International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

# Blockchain Enabled Supply Chain Management

**R.Anusha, A.Angayarkanni, R.Gavoury**

***Abstract: Blockchain technology has the potential to create new avenues for Economic and Social systems. Blockchain enabled supply chain solutions have drastically proven to reduce cost and efficiency in supply chain industry. The complexity of Supply chain management which helps to create and distribute goods is very high. The supply chain spans over numerous stages with long time duration involving different geographical locations and large number of invoices and payments, people and entities based on the nature of the product involved. The blockchains are perceived to bring huge transformations in the current supply chain and logistics industry which are complex and transparent. This paper is organized as Section I-Introduction, Section II-Blockchain in Supply chain, Section III-Elements of Blockchain affecting Supply chain, Section IV-How Blockchain revolutionizes Supply chain, Section V-Results,Section V1-Conclusion.***

***Keywords:Blockchain, Supply chain Management***

**SECTION-I**

## I. INTRODUCTION:

Blockchain is a peer to peer Distributed Ledger Technology that shares data among all its users increasing transparency and avoiding corruption. The transactions are recorded in the ledger in the form of series of blocks replicated over different computers across the network. Since every new transaction block points to the previous blocks, the ledger is secure.

The blockchain network has no central authority, it has a shared and immutable ledger, which is accessible for everyone. Blockchain technology is transparent and the persons involved are accountable for their actions.

Important features of this technology

- Decentralized-no single owner
- The data is encrypted and stored inside.
- The blockchain is immutable
- Tracking the data is easier as the blockchain is transparent .

Manuscript published on November 30, 2019.
* Correspondence Author
**R.Anusha*,** Asst. professor in Department of Computer Science, MOP Vaishnav College for Women, Chennai.
**A.Angayarkanni,** Associate professor at Department of Computer Science, MOP Vaishnav College for Women, Chennai.
**R.Gavoury,** Associate Professor & Head, M.Sc(IT) at Department of Computer Science, MOP Vaishnav College for Women, Chennai


**SECTION-II**

**2. Blockchain in Supplychain**: The focus and the usage of the technology lies around the concept of cryptocurrency called as Bitcoin. It is transparent and secure as all the blocks are linked with each other and the transactions are replicated across all the nodes[5].The blockchain is extremely efficient and scalable as it is decentralized. Hence, the efficiency and transparency of supply chains can be drastically improved by the blockchain and has a good influence of all the chain activities right from warehousing till delivery. Blockchain has the chain of built in commands essential for effective management of supply chain. As all the chain entities have same ledger version there is no conflict in the chain regarding the transactions. Blockchain records cannot be deleted which is crucial factor for maintaining supply chain transparency.

**2.a Architecture of Blockchain in Supply chain Management**


**Figure 1. Supply Chain Entities participating in Blockchain Distributed Ledger Technology**

The Figure 1 illustrates the cooperation and interaction of various actors of supply chain in a block chain network[5].Every participant submits a transaction in the network based on a completed transaction in a specific method. The suppliers preprocessing the natural resources submit transactions in the initial process on the ledger . The transactions contain information such as raw material name, supplier name, quantity, location origin etc. Similarly every network party can verify important information about raw materials received. The manufacturer has the similar interaction in the blockchain on the manufacturing stage with the next participant.The tags which encapsulates information about transactions related to the natural resources are read and verified by the manufacturer before proceeding to the manufacturing step.

It is followed by the creation of new tags embedding manufacturer information and the same is submitted to the distributors who receive the products and trade them to wholesalers and retailers.Data tags are then created with merchant and customer information, invoice and product information which are displayed by the blockchain transactions. Hence at every stage the tag information can be extracted which can be used for tracking the product progress from raw material till finished stage. The popularity of the manufacturer, distributor information can also be derived from the tags.Retailers can get feedback from the consumer before selling it by auditing the product quality.Also the transaction tags can be checked by the wholesaler before selling to retailer[4].Finally, the consumer who receives the final product is is able to check and validate it's every aspect from the beginning of its supply chain till the time the product is received.

