BLOCKCHAIN AND THE SUPPLY CHAIN

Mohit Vijay Ahuja, Amir Gharehgozli, Kunpeng Li,
David Nazarian College of Business and Economics, California State University

Supply Chain comprises of the entire product lifecycle before it reaches a customer. However, supply chains were relatively simple before globalization came into picture. There have been innovations in each and every part of supply chain which has led to complexity and difficulty in tracking of products. The products have lost their value and there has been a lack of transparency and unethical practices involved within various chains around the world. In order to overcome this, Blockchain has been introduced. Blockchain can increase the efficiency and transparency of supply chains, and positively impact everything from warehousing to delivery to payment.

WHAT IS BLOCKCHAIN

Blockchain is a shared, immutable ledger that is reliable and based on peer-to-peer business network. Both tangible and intangible assets can be stored and traded in Blockchain, with benefits of reduced risks and costs. Ledgers can also include loans, identities, land titles, logistics manifests and anything that has value in the real world. Bitcoin is one of the applications of Blockchain wherein the bitcoin transactions can be recorded and stored on the blockchain network. The ledger is built on the basis of the following key characteristics:

1. Consensus: For a given transaction to be valid, all members must agree on its validity.
2. Provenance: Participants can track a given asset and know that its ownership would change over time.
3. Immutability: Participants cannot tamper the transaction once it has been recorded on the ledger. If an error has been made, then the transaction can be reversed by recording a new corrected transaction. Both transactions will be visible to the users.
4. Finality: A single, shared ledger provides one place to go to determine the ownership of an asset or completion of a given transaction

Blockchain works using blocks which store information on the business network. Each block consists of Data, Hash and Hash of the previous block:

1. Data: Data varies depending on the type of chain it is involved in. Example: For the Bitcoin, it includes information about the transaction such as sender, receiver, and bank.
2. Hash: Hash provides a unique identity to the block. Once the data is determined, the calculation for the hash begins. Hash can be compared to a fingerprint, which is very difficult to tamper with. If tampered, the calculations inside the block changes and it can be easily detected. Thus, this makes the blockchain secure.
3. Hash of Previous Block: Each block consists of Hash of Previous Block to help link the blocks in the network. If one block is tampered, it would not be able to link to other blocks, and the network would break.
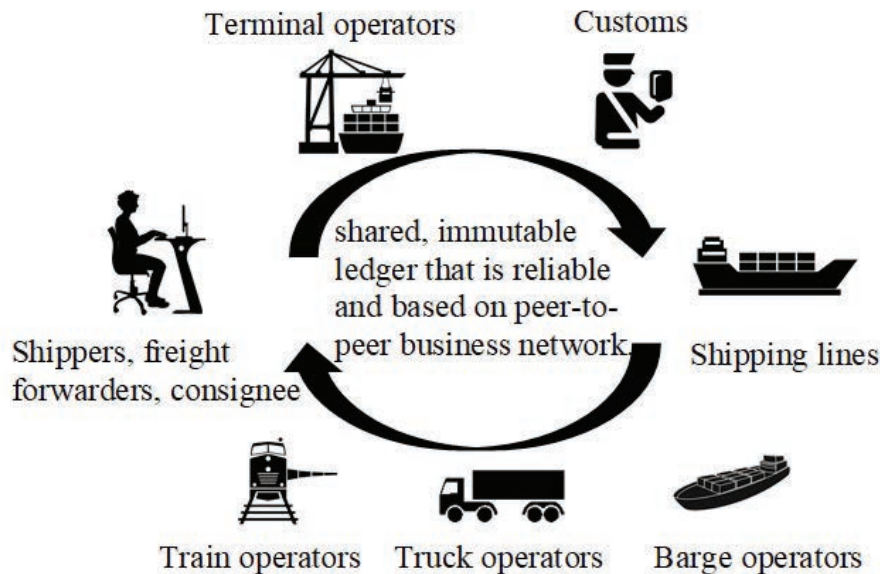
All the information presented in the

Figure 1. Blockchain in the maritime industry

block is based on a given consensus which is provided by the participants. The first block is called as the Genesis Block.

It is necessary to define the Proof of Work in order to understand the creation of a new block. "Proof of Work" is a mechanism that slows down the creation of a new block i.e. it takes ten minutes to create a new block in a Bitcoin network. If anyone tries to tamper a block, one would need to calculate the Proof of Work for all the following blocks. Thus, hashing and Proof of Work make the blockchain secure and tamper-free.

MARITIME SOLUTION

Blockchain can act as a great solution for the maritime industry. A majority of the shipped goods in the maritime industry is slowed by the sheer shipping volume and point-to-point communication. The implementation of Blockchain can improve supply chain efficiency, load traceability, and communication efficiency.

