SAMSUNG SDS

Blockchain, a Game Changer for Logistics!

Blockchain Adoption in the Shipping Business

July, 2017 | Smart Logistics Business Unit

Cello™

Contents

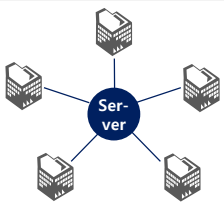
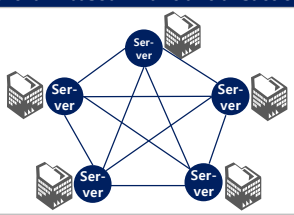
1. Introduction

What is Blockchain?

Today, blockchain technology is emerging as a new wave of technological innovation. The first blockchain was conceptualized by Satoshi Nakamoto in 2009, in order to solve the double spending[1)] problem of the digital currency bitcoin. A block records all of the recent transactions executed during a given period of time. Each time a block gets completed, a new block is generated. These blocks are linked to each other in a linear and chronological order. And the blocks are replicated across a number of computers, rather than being stored on a central server. Therefore, if someone attempts to alter or forge a transaction, they may need to attack computers of all participants to the transaction, instead of attacking the server. Thus, the larger blockchain network becomes, the harder it gets to hack, making it practically impossible to forge or alter transactions.

Blockchain technology is designed to record transactions on the internet in the most reliable way, which is why it's being adopted in the financial services sector first. As a way to ensure security of ever-increasing online financial transactions, a decentralized management system using blockchain technology has been suggested without the need for a financial institution to mediate and verify the exchanges. Before blockchain was born, all transactions were recorded in one central ledger. With blockchain technology, however, each participant has a ledger which records all transactions. A blockchain is thus commonly referred to as a distributed ledger.

[Table 1. Electronic Financial Transactions - Current vs. Blockchain-based]

Type	Current financial transactions	Blockchain-based financial transactions
Struc-ture		
Concept	- Centralized structure - Transactions are between an individual and a third-party financial intermediary (bank, gov't, etc.) - The central server verifies and manages transactions	- Decentralized structure - Transactions are shared and stored among all network participants - All participants verify transactions
Feature	- Strengths: Speed, controllability - Weaknesses : vulnerable to Sybil attacks (DDos attacks), the central server is less secure, high maintenance cost	- Strengths: Transparent transaction information, low cost for development and maintenance of the system, resistant to Sybil attacks (DDoS attacks) - Weaknesses: Less speed, complex to control

Source: Financial Security Institute

1) Double spending: It is a potential attack on a digital currency network in which a malicious user fraudulently spends the coins in more than one transaction.

2. Blockchain in Logistics

Because transaction data on the blocks cannot be altered or forged, the transaction information is very trustworthy. Also, by adopting smart contracts[2] which can automate transactions under certain conditions, you can significantly improve the speed of work. In the logistics sector whose tasks involve a lot of documentations, innovation is happening with this blockchain technology. In 2016, the Denmark-based shipping giant Maersk Line carried out a blockchain proof of concept. And the carrier expects a 20 percent reduction in transportation costs if the blockchain is used for a shipment of goods from East Africa to Europe.

Blockchain is not just another new technology. It is expected to play a key role in achieving a steady growth of logistics businesses. Therefore, there needs to be a discussion about what role the blockchain technology is going to play in the logistics sector.

How will Blockchain Benefit Logistics?

In logistics, numerous parties are engaged to perform tasks of transporting raw materials or products to customers. All transactions in logistics are carried out based on multiple documents to ensure trustworthiness of the transactions. In global trade, in particular, the work is done based on standard trade documents. In face-to-face exchanges, there are usually no trust issues as the buyer would pay after seeing the product for himself. However, in global trade, because transactions are solely dependent on documents, the risk is often high as you're not sure if the other party would really send you the products or if the importer would actually make a payment. Plus, in the case of global trade where documents guaranteeing the quality of products are required, there is a possibility that these documents could be altered or forged. There is also no way of knowing what tasks or process the other party is working on right now unless you make a call or send an email. However, blockchain technology creates a trusted environment by making sure that transaction information on blocks are resistant to forgery or modification.

