

# Integrating Blockchain in Supply Chain

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**Abstract** – Supply chain management is the best exemplification and hope for the promising cradle to cradle delivery. Be it any sector, the importance of operations and understanding the supply chain is pivotal and encompasses all domains of an industry. Be it the construction sector that has for long has been considered to be a laggard in terms of productivity or the automobile sector that is one of the most competitive and timed manufacturing industry, be it the pharmaceutical sector where manufacturing quality and consistency is of utmost importance or be it the FMCG sector that is most dynamic in nature, supply chain management is always at the crux. But with unparalleled growth and the pace at which it is growing, some factors of caution need to be considered. These include information security, dynamic tracking of all processes in the supply chain, quality procurement and delivery, consistency of product, managing bottlenecks and roadblocks and forecasting the same, warehousing and mining of ever-increasing data, etc. Technology is the answer to these clarion calls of caution that can hence ensure continual persistent success of the supply chain performance. While many forms of technology such as Enterprise Resource Planning, Automation, Internet of Things, among others, have galloped into the supply chain realms to boost productivity and performance, one that remains relatively new and yet all-encompassing is Blockchain technology. The paper discusses the scope of Blockchain in enhancing the supply chain across any sector and elaborates on different scientific studies and specialized techniques that can be incorporated. The solutions can be applied across a vast range of industries, from those that are capital intensive to those that are domestically deployed.

**Key Words:** Supply Chain, Technology, Digital, Futuristic, Development, Blockchain, Operations

## 1. INTRODUCTION

The world is converging towards common needs and goals. But with this comes the importance of maintaining privacy, security, authenticity, quality and consistency of each entity and process. Blockchain technology is the new trust machine of the new world.

### 1.1 Overview of Blockchain

The most muted definition of Blockchain is that is a distributed, decentralized, public ledger. Contrary to initial understanding, blockchain is not a programming language or

a cryptographic codification and is not restricted to cryptocurrency applications, although that is what brought this multi-faceted concept into limelight. It is a technology that can virtually record everything of value. It works as an immutable record of transactions that do not rely on an external authority to validate the genuineness of data. Although it is considered to be a new technology, it is interesting to note that its origins can be traced back to a 1991 dated publication called “How to Time-Stamp a Digital Document”. The name of the document best explains the multiple benefits this technology holds.

### 1.2 How Blockchain Works

At the base level, blockchain is a chain of blocks where block represents digital information and the storage area (the public database) represents the chain. Each block is made of digital pieces of information. The process deals with 5 key concepts that include:

- Cryptographic Hash
- Immutable Ledger
- P2P Network
- Consensus Protocol
- Block Validation or ‘Mining’

While we have elaborated the components involved in the blockchain process flow, the below flow table will explain the process. It is also the assumption of the paper that the reader has a basic understanding of how blockchain works. The paper shall concentrate on the applications of blockchain in the supply chain sector.

Step No.	Blockchain Operation
1	A transaction is registered by someone
2	Transaction is registered in the shared ledger
3	Block is broadcasted to all participants
4	Participants approve the valid transaction
5	Post consensus, block is added to chain

6	Actual state of blocks can be seen by all authorized participant
7	Chain is displayed to all peers in single picture

### 1.3 Introducing Supply Chain and its Importance

Supply chain management is the management of the flow of goods and services from point of origin to point of consumption. It involves the domains of raw material, purchasing, inventory, warehousing, logistics, forecasting, hedging and finished goods. Supply chain is a network of entities, directly or indirectly linked.



**Fig -1:** Supply chain management  
(Source: TechTarget : SearchERP)

## 2. BLOCKCHAIN AND SUPPLY CHAIN

The fundamental advantage of this distributed system of blockchain is that no single entity has control, such that it helps resolve problems of disclosure and accountability between individuals and institutions. Data can be updated real-time and internal records need not be continually manually maintained. It helps create a dynamic and transparent supply chain ecosystem. The practical real-time applications of supply chain have been exemplified ahead:

### 2.1 Food Industry

It is of primary importance in the food industry to maintain quality and hygiene of raw materials, process and end-product. Multiple ingredients need multiple suppliers. Transparency and accountability of these suppliers is pivotal. If the suppliers are not monitored real-time, issues of

contamination during process flow and containment after delivery cannot be countered. A radical solution to this is blockchain technology. This technology will help maintain exhaustive activity logs in order to track the flow of goods and services between suppliers and across boundaries. Transfer of titles and permissions between producers, suppliers, consumers can also be efficiently maintained and tracked by all peers involved.

An example of above is displayed in the partnership between Walmart and IBM to put meat on a blockchain. Deadly strains of E.Coli have sickened or claimed the lives of many in the past. This is a consequence of poor sourcing strategies wherein contaminations cannot be detected. The blockchain being discussed here, is designed to provide the retailer with a way to record transactions that indicate how the meat has flowed through a commercial network, from producers to processors to distributors to grocers- and finally, to consumers.

### 2.2 Dynamic Retail

The needs of the urban population are ever-changing in today's world. It is difficult to maintain a uniform demand-supply curve. Digital tokens that track progress of goods and retail inventory across production, shipping and delivery help in efficient resource management. This helps replace the rigid supply curves with a dynamic demand based curve to enhance the supply chain.