IBM Blockchain Network came up with IBM TradeLens, which is a Blockchain solution for the maritime industry provided by IBM in collaboration with Maersk. It enables digital collaboration across multiple parties involved in the trade, such as shippers, exporters, freight forwarders, ports, terminals, ocean carriers, custom brokers, government authorities (see Figure 1). TradeLens establishes a single shared view of transactions without compromising privacy, details, or confidentiality.

The following presents the three important characteristics of TradeLens:

Shipping Milestone Visibility: TradeLens provides a Shipment Manager User Interface where users can easily track their shipments. Users can publish and subscribe data involved in the shipment process by using TradeLens.Tran sport planning is one of the key aspects where users can access more than 120 shipment event types that are communicated directly by the source. It provides permission access, flexibility and control for shipping milestones. It also provides documents that can be accessed by authorized users.

Digitized Documents: Users can easily view shared documents for a given consignment, easily identify new version of document and guarantees immutability and traceability of trade documents. There are two types of documents:

1. Structured Documents: These documents are built based on industry standard and provide ample amount of data that can be analyzed with reduced errors.
2. Unstructured Documents: These documents are in the form of PDF or Scans with information to be shared among supply chain parties.

Workflow Automation: Shippers upload packing lists as structured documents in the blockchain. Data is extracted from the packing lists and customer invoices in the broker's system. Once the vessel departs, the broker uses this information to create a customs declaration form for a faster clearance process. All versions of these documents are stored in the Blockchain to guarantee their traceability and immutability.

THE STUDY OF BLOCKCHAIN

Researchers have recently started with studying Blockchain implementation in maritime industry. A recent study conducted in Nhava Sheva, one of the largest ports in India, shows that Blockchain could save about $860 million by digitizing the process with the help of TradeLens. It could help importers and exporters save about $220 million and $40 million respectively, by lowering transport and logistics cost with shorter lead time and fewer delays.

TradeLens helps reduce time on import documentation from 67 hours to 35 hours,and reduce import Total Transport and Logistics Costs (TTLC) by 2%. TradeLens helps reduce the custom delays by making the documents available digitally on the shared ledger. Customs officer can easily access documents up to three weeks prior to arrival, as opposed to currently two-to-three days. This would eventually help in reducing the import TTLC by nearly 4%. TradeLens facilitates faster and frequent information sharing, with greater accessibility for importing general manifests, quicker filing of bill of entry, and faster Bills of Entry (BE) payment of duties. All of these help in reducing dwell time and other indirect costs.

BLOCKCHAIN BENEFITS

To conclude this article, we summarize the benefits of Blockchain for major players in the maritime industry:

- **Ports and Terminals:** It provides information about the deposition of shipment at the boundaries. Blockchain provides real time information about the ports and also helps to improve terminal planning.
- **Ocean Carriers:** It provides information about the deposition of information at the ocean leg. Blockchain provides flow of information to customers and ports/terminals

beforehand. Also, it helps to access real time supply chain events.

- **Custom Authorities:** It provides information about the custom clearance status of import and export from and within a country. Blockchain provides information flow and risk assessment with less manual paperwork.
- **Freight Forwarders/ 3PLs:** It provides transportation plan, inland events, intermodal handoffs and document fillings. Blockchain provides an improved tool for customs clearance brokerage function and also helps in improving traceability of goods.
- **Intermodal Transport:** It provides information about the shipments carried by trucks, bridges, and rails. Blockchain helps in improving the planning and utilization of events.
- **Shippers:** It provides online information to and helps them engage with all parties using online platforms. Blockchain helps in improving the safety stock inventory and the predictability and transparency to fees and deadlines.

ABOUT THE AUTHORS

Mohit Ahuja is a graduate student at California State University, Northridge majoring in Engineering Management with a focus in Supply Chain Management. He has a research-oriented mindset whose goal is to bring transparency in supply chains. Being a Blockchain Enthusiast, he wants to digitize supply chains for a cost-efficient and sustainable output.

Amir Gharehgozli is an Industrial Engineer who has got his PhD in Logistics and Operations Management from Rotterdam School of Management. His research interests are Facility Logistics Management, Distribution Logistics Management, Supply Chain Management, and Maritime Logistics; in particular, studying recent innovations in these areas. He is now the associate editor of Maritime Policy and Management. He is currently an assistant professor in David Nazarian College of Business and Economics at California State University, Northridge.

Kunpeng Li is currently an Assistant Professor with the department of Systems and Operations Management at the California State University, Northridge. She holds a Ph.D. in Operations Management from the University of Illinois, Urbana-Champaign. Dr. Li's research interests are quantitative analysis in supply chain and operations management.

ABOUT THE ORGANIZATION

David Nazarian College of Business and Economics at California State University Northridge is dedicated to educating the leaders of tomorrow. By offering a challenging curriculum, smaller class sizes, state-of-the-art facilities, and nationally recognized programs, the College offers a truly unique educational experience. Access to prominent alumni and influential business leaders provides students the opportunity to network with and learn from successful individuals.

ENQUIRIES

Please reach out on LinkedIn by searching the authors names.