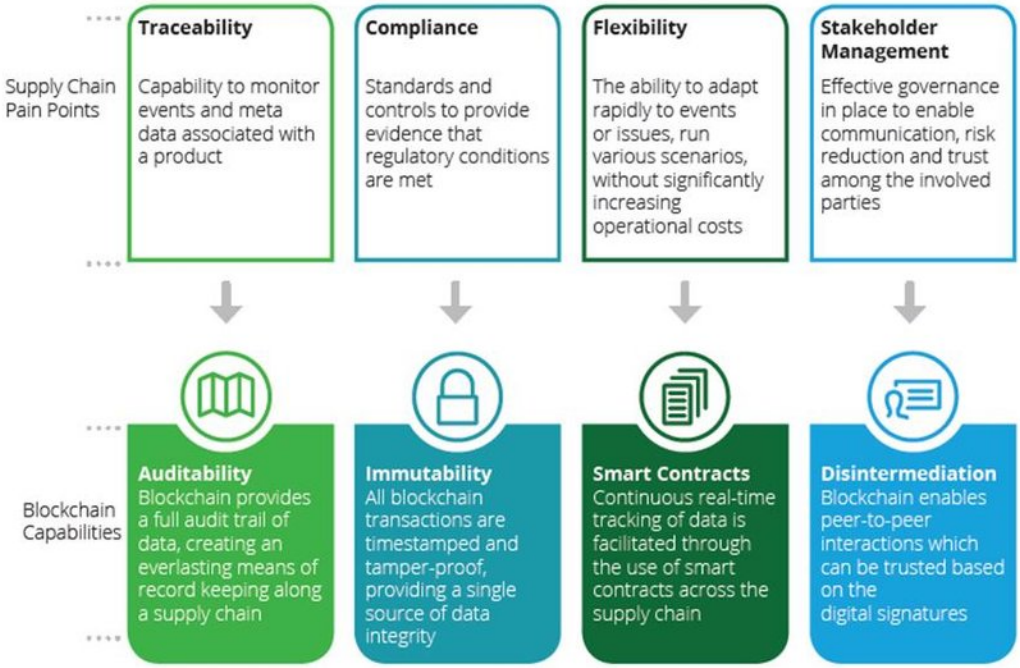


Fig. 3. Blockchain and Supply Chain Flexibility [29].

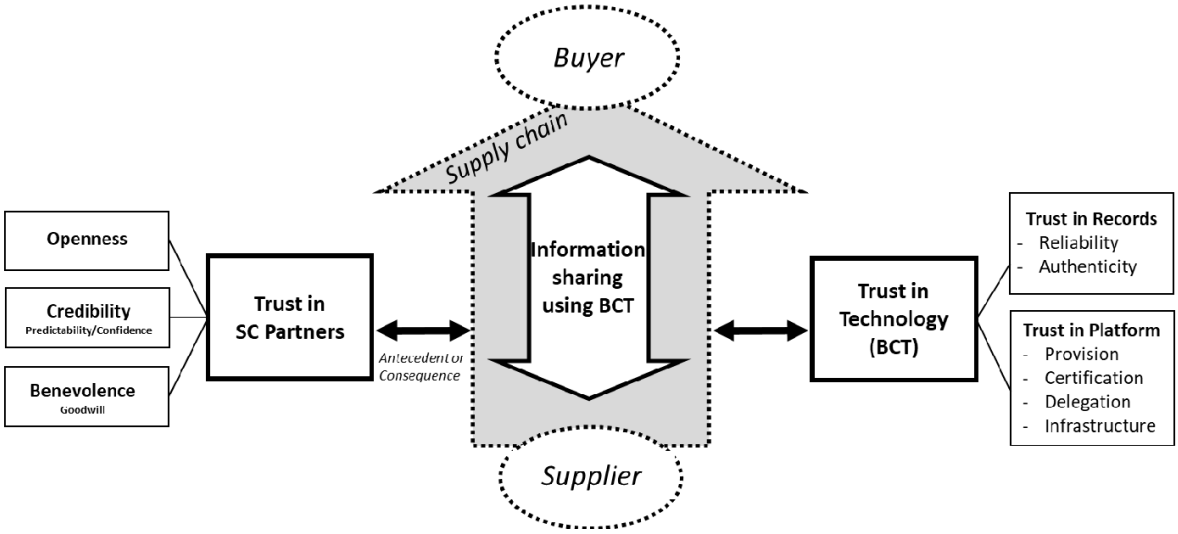


Fig. 4. Blockchain and Trust in Suppliers [13].