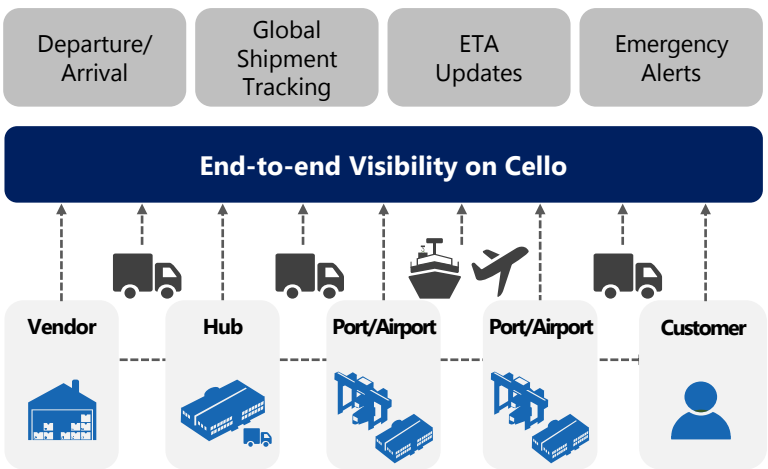
2) Smart contracts: Contract terms and conditions such as expiry date, strike price of an option, etc. are encoded on a blockchain beforehand. Once these encoded pre-conditions have been met, the contract is automatically executed on a smart contract platform

Benefits of Blockchain - Visibility

One of the major benefits blockchain can offer in logistics is enhanced visibility. Here, visibility means displaying the current status of logistics to the parties engaged in the supply chain. In traditional transactions of the past, visibility was only provided to the two parties of the transaction. For instance, there was no way a wholesale operator would know if raw materials were delivered to the manufacturer or when the finished products would be delivered. Using blockchain technology, however, this has become possible. If all participants on the supply chain record their transactions on the blockchain, the transaction information can be shared with all the other participants in the network, and this offers an end-to-end supply chain visibility.

Indeed, many logistics providers have been promoting that they can provide this end-to-end supply chain visibility through their logistics information system. However, as explained earlier, it is more common that this supply chain visibility is provided to the two parties only. Furthermore, the data is often unstandardized and thus less compatible on other devices. From an ROI (Return on Investment) perspective, it is not easy for logistics companies to create a platform which enables data sharing of all parties involved in a supply chain as each party produces visibility information in their own way to suit their needs. Only those logistics providers with enough technical expertise and capital can provide this end-to-end supply chain visibility from sourcing of raw materials to delivery of finished products.

[Picture 1. Cello End-to-End Supply Chain Visibility]



There are three different types of flows in supply chain management: information, material and money. Information flow (or also called orders) drives material flow (or delivery). Transactions come to an end after money flow (or payment). Blockchain recognizes each of these flows as one transaction. Transactions that take place for a certain period of time are then grouped into a block. Since all participants share a series of blocks, the information, material and money flows are updated and shared in real time among the participants.

However, this public blockchain can hardly be put into use in the actual supply chain because transactions are typically bilateral[3] in nature. For instance, manufacturers purchase raw materials at different terms and conditions from each provider. This is why one's terms and conditions should be strictly protected for supply chain sustainability. Thus, transactions on a supply chain requires a permissioned blockchain in which only the entities participating in a particular transaction will have access to it.

On information system, it is generally the system administrator account that grants an access rights. This approach, however, cannot be adopted in a distributed network of blockchain. Instead, blockchain uses a channel which connects a node (Participant A) to another node (Participant B). Nodes on the same channel have access to each other. For instance, if a manufacturer and an importer are on the same channel, their transaction records are shared with all the other participants connected to the channel. However, manufacturers often don't want to disclose their transaction information because the terms and conditions of their sales differ from customer to customer. To deal with this, separate channels called multi-channels are created to manage the access rights.

Among a series of logistics transactions recorded on multiple channels, you can check the current status of a shipment or see if a certain process has been completed on a particular channel. It is possible by getting consent of all participants to providing information to a channel to offer visibility. Here, the data compatibility issue mentioned earlier doesn't happen because data on blocks have all been standardized already. All participants can therefore get an update on the current status of their transactions. This leads to more transparency in transactions, helping to create trustworthy trade relations.

3) Bilateral transaction: Both parties undertake obligations to each other as specified in the contract

Benefits of Blockchain - Trustworthy Transactions

In the logistics sector, global trade business usually does not involve face-to-face contacts. Transactions are mostly executed over the phone or by e-mail. If you've been working with your trading partner long enough, the risk of refusal of the cargo handover or the risk of non-payment is low. However, if it's a new partner you haven't worked with before, you may need to check if they are trustworthy. This trust issue happens all the time in the global trade business. Indeed, it was estimated that the Korea Trade Insurance Corporation paid more than 700 billion won as an insurance coverage for the accounts receivable becoming uncollectible, as of 2011.

Trustworthy transactions on blockchain will not only guarantee payment or product handover. It will also create a virtuous cycle in the global economy by further increasing the size and volume of global trade. In the global trade business, trust becomes a big issue as most fraud are related to forgery or modification of documents. Thus, if we can create an environment where documents cannot be altered in the first place, people will trust transactions significantly more. This is why we need to adopt blockchain in the logistics sector as soon as possible.

