

# Improving the process of container shipping using blockchain

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## Summary:

Container shipping is one of the most important aspects the global supply chain. Today, approximately 60% of all seaborne trade is moved through containers. However, despite the growth in trade, there has been minimum investment in process improvements which has led to the growth of supply chain issues in the containership industry. In this research we re-engineer the existing process of container shipping using blockchain and map the areas where the overall efficiency of the process can be improved.

## Photo



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## KEY INSIGHTS

1. There are multiple inefficiencies in the current process of container shipping such as border administration, inefficient contracting practices and aging technology.
2. A blockchain that connects all the parties such as Freight forwarders, customs, seller and buyer will help reduce the wastage due to paper documentation in the process.
3. To maintain privacy in the supply chain, a private permissioned blockchain will be better than a public permissionless blockchain.

## Introduction

Container shipping is one of the most important aspects of the global supply chain. According to statista.com, the global container shipping industry amounted to approximately 60% of all world seaborne trade which was valued at 12 trillion USD

in 2017. Despite the growth in trade over the years, there has been major technical advancement in the industry. Three main areas of improvement namely, border administration (customs), technology adoption and inefficient contracting practices were identified. Customs clearance is a major obstacle today. As per the World Bank, it takes around 7.5 days for an export shipment to clear customs due to the extensive documentation required. The second issue is that of technology adoption in the maritime industry. The industry faces significant problems from inefficiency and waste due to aging technology infrastructure and business processes that lack real time information sharing and effective collaboration. The third aspect is that of inefficient contracting practices. Slow, inefficient contracting practices and a high degree of unreliability are some other concerns plaguing the containership industry. These result in poor contract compliance, booking downfalls, blanked sailings (where to

adjust capacity or freight rates, either a particular port is missed or the sailing is altogether cancelled), excessive inventory costs to shippers, and other supply chain disruptions. In this research, we try to solve these problems through the implementation of blockchain.

### Blockchain

Blockchain's genesis lie in the development of Bitcoin. It is an algorithm and distributed data structure for managing electronic cash without a central administrator among people who are not familiar to each other. The first blockchain was conceptualized by a person (or group of people) known as Satoshi Nakamoto in 2008. It was implemented the following year by Nakamoto as a core component of the cryptocurrency bitcoin, where it serves as the public ledger for all transactions on the network.

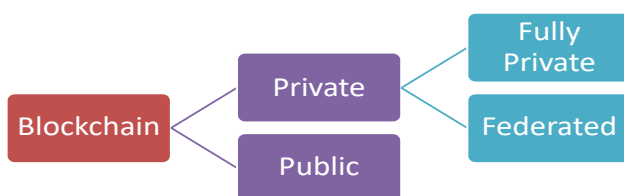
There are three main types of blockchain that are popular. First is the public blockchain which is permissionless and anyone can join it. Each computer/individual working on a blockchain is known as the node and a public blockchain has multiple nodes. No one node knows the identity of the other node working on this blockchain. In a public blockchain, any changes to the blockchain need to be validated and approved by each and every node thus making the data immutable. The second type of blockchain is fully private. This blockchain is governed by a single node and that node is solely responsible for all the approvals. The third blockchain, which is popular in the financial industry, is the federated blockchain in which there are multiple nodes which are known to each other. This is good for businesses where privacy is important and some nodes govern the entire network. These are also known as permissioned blockchains.

In supply chains as privacy is important and the nodes are known to each other, private permissioned blockchains are most suited. Blockchain technologies provide increased supply chain transparency, but more importantly create an immutable and distributed aspect of the custody record by nature of the protocol which lends itself well to traceability applications. Today many major companies are leveraging blockchains to improve their supply chains. Provenance, a UK-based startup, is giving its clients the access to its blockchain so that they can share their product details, journey and other facets with their consumers. Walmart is working with IBM and Tsinghua University, in Beijing, to follow the movement of pork in China with a blockchain.

Another important aspect of blockchain which is extremely useful in terms of supply chain is that of smart contracts. A smart contract may be understood as creation of algorithms and programs in a digital environment that can be partially or fully executed or enforced when certain conditions occur.