**SECTION-III**

## II. PROPOSED METHODOLOGY

### 3. Elements of Blockchain affecting Supply chain

The transactions[2] of the blockchain are made immutable and secure after the circulated data in a supply chain undergoes different transitions thereby satisfying the different complex requirements for achieving the same. A mechanism to increase the mutability and ensures the transaction confidentiality to be endorsed, that prevents or blocks any malicious party participating in the supply chain from tampering or illegally modifying the payment and invoice information. Hence it is very essential to have a mechanism to ensure immutability and maintain transaction confidentiality in the use cases of supply chain .A feasible solution for addressing security problems by improving the integrity and product transaparency is provided by Blockchain technology .The different components of blockchain technology that affect, the supply chain are presented and analyzed[2]

1.Scalability: A well networked and decentralized database increases the scalability in the Blockchain by enabling the connection between the entities involved. Thus any single point of failure disappears while, at the same time, all supply chain data is recorded on a ledger, shared among all participants in peer network.

2.Performance:The actions and procedures in a supply chain is prone to human errors or frauds which degrades the performance. Since all the activities are presented as electronic transactions in a block chain enabled system they execute faster and improves performance.

3. Consensus: It is a mechanism by which Blockchain ensures data immutability throughout the ledger. It keeps information about all submitted transactions across all the nodes of the network .The timestamp of the order received and the amount transacted is maintained in the transaction..

4.Privacy: Blockchain users's privacy is maintained in the ledgers which contains immutable information. Any user can interact without disclosing their real identity with the ledger through a newly created address in the public blockchains which offers pseudonymity

5.Location: The functionalities and attributes of Blockchain technology are independent of the geo-location of its users and hence the blockchain enabled supply chain can be bigger spanning across the globe allowing the participants to carry out their business and provide product services from any part of the globe.

6.Cost: Blockchain technology in a supply chain system reduces the cost drastically by providing cryptocurrency technology which improves the speed of transaction processing. It makes the workflow faster and improves efficiency as it involves digital transactions.

## III. ALGORITHM/STEPS TO DEPLOY A MODEL FOR BLOCKCHAIN IN SUPPLY CHAIN

**Step 1**.Identify the driving,economic and reliability factors for incorporating the block chain in to supply chain

**Step 2**.Identify the operational,technical and organizational factors

**Step 3**:Identify the cultural barriers and resistance factors for embedding blockchain into supply chain.

**Step 4**:Design a framework and validate the same to incorporate blockchain into supply chain management process.

**SECTION-IV**

### 4.How blockchain revolutionizes supply chain management?

Currently Supply chain is a vast ecosystem , with multiple parties all trying to work together in coordination. Many of the supplied products passes through multiple parties, unlike traditional networks of OEMs (original equipment manufacturer) and suppliers. Secondly, dynamic ability of supply chains and its operations[3] have increased by reducing Product lifecycles.

The companies are yet to update their conventional supply chain management by leveraging the potential of blockchain and integrating them with supply chain management process thereby expand their business horizon to global levels.

a)Trustworthy truth without trusted intermediaries[3]

Blockchain eliminates the need of any intermediary and allows the business partners to share the information,thereby enabling them to validate the process and calculations involved in the transactions.

b)Blockchain logic into supply chain

Product tracking right from the finished stage to transit stage can be updated for all the involved parties in the supplychain and backtracking to the point of origin can also be achieved for all the products.

We can negotiate procurement deals based on total ecosystem volume and the exact volume discount based on total purchasing can also be manipulated. Block-chain based solution allows us to do this by maintaining the privacy information about individual volumes of the entities involved.

Thus the integrated physical, financial, and digital information available in one platform to reveal sources of value leakage, fraud detection and exploitation and design new strategies to eradicate them.

The diversity of blockchain applications in supply chain for payment processing are made feasible by the usage of software program called smart contracts.