### B. Current Challenges

The study has pointed to the implementation of blockchain in the field of supply chains. The blockchain is at an early stage but the study has predicted to bring revolution in the supply chain in the future with the implementation of blockchain technology [17]. It has been predicted by scholars that the implementation of blockchain in supply chain management can bring a lot of positive results [35] and therefore, they are optimistic about this technology. An increasing number of papers have now been made on the blockchain in the field of supply chain management [17].

### C. Literature Gap

In supply chain management, there are very limited papers on blockchain technology. [36] has talked about the transparency and traceability that blockchain technology can bring into supply chain management and [20] has come up with a study that has explored the adoption of blockchain. [21] explored the supply chain management of the tips. This technology has not only attracted the attention of the managers of the supply chain but there are other technologies such as smart contracts, the internet of things, and artificial intelligence that could bring a revolution in supply chain management significantly [37]. However, there is a shortage of research papers that study the role of integrated technologies in supply chain management along with blockchain technology.

Moreover, there were very few literature reviews have been conducted on blockchain in the field of supply chain management over the past few years [19]. Few papers have concentrated on certain aspects of the supply chain like sustainability, provenance, and resilience, while other literature reviews have explored the topic with a broad comprehensive view. An in-depth analysis of this literature review based on the citation and bibliography can help in gaining insights that were not obtained in the previous pieces of research.

## III. Methods and Materials

### A. Research Methodology

The literature review method has been taken in this research paper to answer the research questions. The research paper has highlighted that many review papers have talked about the technical aspects of the blockchain in the field of the supply chain, but the research paper has not concluded any specific management focus on the supply chain [35]. The research paper has only given the foundation of the research. According to [31], the literature review is a systematic, explicit, and reproducible design for figuring out, evaluating, and assessing the body that exists of the recorded documents. In this paper, one will get to know the literature review on the implementation of blockchain in supply chain management [19]. Moreover, one will also get a detailed study of the blockchain review and the practical application that focuses to give a more prominent and integrated understanding of the blockchain and the influence it has on supply chain management.

### B. Research Design

To carry out any research, the researcher can use any research method from qualitative data, quantitative data or a mixed-method approach. The qualitative research method utilizes interpretivist research philosophy as this research design is suitable for research where new insights are required to be gained from existing knowledge or the phenomenon is not much known [38]. Therefore, considering the nature of the study of blockchain technology and its application in supply chain management, the best research method to be used is the qualitative method. An exploratory research approach will be followed as the research tends to explore the impact of integrating blockchain in supply chain management [39].

### C. Data Collection

There are a couple of keywords that are supply chain and blockchain in the searching process. The research paper has been chosen based on the past seven years and the aim is to go for related topics that resemble previous research publications. Journals such as Google Scholar, Emerald, Science Direct, Research Gate, Taylor and Francis, Elsevier, Wiley Online, etc have been taken into account to research. Mor than 441 documents were found and out of these, 285 and 116 documents have been eliminated because of duplication and irrelevant content to the topic respectively. The topic selection process has taken 156 candidate documents and the grey research paper has only considered 40 selected documents to discuss father. High-quality peer-reviewed journal articles have been taken into account that establishes communication between the research fellows. The reason why the report has also considered conference papers, consulting reports, and third-party reports is because the blockchain is at an early stage and there are only a few published articles on this topic and all these resources that have been considered would provide updated information on the topic [15]. Moreover, the paper has reviewed the full article and assessed for relevance when the abstract of the specific study was not available.