Once a document is recorded or registered on a block, it is no longer possible to modify the details, thus making it possible to keep all documents in their original copy. However, in global trade, the shipping business in particular, some documents need frequent amendments. Blockchain solves this issue by registering amended documents to the blockchain and recognizing the (chronologically) oldest one as the original copy. This way, participants can see and check what amendments have been made in the chronological order.

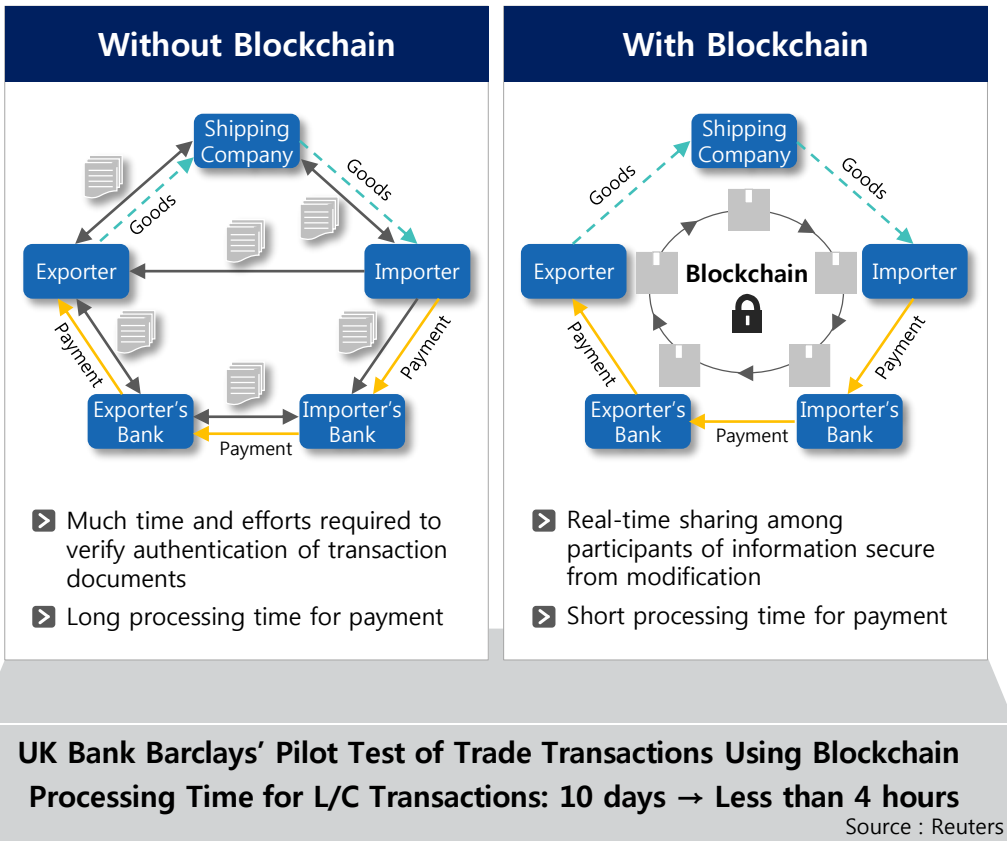
Blockchain offers end-to-end visibility. Because of the nature of blockchain, you would immediately know what process the other party has completed at which time. As such, blockchain enhances transparency of transactions, which greatly helps improve trustworthiness among participants in transactions.

We can expect the following benefits from a trusted blockchain environment.

First, transactions costs can be significantly reduced. Under the current structure of trade, it takes much cost to find new trading partners, mainly because of the credit check conducted on potential partners to see if they are trustworthy enough. In addition, you have to verify the authentication of documents at each stage until the transaction is completed. With blockchain technology, however, this transaction costs will be reduced as it will resolve the trust issues by guaranteeing that all transactions are resistant to modification.

Second, the size and volume of global trade will increase. Reduction in transaction costs leads to more transactions. If it takes less to find a new trading partner than before, you would want to do business with more partners. As a result, global trade will be on the rise.

[Picture 2. How Blockchain Reduces Transaction Processing Time]



UK Bank Barclays' Pilot Test of Trade Transactions Using Blockchain
Processing Time for L/C Transactions: 10 days → Less than 4 hours

Source : Reuters

Benefits of Blockchain - Automated Transactions

In each step of the logistics business, manual work is done to check if all of required information has been written without missing. It was indeed these types of manual or duplicative tasks that made Maersk Line and IBM decide to employ blockchain for their business. These tasks are not about creating new documents. Instead, they involve checking if required information is included in documents. And because these are mostly repetitive work, blockchain-enabled smart contracts can be applied to replace repetitive document verification tasks in the shipping process.

For instance, smart contracts can be used to check if any required documents submitted to government agencies such as the Korea Customs Service have any omissions because this type of work is a simple verification based on rules.