### 2.3 Enhancing the Buyer Experience

Blockchain platforms can provide consumers buying a product online with a gateway to the entire pathway of a product, end-to-end. A piece of clothing ordered online powered with such a blockchain platform, can give the user a well-informed and transparent buying experience. The buyer can find out when and where the raw material was procured, how it was sent across to the producer, what the environmental impact of the product was and with what level of quality was the product made and delivered. An organization called Provenance has already picked up on this and provides the consumer with a holistic buying experience.

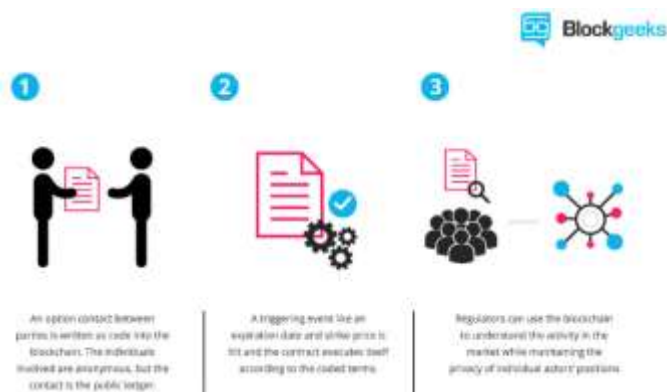
### 2.4 Blockchain in Mining and Oil & Gas

The importance of this has already been realized by the one of the world's largest mining firms, BHP Billiton. The benefits of this can be implemented from upstream to downstream. Blockchain can be used to record movements of wellbore rocks and fluid samples. In pipelines, blockchain can be used to record leaks, flow rates, diversions, etc. In downstream, blockchain can be used to assess alarming situations, turndown time efficiency, inspection and testing, etc.

Sharing of data between vendor, clients and consultants is also easily achievable and every party involved can have a

constant understanding of where the process is and how a potential bottleneck can be countered.

Particularly in Oil and Gas, data is constantly generated. Blockchain helps a company save a lot of money by reducing needs for data management, settlement delays, communication between departments, and so on. The entire operation of this sector is highly detailed. It starts from searching for a resource, then extracting it, transporting and storing it, refining it to create a product and by-product, and then delivering it to shops or fuel stations. Blockchain can make the entire process much safer, easier and cheaper to control. Smart Contracts is a component of Blockchain that can help with reduced time to make deals, improve process safety, improve cyber security and make a deal possible with fewer participants involved.



**Fig -2: Working of Smart Contracts**  
(Source: Blockgeeks)

### 2.5 High-Value Items

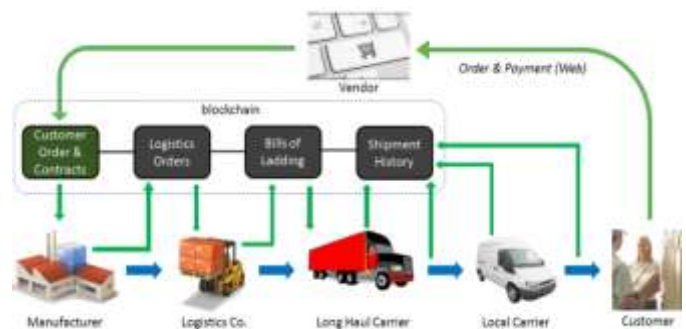
The supply chain of luxury goods and precious metals is a highly monitored supply chain. An example of this is seen in the practical implementation by Everledger, a global digital registry for diamonds. It is working on a model to fully account for the diamond’s sourcing history and eliminate the possibility of forging documents. Every diamond registered on the platform will have a permanent digital record. This also holds a high moral value as it ensures that the problem of “blood-diamonds” is eliminated and that the diamond is not extracted from war zones.

### 2.6 Shipping and Logistics

Improved security and distribution of shipping container data is one of the best advantages of using Blockchain in shipping and logistics.

When the manufacturer transmits loads to suppliers, warehouses and third-party logistics providers, Blockchain helps permanently record certificates of origin, batch numbers, barcodes and shipment dates. The Blockchain then helps record the order numbers, packing numbers and

shipment specifications prepared by the third-party logistics providers. The routing information and bills of lading are provided to the long-haul carriers. Meanwhile, Blockchain helps logistics providers optimize capacity and shipments in real time as new loads are received. The shipments reach the warehouse which then records deliver signatures, storage conditions and shipment status using blockchain. Using blockchain, the shipment status is provided by the carrier at every stage to all peers involved. Finally the goods reach the consignee who then uses blockchain to permanently store and share data such as receipt date, invoice number, customer ID, etc.



**Fig -3: Blockchain in Logistics**  
(Source: Steemit)

### 3. CONCLUSIONS

While security, traceability, integrity, immutability, transparency, faster transactions, low transaction costs, are among the many benefits of blockchain, lack of official regulation and power consumption are factors that need to be considered in order to promote an economically scalable blockchain environment.

With future regulations, integrating payment with blockchain technology in supply chain is also a domain that could be widely explored.

While all pros and cons can be discussed, a pertinent question remains whether business owners and regulatory bodies are ready for Blockchain Supply Chain Management?

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