A smart contract is made up of a computer code which is used to automate the "if then" parts of a traditional contract. The benefit of a computer code on a blockchain is that it has a very low probability of manipulation as there are fewer potential points of contention. The code is replicated on many computers and run by those computers, who come to an agreement on the results of the code execution.

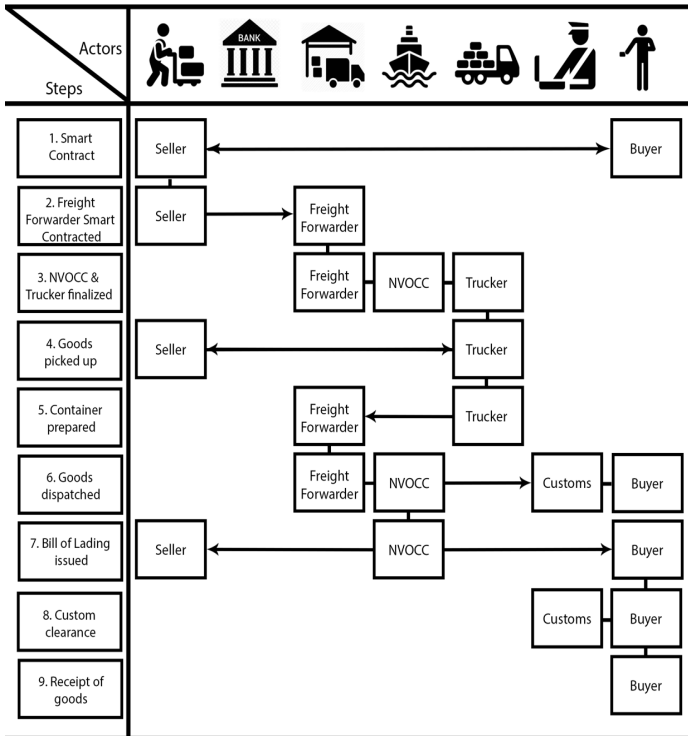
**Figure 1 Types of blockchains**



## As-Is process of container shipping

We first mapped the existing process of container shipping. This process is shown in Figure 2

**Figure 2: As-is process of container shipping**



We identified many limitations in the as-is process of container shipping. First, there is a lot of documentation that is required on paper. For example, for customs clearance, the seller will have to produce a set of documents such as commercial invoice, packing list, declaration of hazardous goods etc. The customs generally take a lot of time to verify these documents before the shipment is cleared. Thus, this creates wastage in terms of time and resources. Next, the agreements between different parties are made on paper and are generally treated as a formality. In case there is any service deficiency from the side of the carrier or shipper, penalties are generally not paid for. This creates issues such as underutilization of capacity for the carrier and disappointment for the shipper.

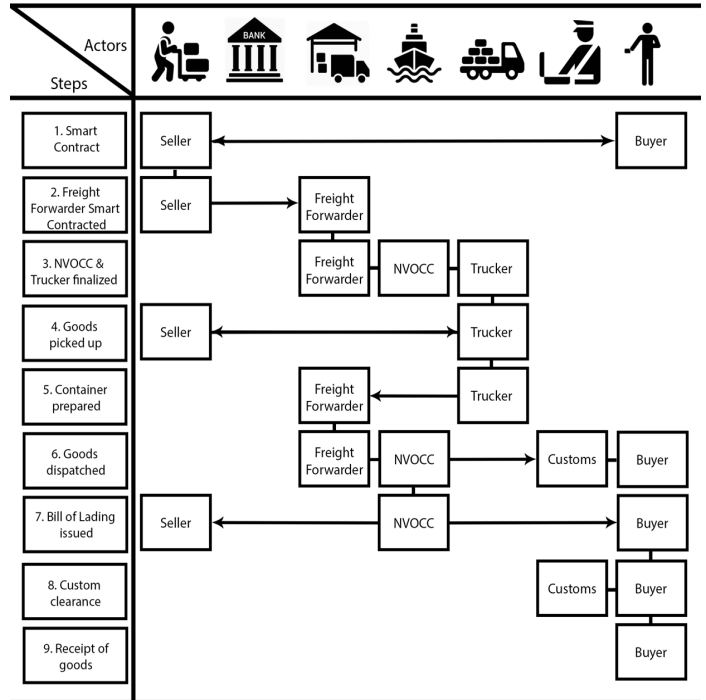
The third issue is that of bank guarantees. Generally, for high valued transactions, the seller asks the buyer to provide a bond in terms of letter of credit. This document serves as a guarantee for the seller that once the goods arrive at the destination, the seller will be paid. However, this letter of credit does not take into account the quality of goods shipped. Even if defective goods have been shipped, the seller will still be paid as the conditions for the letter of credit will be met.

