

Evaluation of Digital Supply Chain Management with Help of Blockchain

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ABSTRACT

Blockchain, by architectural and behavioral which is a distributed, decentralized open ledger or database. It is linked with each other using the cryptographic hash value. Blockchain technology is more secure than other database systems due to its transparent and distributed nature and it starts its journey from bitcoin. Blockchain security is a more reliable and prospective part of our future life, it is now utilized in different areas like supply chain management. The digital supply chain meets customer demand, customer needs as well as shared them effectively. Here the product and service deliveries must maintain transparency and should be tracked to provide visibility in the supply chain. Companies operating in supply chains as an established process and data integration is done through the specialized intermediate companies, with the company-specific data for various organizations and systems. This paper investigates the requirements and functionalities of supply chain management. We explain how supply chain integration through the blockchain technology and how it can achieve disruptive transformation in digital supply chains and networks.

Keywords: Blockchain, Supply Chain Management, Miners, smart contract, B2B, Digital Supply Chain.

1. Introduction

Though Bitcoin was the first application of blockchain and it deals as a kind of digital crypto-currency based on blockchain technologies and it gets mind-blowing success. Now the trends go to the utilization of the things on the internet as we do in our real world. After the success of Bitcoin[1], people now can utilize blockchain technologies in many other fields and services, such as digitized financial market, IoT, supply chain, voting, medical treatment, performance report generating, and storage. Blockchain technology is also taking a big role in logistics and supply chain management. This particular technology received attention by giving some global features by which it can able to create a trusted, distributed, and transparent open ledger of transactions. Now, as supply chain managers start to recognize all possibilities of this new technology, there is a high potential for this distributive transparency. The arrival of this technology is very timely because consumers are demanding supply chain transparency. For example, consumers often want guarantees that what products they purchased and consumed are must be in good quality and the authenticity may be checked by every user, and if it is not up to the mark then wherefrom it deviated and who is the responsible person for it[2]. The responsible concerns are exacerbated when supply chains are multi-tiered and increasingly global in scope. Blockchain technology also promises to drastically change transaction methods by providing a transparent and immutable record for every step of inspection[3, 5].

Blockchain technology combined with the business ability logic with the use of smart contracts (in case of ethereum platform) enables the following:

- Transparency into the consumer ends— from the source point to end consumption of supply chain
- Accurate asset tracking of the supply chain
- Enhanced licensing of services, products, etc. for everyone from manufacturers, retailers or consumers

Today's technologically advanced world, supply chain also able to improve its efficiency, tracking, and limit exploitative behaviors.

The implementation and utilization of public, private, and hybrid blockchain will able to bring traceability, transparency, and accountability to the movement of goods, logistics, and commodities. The technology can be applied to logistics to make business processes more efficient and to cut costs from supply chain infrastructure. In section 2 we discuss the basic concepts and background of blockchain technology, and section 3 explained to us the basic concept of digital supply chain management. How the blockchain technology helps and enhances the prospect of digital supply chain management is presented in section 4, followed by this discussion and application of blockchain technology in the supply chain the conclusion and future scope is found in section 5.

2. Background of Blockchain

A blockchain is nothing but an immutable ledger that replaces the concept of the traditional ledger by creating blocks and linking them cryptographically to form an almost unbreakable chain. For example, if a person wants to purchase a new property and got the authority of that property then the purchase is a valid transaction and a block will be generated and linked with the previous blocks of other people who have bought that particular property previously. Blockchain is a solution to all the participating nodes in a distributed network to maintain a continuously growing list of data records. A public ledger records all the data, including information after the completion of every transaction. No third party organization is needed in the middle by blockchain. All nodes in the blockchain maintain every transaction ever completed in Blockchain and share among themselves. All anonymous nodes in blockchain make it more secure for other nodes to confirm the transactions. The first application was "Bitcoin" that introduced Blockchain technology. [1] In a decentralized marketplace, the participants can make transactions to buy and sell products through Bitcoin [6].

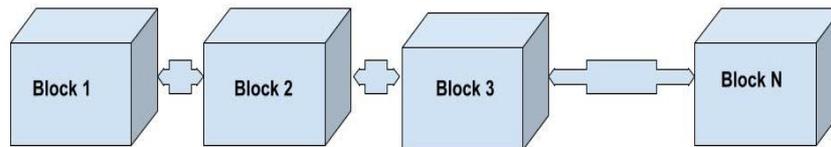


Fig1. Blockchain

Here, figure 1 is the pictorial representation of Blockchain where N blocks are connected.