### D. Study selection and evaluation

The author has reviewed the eligibility of the literature properly based on predefined exclusion and inclusion criteria. Before introducing the literature, the exclusion criteria have been utilized in the bibliographic manager. The grey literature was assessed where the author has looked up to the abstract of the research paper in the introductory part. The step was followed by the full-text review as well as some additional articles were excluded from study documenting. The discussion has helped in resolving any discrepancy related to the relevance of the articles that were reviewed until consensus was achieved. Apart from this, many studies were also excluded because they have not focused on the technical aspects of blockchain technology as well as blockchain architecture. The reason why they are excluded is that all these articles were not fitting the introductory criteria and thus they are used in the article introduction.

## IV. Results and Discussion

### A. Results

There is no doubt in the fact that the modern supply chain has benefited from the advancement in technology but there are still significant challenges the modern supply chain management encounters in functioning which are discussed below:

- Complex ecosystem: there is an intricate web of suppliers as well as registered channels of the global enterprise that operates at regional, national, and international levels [16]
- Lack of traceability: it becomes difficult for the supply network to pinpoint providence
- Improper response: there can be delay experienced if the process mismatch in between the individual country and the operating company
- Poor visibility: when the process is dispatched, [17] the company cannot keep track of the goods with the help of barcodes in the transit
- Data reconciliation: there can be problems with data reconciliation because there is a different process that is likely to log data in various ways
- Lack of trust: there can be a lack of trust in the system and the function when they are not transparent [40]

The research paper has highlighted that complexity is the main factor of all these challenges. Previously companies had a limited number of suppliers and thus they know what to expect and whom to communicate with at the time of problems. But with time, the business ecosystem has changed, and the participants are not aware of one another and don't have visibility into the multi-layered supply structure [36]. The business is also not aware of each other stated activities which increase the possibility of risk. There is no way that the business can go back to the old practices because the market has become very wide and complicated as of now. But the complexity can be solved by finding a new way that would help in transparency and building trust between the companies [35].

One of the major problems of supply chain companies is end-to-end monitoring. This has led to difficulty in figuring out the location as well as the condition of inventory in forecasting customer demand and properly tracking the share of the capacity of the transport [7]. Moreover, this also gives rise to improper end-to-end visibility, when global supply chains with geopolitical unrest are considered and it can put the organization at potential risk of disruption. If the company does not have a transparent supply chain, they can experience heavy losses as they have very improper information to figure out t response to disruption [20].

Blockchain in the supply chain process assures secure online transactions and this technology is the most suitable technology that can be adopted by supply chain management companies [18]. Apart from this, the technology is also helpful in providing the customer proper service by making it easier to access all the information of the product. The technology is also well valued for transparency, honesty as well as openness in the relationship of the various fields of the supply chain [28]. Blockchain technology also offers faster transportation of goods and to figure out the weakness in the chain.

There is no doubt in the fact that the technology would offer potential security and transparency comprehensively. The companies using blockchain technology can monitor the changes as well as record everything that was changed and who and why they have changed [14]. The reason why they can track the changes is that the items in the chain have a particular version of the registry and they will not experience any disagreement about transactions in the supply chain which makes the transaction process efficient [21]. When the products in the organization are shipped and the smart contract is signed the data gets reflected in the ledger. The data is then stored with proper information that as who created it and when it was created as well as the information on whether it was difficult to fake. Moreover, the companies who have access to this ledger can read the items and look at who is having the items currently [34].

The paper has also discussed how blockchain can be treated with the internet of things and mobile technology to prepare a real-time delivery monitoring system [6]. There is no need to track the products manually rather one can use digital sensors to track goods in the entire supply chain from beginning to finish. The combination of blockchain and the internet of things in logistic companies can help in reducing delivery as well as with the logistic process to transfer it to closely track deliverables [17].

With the help of this, the organization can have an accurate and updated inventory by attaching small sensors to the products [1]. The smart inventory can provide useful data about the items that talk about past location and on-site storage times and many more.