A smart contract[3] uses blockchain to execute an agreement.. No fraud or other interference is possible. A smart contract triggers an event after taking input from a ledger . For example, after receipt of a payment as part of a transaction, the smart contract can trigger a delivery or it can trigger a penalty for unsatisfied requirements. Third-party intervention is not necessary for the execution of smart contracts.

Smart contracts wipes out costly delays and waste generated by manual operations and paperwork. This pave way for the entire supply chain to be faster, more intelligent and more secure .

**4.a Benefits of Blockchain Technology in Supply Chain**

1. Transparency[4]

The Blockchain process that establishes communication between partners is streamlined with shorter lead times, less redundancy, fewer delays and ultimately a leaner supply chain. It also ensures quality standards, giving the seller more control of the production of the product from A to Z. The product's navigation is documented across the supply chain to record its origin and touch points, which improves trust and helps eliminate the bias in traditional supply chain systems thus increasing the transparency in the supply chain lifecycle.

2. Security[4]

Hacking is impossible for any intruder as a change has to be incorporated simultaneously on thousands of copies to hack which is infeasible without the software picking up on it. This is made possible with the block structure used in this technology. The audits required by internal systems can be eliminated by the shared, indelible ledger with codified rules thereby increasing the security of the processes.

3. Analytics[4]

Blockchain offers complex solutions to analyze the data being uploaded. With the help of previous data, this technology can create forecasts , predictions and it can allow users to pinpoint lags in the supply chain. The companies are making use of the data analytics information to minimize supply chain expenditures and to grow their businesses.

4. Customer Engagement[4]

Using Blockchain database the retailers can track the items that are in production and shipment to better build a delivery timeline for their business. This kind of data sharing creates a new level of transparency with the consumer and helps to build a deeper client rapport and loyalty.

5. Increased Innovation[4]

The decentralized architecture provides opportunities abound to create new, specialized uses . The innovations to increase profits are tapped by the smart shippers are finding ways to make the most of these innovations to increase profits and strengthen relationships across the supply chain.

**4.b Applications of Blockchain**

New business applications that will result from this technology are Smart contracts, Crowd funding , sharing economy, Governance , Supply chain auditing , Prediction markets, File storage, Internet of Things (IoT) Neighbourhood Microgrids ,Identity management, AML (Anti-money laundering) and KYC (know your customer ) , financial institutions audit trails, Digital identity, Tokenization, Land title registration and Stock trading.

Blockchain enables faster transaction by: a) processing payments directly between peers with no third-party intervention, b) automatic updation of ledgers and c) executing both ends of a transaction simultaneously.

Some of the companies implementing blockchain for SCM9

- SecurCapital – Clearer settlement terms through blockchain verification
- TBSx3 –Preventing fake products and improving transparency
- Fr8 Network – Enhanced data tracking for the supply chain
- British Airways – Using blockchain to resolve conflicting flight data
- Walmart – Giving employees visibility on where food comes from

- **SECTION V:RESULTS AND DISCUSSIONS**
- Based on the study carried out the following are
- identified as the key drivers and challenges for deploying blockchain in the traditional supply chain management.

**SECTION VI**

## IV. CONCLUSION

Companies get access to real time account of digital transactions of the supply chain participants through block chain. Other benefits are improved visibility into procurement, availability of reliable, accurate data for analytics and enhanced trust between the participants in Blockchain . The first traceability application, a project enabled by Ethereum[8] , tracked yellowfin and skipjack tuna fish throughout the entire supply chain, from fishermen to

**Table 1:Drivers And Challenges For Blockchain Enabled Supply Chain**

| KEY DRIVERS FOR BLOCKCHAIN ENABLED SUPPLY CHAIN MANAGEMENT | CHALLENGES FOR BLOCKCHAIN ENABLED SUPPLY CHAIN MANAGEMENT |
|---|---|
| • Trust- reliability of information provided by trade partners, or the safety and security of the data managed by a central authority. | • Organizational challenges- Banks may resist the blockchain enabled businesses due to fear of losing revenue models |