2.1 Structure of Blockchain

As per structure, blocks of the blockchain are tamper-proof. The structure of the Blockchain has 2 main parts. The blocks are tamperproof. The structure of the blockchain has two portions. They are blockchain header and transactions. The blockchain header has a) hash value of the block, b) the hash value of the previous block, c) nonce, and d) Merkle root. Another is the transactions, i.e. the data stored in the block. Fig 2. Shows a diagram of the blockchain header. Each block starting from Block A to Block N all have the four fields in their header. These are as follows:

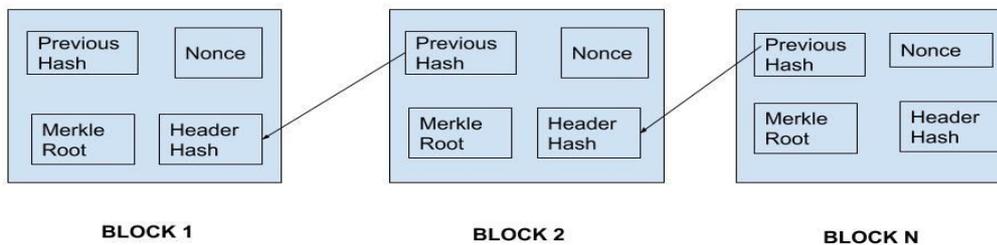


Fig 2. Blockchain Header

A hash value of the header: The principal block identifier is the hash value of the header. Each complete node computes after receiving the new block. To identify a block unambiguously the hash is used [8].

Previous Hash value: This field holds the hash value of the previous block. It is used to create the chain by linking the blocks with each other.

Nonce: A nonce is a number that is used and validated before generating the header hash value of the current block.

Merkle root: This concept of the Merkle tree was introduced by Ralph Merkle. Also known as a hash tree.

each leaf node of the Merkle tree is labeled with the hash of a data block.

each non-leaf node of the Merkle tree is labeled with the cryptographic hash of the labels of its child. Merkle tree root is one of the fundamental data structures behind blockchain. Construct a Merkle tree with all set of transactions and if someone wants to change any transaction then the Merkle root will be changed.

2.2 Advantages of Blockchain

A Blockchain, a distributed severally decentralized ledger that facilitates the transaction recording process that (recorded data) shared among all nodes connected to the network, If the transaction is verified in the block and added to the blockchain then it becomes immutable. Though it operates in a not trusted – third parties until Blockchain becomes one of the most promising application prospects and attracted to a lot of areas including academic and industry [4, 7].If we analyze the major reasons for the trust of Blockchain, then we can be framed priority-based properties. Some of them are discussed here –

1. *Transparency:* It is one of the most prime reasons of which Blockchain is intriguing technology because it is an open-source i.e. all the connected participating nodes have the opportunity to visualize the data but they as well as the owner can't change or modify it after entering to the Blockchain and if it is altered then countless eyes on the network can see it. So the Blockchain becomes transparent which also makes Blockchain anonymity.

2. *Minimize the Transactional Cost:* Blockchain allows peer-to-peer transactions i.e. B2B (Business –to – Business) which may complete without third parties interaction. So since there is no middle person then the transactional cost is also reduced than any other technology.

3. *Make Transaction Faster:* In the case of blockchain, the transaction time is the time to create a block and adding a block into the chain which is very smaller than any other transaction method. In the case of blockchain which is a peer-to-peer and distributed open ledger that means when it added to the main chain then the block is open to every node and then the transaction time is not additionally added to make any transaction, though it flows any no trusted media.

4. *Distributed and Decentralized:* Without any centralized third party or authorities' involvement, the blockchain can work in case of blockchain all the blocks have their transactional proof-of-work and proof-of-validity to enforce the constraints. It is decentralized, that's why no central control is there, and only for this reason if the documents come to any unwanted hands then also a very little amount of data comes and the whole network remains secure.

5. *Protected Cryptography:* It uses protected cryptography to make the data ledgers secured and in blockchain, the current block also depends on its adjacent blocks to complete the cryptographic process and in blockchain, all data are added to the block after the maximum trust verification which is termed as the consensus of the block which also removes the risk of duplicate entry.

