Inventory Management with Blockchain

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1 INTRODUCTION

Blockchain has been a popular technology in recent years revolutionizing the financial industry. It's mechanism of chaining blocks of data in pair with it's distributed nature has made it absolutely impossible to tamper data, bringing high security and full transparency in transactions, not only in the financial sector but also in other potential industries as well. This paper will shed light on how this technology can be used in supply chain making inventory management more efficient and transparent to the stakeholders and also try to help understand few of the potential challenges that it presents.

2 BACKGROUND

Blockchain is a decentralized digital ledger consisting of records called blocks that is used to record transactions over a distributed Peer-to-Peer network, where each block of data is secured and bound to each other using cryptographic principles that form a chain, so that any involved block cannot be altered retroactively, without the alteration of all subsequent blocks. Trying to tamper one block of the data makes all the following blocks in the chain invalid and intention to bypass this obstacle by altering data for all the blocks in its own node does not persist as verification the authenticity of the data is necessary over the decentralised network that it is part of. This way, it not only ensures the security of the data, but also makes sure of the transparency of the chain of the transactions that took place within the network.

Traditional inventory management is based on a reactive model[1], where replenishments were ordered once inventory was depleted, or a predictive model that estimated when inventory would run out. Although blockchain was not originally designed to help warehouses improve and optimize inventory management, it can allow the stakeholders in the supply chain to connect to each other through a permanent record of every transaction that takes place. With such transparency, manufacturers will be better able to manage product origins, traceability, potential recalls and perishable goods[4]. With this, manufacturers will also be able to see consumer-level demand in real time [3], allowing them to forecast demand accurately and plan manufacturing and replenishment. This has the potential to make it possible to optimize revenue and profitability, while reducing the risk of lost sales.

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3 PROPOSAL

In the proposed system, blockchain will be used for record keeping and assets such as units of inventory, orders, loans etc will be given unique identifiers, which serve as digital tokens. Additionally, participants in the blockchain will be given unique digital signatures, which they can use to sign the blocks they add to the blockchain. However, since the open and decentralized structure of blockchain poses a risk to data privacy, the blockchain needs to be a private one, where members will be granted permission to the system selectively. Every step of the transaction will be recorded on the blockchain as a transfer of the corresponding token from one participant to another.

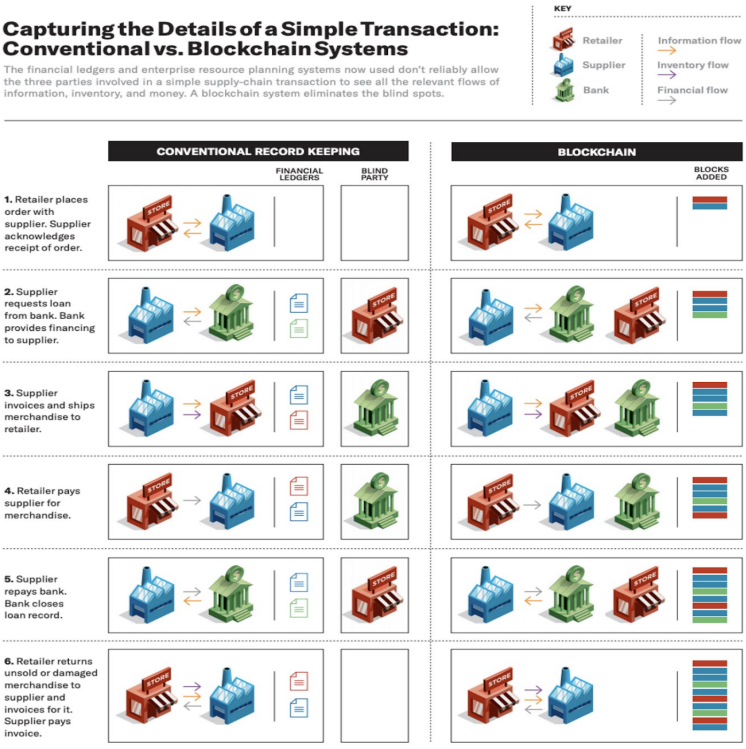

Fig. 1. Comparison of Conventional vs Blockchain based Supply Chain Management System [2]

To illustrate the system in action, when the retailer will generate an order and send it to the supplier, the digital token for the order will be recorded. As the supplier then logs in the order to confirm the order to the retailer, that action will be recorded as well. Next, as the supplier requests a working-capital loan from the bank to finance the production of the goods, the bank would be able to verify the order on the shared blockchain. If approved, the loan's digital token will be recorded too. In this way, the system will be able to maintain a transparency with a chronological string of blocks integrating all three types of flows in the transaction and will capture details that wouldn't have been recorded in a typical financial-ledger system. In addition, since each block is encrypted and distributed to all participants, it will provide a complete, trustworthy and tamperproof audit trail of the three categories of activities in the supply chain. Since participants will have their own individual copies of the blockchain, each party can review the status of a

transaction, identify errors, and hold counterparties responsible for their actions. No participant can overwrite past data because doing so would entail having to rewrite all subsequent blocks on all shared copies of the blockchain.

Moreover, many of these functions can be automated through smart contracts. In this way, a computer program will be stored on the block chain that will use data from the blockchain to verify whether the contractual obligations have been met or not, and depending on that, payment can be issued automatically by the banks. Smart contracts can be programmed to assess the status of a transaction and automatically take actions such as releasing a payment, recording ledger entries, and flagging exceptions in need of manual intervention.

4 POTENTIAL CHALLENGES

Building a network of trusted groups of partners with which to share data on a blockchain may run into several challenges. One is the need for a governance mechanism to determine the rules of the system, such as who can be invited to join the network, what data is shared, how it is encrypted, who has access, how disputes will be resolved, and what the scope is for the use of smart contracts. Another challenge will be figuring out how to address the impact that blockchain could have on pricing and inventory-allocation decisions by making information about the quantity or age of products in the supply chain more transparent. It's hard to predict where in the supply chain the costs and benefits of this transparency will fall.

5 CONCLUSION

There is considerable room to improve supply chains in terms of end-to-end traceability, speed of product delivery, coordination, and financing. The proposed system with blockchain can be a powerful tool for addressing the deficiencies.

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