| | |
|---|---|
| • Acquiring and maintaining critical and consistent data | • Technological challenges- Due to its decentralized architecture it is prone to cyber attack and latency problems |
| • Seamless networks with full visibility throughout the chain with symmetric information | • Operational challenges- Requires all supply chain actors to comply with diverse laws and regulations. |
| • Authenticity and legitimacy of the purchased products | • Loss of control and cultural resistance and existing barriers could be the major stumbling blocks |
| • Public safety and security to prevent anti social behaviors like terrorist attacks in ships and maritime containers | • Smart contract enabled payment doesn't address the issue of need of upfront funds to keep the production or service in the chain |

distributors. The suppliers, producers tracked the tuna fish through their smartphone in the blockchain enabled supply chain to know the different stages of the product in transit. The authentication of the entire process was carried out by issuing a digital token thereby presenting a feasible model for product certification to an end customer. The exploratory growth of supply chain management blockchain is growing up very fast and the cryptocurrency has given way for the following supply chain management blockchains:

- Clothing Supply Chain monitoring by Waltonchain
- Blockchain-powered IoT network for Food & Pharmaceutical enterprises by Ambrosus
- Pharma digital Supply Chain monitoring solution by Modum
- Decentralized Protocol For Supply Chain Blockchains by Original Trail

Proper Implementation of SCM can:

- Enhance Revenues
- Reduce Costs
- Minimize Human Error
- Maintain Data integrity and validation
- Improve Quality
- Improve Sales
- Speed up Production, Distribution and Sales etc

The blockchain will definitely have solutions to a majority of problems of the supply chain. The combination of blockchain with Artificial Intelligence, smart contract and IOT technology can definitely solve all the problems of the supply chain management .

## REFERENCES:


1. Aburto L, Weber L, Improved supply chain management based on hybrid demand forecasts, Applied Soft Computing, 7: 136–144, 2007.
2. Croxton K L, García - Dastugue S J, Lambert D M & Rogers D S. (2001). The Supply Chain Management Processes. The International Journal of Logistics Management, 12(2), 13–36.
3. Deloitte Touche Tohmatsu Limited, Blockchain technology in India, Opportunities and challenges April, 2017
4. Field, A.M. (2017), "Blockchain for freight?", Journal of Commerce, Vol. 18 No. 5, pp. 88-92.
5. Nakasumi M. (2017). Information Sharing for Supply Chain Management Based on Block Chain Technology, 140–149.
6. .O'Marah, K. (2017). Blockchain: Enormous potential demands your attention. Supply Chain Digital. Retrieved from http://www.supplychaindigital.com/technology/blockchain-enormous-potential demands-your-attention
7. Sporny M. (2017). Building Better Blockchains: Linked Data in Distributed Ledgers. Proceedings of the 26th International Conference World Wide Web Companion, 1431–1436.
8. Kristoffer Francisco and David Swanson , Department of Marketing & Logistics, University of North Florida (2018). Article The Supply Chain Has No Clothes: Technology Adoption of Blockchain for Supply Chain Transparency , Logistics .
9. Disruptor Daily (October 2018), Blockchain In Supply Chain Management: 13 Possible Use Cases.
10. Dr. Gavin Wood Founder, Ethereum & Ethcore, Ethereum: A Secure Decentralised Generalised Transaction Ledger EIP-150 Revision (1e18248 - 2017-04-12)


## AUTHOR'S PROFILE

**Dr.R.Anusha,** is working as Asst. professor in Department of Computer Science, MOP Vaishnav College for Women with 14 years of teaching experience .Areas of research interests include Data Analytics,Artificial intelligence and Machine learning.

**Ms.A. Angayarkanni** is working as Associate professor at Department of Computer Science, MOP Vaishnav College for Women, Chennai with 26 years of experience. Her areas of research interests include Algorithms, Data Analytics, and Artificial intelligence.

**Ms.R.Gavoury** is working as Associate Professor & Head, M.Sc(IT) at Department of Computer Science, MOP Vaishnav College for Women, Chennai with 25 years of experience. Her areas of research interest includes Data structures,Machine learning and Artificial intelligence.