3. Digital Supply Chain

The digital supply chain is the process of the delivery of products through digital media. Here through digital media means supply from the point of origin (maybe manufacturers or retailers), the whole process is done by using some electronic way or electronic channel. In very similar to the physical medium which goes through a "supply chain" process to maintain a consumable product physically. That's means physically all process is going on without any electronic media. Whereas the digital media must pass through various stages in processing to get to a point in which the consumer can able to get products from any business persons using some electronic channel. One of the key advantages of a digital supply chain is that it takes care of all the processes in the background that can be automatically executed with the actual use of electronic media files including metadata and there is no need for any kind of manual interaction such as search, manual quality control, conform and editing. [8]

A broader definition of the term "digital supply chain" is given in a book chapter by Tony Hines[9] where the term was coined in 2001 to explain a transformation from what he called analog supply chains to his new conception - the digital supply chain. This contribution recognized that digital supply chains were configured to distribute goods or services that had previously been supplied in physical form.

4. Use of Blockchain in Supply Chain Management

Blockchain technology can transform the supply chain with these three use cases:

- Traceability
- Transparency
- Traceability

Traceability: Traceability is trying to improve operational efficiency by mapping, operating, and visualizing enterprise supply chains. A large number of consumers now demand all information including the source details about the products that they are going to buy. Blockchain helps organizations help that by giving that data in the block which can be readable to all users in that supply chain and engage consumers with real, distributed, and immutable data.

Transparency: By capturing key data points of the product details, such as certifications and claims the transparency of blockchain generates, and then it provides open access to this data publicly or open to those when are in that blockchain. Once registered on the Ethereum blockchain, it's authenticity can be verified by third-party attestors or by majority miners. The information can be updated and validated in real-time as an immutable format.

Traceability: Traceability is a unique blockchain feature that offers the conventional marketplace concept. Using blockchain, one may store that miners data as digital assets in the blockchain which is termed as "tokenize". It is similar to how a stock exchange allows trading of a company's shares and allows tokens to represent the value of a shareholder's given object. These tokens are tradeable, and users can transfer ownership without the physical asset changing hands.

4.1 Role of Blockchain for Product Recall

Blockchain makes recall easier and easier, efficient, and less expensive. It is more effective because when manufacturers can locate the affected products quickly and easily, then the recovery becomes easier too. Blockchain technology stores the data in a transparent and traceable format so the supply chain, therefore, facilitating faster and more efficient recalls.

4.2 Blockchain Technology Reduce Counterfeiting

Blockchain stores data transparently, distributed, and in an immutable format so any duplicity, counterfeiting, fraudulent can identify very easily. Blockchain records can transparently verify certifications, official legal documents, and coordinate record-keeping immutably, which prevents counterfeiting or fraud. Blockchain technology enhances supply chain management through process tracking, regulatory compliance, reporting in an immutable format that cannot be changed by others and the authenticity may be checked by every miner.

4.3 Blockchain Enhance Supply Chain Transparency and Process Tracking

Traceability of the supply chain is the major utilization of blockchain technology. Replacing the traditional processes with transparent, distributed open ledger technology can able to increase the scope to find out or trace out where the fault is. Blockchain provides the ability to track any digital or physical product during its overall lifecycle.

Blockchain can able to track the progression of the miner's digital assets, records, or information, and show previous and present asset records. Smart contracts are used to enforce the asset tracking processes on the Ethereum blockchain. Anyone can view the details of the asset details which may be physical or digital.

4.4 Blockchain technology brings traceability to the supply chain

Blockchain technology also able to enhance the efficiency of ownership and licensing of the property very easily because it stores all the part records wherefrom the origin or actual property holders details can be checked as well as all the other details including license details may check and utilized.

Blockchain provides consensus, which means there is no dispute in the chain regarding transactions by design. All entities on the chain have the same version of the ledger, giving it the unique potential to track ownership records for real estate, automobiles, and digital assets.

5. Conclusion

As per our study and analysis, we can able to conclude that in near future digital supply chain management can able to more flourish and stable with the help of this most promising technology. As it gives us the full transparency and the

records are immutable too, so the chances of misguiding or duplicity will be minimized here. But till some security threats are there in blockchain technology and the research works are going to prevent those threats or attacks by which the product information, as well as all record, can be saved easily in the block as digital assets.

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