There are also important attributes that are offered by digital ledgers that the supply chain can adopt. A study by [19] has indicated that blockchain assures transparency, security, authenticity as well as visibility. However [30] have explored the various attributes of the blockchain like decentralization, security, visibility as well as trust in the supply chain. [36] has come up with the characteristics of the blockchain that has talked about decentralization, persistence, anonymity, and the various commercial properties of the blockchain. [24] has highlighted that building trust is one of the important parameters for a business network that the blockchain can assist in the supply chain field.

The literature merges the attribute with similar names and also summarizes the key attributes of the blockchain even though the previous studies might have different names for that attribute [11]. The key attributes ate properly and were explored accordingly in the section.

### B. Discussion

It has been discussed above that blockchain development is still a beginning and Technology such as robotic Technology, 5G, IoT, 3D printing, and big data can be integrated with blockchain technology in the 4.0 era [37]. Talking about the IoT system, can be used in conjunction with blockchain technology for enhancing traceability by collecting census offering consumers as well as retailers to trace the total process of the supply chain [22]. Other applications suggest monitoring delivery process and machine landing models can be used in predicting potential

risk and tracing the origin of the raw material. their system can be used to its full potential by installing different types of sensors that can help in generating various traceability reports. Moreover, by integrating the above Technology with blockchain, many features can be benefited by arranging the resources of the logistics by the IoT system availability [10]. Hence the client can figure out the delivery status as soon as possible without any hassle.

## V. Conclusion

There are a group of companies that make supply chain systems, and it also consists of various types of flow such as information, finance, and goods. It Is important to collaborate with the various forms of the business and integrate the flows to enhance the total performance and come up with a competitive advantage for the various organizations. The literature review of the blockchain explored the powerful features that can be used in various fields. Moreover, the paper has also highlighted blockchain technology and how it would facilitate supply chain collaboration and integration.

This paper converges the main themes of compliance, immutability, disability as well as transparency. It also agreed to the fact that the main themes are there in the blockchain and how it can help in bringing advantages of the supply chain management. The reason has also shown that the blockchain is one of the emerging technologies and the pandit must be given the chance to prove that it can bring a change in the supply chain.

The people have also explored smart contracts and how in reality they can be helpful by implementing them in today's traditional system. Analysis has also been done on smart contracts about how one can input data into the blockchain. On the other hand, a few of the researchers did not agree with the fact about blockchain implementation is a standalone software that plays a pivotal role in reducing the cost of traditional software. But most of the researchers have agreed to more than one point that blockchain implementation in IoT devices reduces cost.

### A. Future Work

Blockchain is an emerging technology and can help in the upliftment of the supply chain business; it alone cannot make any disrupted changes in the business ecosystem. But the research paper has highlighted that the technology would provide direction and ideas for future research and a couple of directions have been suggested. The primary objective is to monitor the business needs that are defined at the high level which consists of capability needs. The second factor is the Technology exploration research that will develop innovative services by taking into account new information and communication technologies.

Lastly, the authors suggested that it is very crucial to integrate blockchain with other technologies like the IoT, smart contract 3D printing, etc, and welcome the end user to give ideas on the various services. All the studies would help government managers as well as researchers to understand blockchain technology and implement it in business and supply chain management.

### B. Open Research Questions

Currently, the organizations have no clue about blockchain-enabled solutions and a seeking networking with the corresponding groups on this concept. The progress of blockchain technology in the supply chain field has been slow in enterprises because of several reasons that are discussed below.

- The organizations are still arguing for finding a solution that can offer the best integration, security, privacy, customer experience and scalability.
- The organizations are not sure of the regulatory as well as compliance application of the deployment
- The potential use cases have not been identified and how the use cases can be comprehensive is also not judged
- The organization fails to identify when to initiate in making a consortium or to join with the existing one
- Metal hurdles because of the extensive complication interaction as well as change in the management ahead
- The rising tactical and technological issues that are required to be addressed include performance and scalability, data governance, enterprise architecture as well as business process design.

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