Blockchain-based smart contracts have so much potential. For instance, they enable an automatic comparison between the number on the invoice submitted to the Customs Service and the number on the packing list sent to the carrier. This way, smart contracts can prevent potential shipping delays caused by errors and shorten the entire shipping lead time by automating tasks that are typically accomplished through manual means.

Blockchain automates a number of processes in logistics currently being managed by multiple channels with no need for manual work. It will result in getting rid of overwrapped processes and documents. Once a legal and institutional framework is created to support blochchain adoption, blockchain will enable self-executing contracts, thus minimizing wait time for processing documents and increasing efficiency.

3. Blockchain Consortium for the Shipping Industry

Overview of the Consortium

On May 31, a total of 15 members in the shipping logistics launched a consortium to employ blockchain technology to the shipping business. The members include government agencies, carriers, shipping system providers as well as Samsung SDS. Over the next few months, they will analyze shipping processes and carry out a proof of concept to figure out potential of blockchain applications.

Shipping processes refer to the entire structures and processes that guide the flow of goods from executing trade contracts, leaving the port of origin, arriving at the final destination port, going through customs clearance to the cargo handover to the importer. Today, this shipping process is becoming more important with economic activities and trade taking place all over the world. And the blockchain technology is expected to greatly benefit the shipping sector in preventing fraud or forgery as most transactions take place through documents instead of face-to-face interactions.

[Picture 3. Participants at the Blockchain Consortium Ceremony]

Significance of Blockchain in the Shipping Industry

Adopting blockchain to the shipping process means that participants in a transaction will be recording transaction information on blocks, instead of exchanging it through paper or electronic documents. Because it's nearly impossible to modify or change an existing transaction recorded on the blockchain, participants can trust each other's documents. And since all documents are digitized, anyone can have access to documents based on their level of permission without having to worry about data compatibility. And this offers greater end-to-end visibility of the shipping logistics.

Because participants in the shipping blockchain are involved in the shipping business, this blockchain will be a corporate type, accommodating distinctive features of the shipping sector. In order to make the ocean shipping blockchain a success, we need to consider the following.

First, blockchain participants need to trust each other. Although documents on the blockchain are secure from revision or tampering, integrity of documents they register initially is highly dependent on each participant. Thus, creating a trustworthy blockchain requires an attitude of putting aside one's interest and a strong belief that the blockchain would bring greater productivity to the whole shipping sector.

Second, there needs to be a general consensus on digitizing documents first. Because blockchain is based on information technology, it requires all documents to be digitized and all participants to be capable enough to provide technical support.

Lastly, support for documents is much needed both legally and institutionally. In the shipping business, government agencies play a key role in verifying transactions. Thus, these government authorities should be able to use these digitized documents on the blockchain without modification.

4. Closing

In this paper, we have looked at what blockchain is, why the logistics sector needs blockchain technology and how it can change the shipping logistics. Blockchain technology uses a distributed network to enable individuals to manage the same transaction records, instead of relying on the central authority.

Blockchain also makes the existing supply chain more trustworthy. Each record on the blockchain is secure from revision or tampering. So blockchain enables to reduce costs for preventing fraud or forgery. It creates the most optimized environment to provide an end-to-end supply chain visibility by enabling participants to share digitized transaction documents with other participants. Furthermore, blockchain-based smart contracts automate different types of transaction processes so that they can be executed much faster.

In the future, blockchain is expected to bring about a paradigm shift in logistics. It will make transaction verification process more efficient and help achieve a quick delivery of goods and services through mutual trust among participants.

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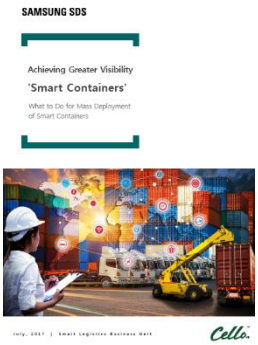

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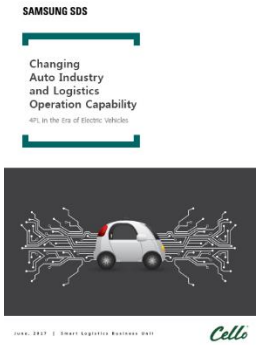

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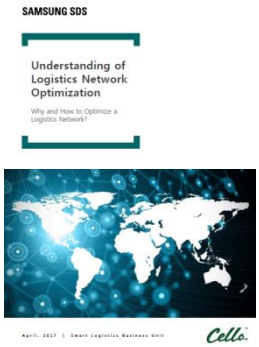

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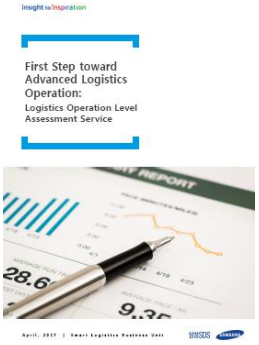

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