These are some of the major limitations of the as-is process and next we tried to address these through the implementation of blockchain.

## To-be process of container shipping

The to-be process with the implementation of blockchain is shown in Figure 3 below

**Figure 3: To-be process of container shipping**



Post the assessment of as-is process and the inefficiencies in the process, we used blockchain as an enabler to improve the efficiency of the system. We propose to implement a permissioned blockchain in the container ship industry and believe it can have the following benefits:

- Implementation of blockchain would mean that all the documentation shall be done electronically thus the need for paper documentation shall reduce significantly if not eliminated completely.
- Next with the use of smart contracts, we propose to initiate performance-based payments. With this framework, for example, the buyer and the seller can initiate a condition based smart contract. If all the conditions in the smart contract are met, the seller is paid automatically thus limiting human interface.

- Another key benefit of blockchain implementation is that it will reduce if not completely eliminate the need of intermediaries such as banks or customs brokers.
- Finally, blockchain will help address the issue of aging technology in the container shipping industry.

Despite the benefits that blockchain is expected to serve, we understand that there will be limitations associated. For example, there will be an issue of acceptability of this new system. We propose to connect the customs of various countries and only then this system will be really effective. As this involves the adoption by government agencies, it may take time for adoption.

Further a private blockchain is not as secure as a public blockchain and will always remain vulnerable to hacking and cyber-attacks. Such blockchains will have to be made secure through multi-layer authentication.

### **Conclusions**

This research focused on exploring the role of blockchain in resolving the supply chain issues in the containership industry. Specifically, it sought to answer how the existing process of shipping containers can be made more efficient. In summary, the research effort found that blockchain can act as an enabler and improve the current process in the containership industry. With the immutable nature of blockchain, it has the potential to build trust amongst various parties such as customs, shippers, freight forwarders etc. thus reduce wastage in terms of documentation.

Also, blockchain can help resolve the issue of inefficient contracting practice in the industry with the use of smart contracts. The algorithm of a smart contract is self-executing based on a certain set of conditions. Once, the conditions are met, the payment is made else the payment is withheld in form of cryptocurrencies. This builds trust in both the buyer and seller that only when both the parties are satisfied, the payment is released.

The proposed blockchain is said to be a private permissioned blockchain which will have many of the critical features that a Supply Chain will require. It will be scalable, low cost (transaction) and will provide privacy to the implemented supply chain. These are some challenges that relate to a public blockchain.

Having said that, there are some limitations of a permissioned blockchain. For example, it is susceptible to attack by hackers as the number of nodes are limited to the participants. Also, the acceptability and interoperability of this new technology poses certain questions which remain to be answered.

Despite these limitations, we feel that the implementation of blockchain in the containership industry does hold value. The US Customs and Border protections (CBP) is already evaluating the benefits of blockchain through a pilot. If successful, it may be replicated in other countries and may re-engineer the way border administration is done. Also, one of the major benefits of blockchain is that reduces the need for paper documentation thus reducing carbon footprints.

In future research, the role of insurance companies in containership industry may also be evaluated. Insurance companies may stand to benefit a lot from the implementation of blockchain as they can have real time data of shipments and this will help them minimize fraud. Also, it will be interesting to see how Internet of things (IoT) can process real time data for containerships and send it directly to blockchain thus eliminating any human interface which will build greater confidence in this technology.