"A study on Utilizing Blockchain for Streamlining Letter of Credit-Based Trading in the Supply Chain Sector"

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Abstract

Supply-Chain Management (SCM) is a network of facilities that operates through many operations, including the acquisition of raw materials, storage, transit, and conversion of those resources into products, as well as the distribution of finished goods to consumers. Though all of this is straightforward in theory, managing a system effectively in practice can be difficult. Different technologies are being employed to address and overcome these inefficiencies and save the Organization money. Among these, blockchain is looking into fresh methods to alter the playing field. The innovative supply-chain system proposed in this study is based on blockchain technology and addresses the shortcomings that the conventional system was unable to fully address. The suggested Blockchain system uses a distributed, immutable, and highly reliable ledger concept to enable transparent record keeping and provenance tracking at a lower cost, and it does so without the aid of a third trusted party. Utilizing Hyperledger Fabric, this paper demonstrates the effectiveness of the suggested approach.

Keywords: Supply chain management, smart contracts, blockchain technology, Hyperledger Fabric, permissioned network, trade, letter of Credit.

I. Introduction

Situations of the kind found in international trade serve to highlight the inefficiencies and mistrust present in the actual world. Bank participation was encouraged by the risks associated with trading goods or making purchases without a reliable middleman, which helped to shape the concept of the "cash letter and lading bill." Not merely increased costs (banks charge commission to issue letters of credit) or overhead were a result of these procedures. The turnaround time is additionally lengthened by the process of applying and waiting for export permissions to be granted.

The risks involved in sending goods or making payments without security (such as a reliable middleman) motivated banks to step in and helped shape the principles of credit letters (LoC) and lading bills (BoL). These procedures had effects beyond only cost increases (banks charge commission to issue LoCs) or increased overhead.

The turnaround time is significantly lengthened by the process of applying for and waiting for export licenses (LoE). In an ideal commerce system, communication and the actual shipping of the items both take time. The collecting operations and document application have recently been more successful thanks to the integration of SWIFT messaging with manual communication, although the system has not really altered.

In contrast, a blockchain provides up potential that wasn't previously available thanks to its (nearly) quick transaction obligations and certain assurances. We will have a clear mutual basis of reality by including all parties in a global blockchain trading arrangement that applies a specific smart contract, which can decrease vulnerability and increase transparency. This will be done using the Composer platform's Hyperledger Fabric.

For instance, the straightforward solution we included in our use case—payment in increments—cannot be implemented in the legacy system since there is no reliable way to find out and share information about the status of a shipment. Given the circumstances, such a deviation would be viewed as being excessively risky, which is why awards are only based on historical evidence.

Blockchain's distributed ledger technology, known as the Hyperledger Fabric architecture, is used to create permissioned networks where access restriction is managed by a Certification Authority, giving network users privacy concerns.

II. Literature Survey

Massimo Vecchio, Muhammad Salek Ali, Miguel Pincheira Caro, and Raffaele Giaffreda [1] Proposed AgriBlockIoT and Blockchain, a fully decentralized and blockchain-based traceability solution for the agriculture-food supply chain system, enable to continuously assimilate IoT devices generating and consuming a lot of digital data along the chain. This practical implementation approach for traceability in Agri-Food supply chain management. In this article, they used the Ethereum blockchain to demonstrate the traceability of information.

A Paper on A Systematic Mapping Study of Management of Supply Chain Using Blockchain was proposed by Abdelali El Bouchti, Houssine Bouayad, and Youness Tribis [2]. Their goal was to examine and investigate the cutting-edge applications of blockchain technology for supply chain management. By combining the current and available research, they have attempted to identify the gaps in SCMs.

Antonios Litke, Theodora Varvarigou, and Dimosthenis Anagnostopoulos [3] A thorough examination of how blockchain fits into the supply chain business is proposed. In order to better understand the supply chain business, this study focuses on key blockchain components that will have an impact on it, such as performance, scalability, privacy concerns, consensus process, cost and location evidence, and specifics on the blockchain.

By cutting out the intermediary, Balaji Prabhu, et. al.[4] has also worked to increase transparency in the agricultural trading system from farmer to customer.

The research done shows that numerous authors have suggested the secure trading system using block chain technology. The idea of a letter of credit (L/C) has not been explored. With the help of a blockchain implementation that is intended for the deployment of a modular and permissioned architecture in supply chain management, the proposed model in this article makes an attempt to secure the trust, transparency, and traceability in trading. According to the study's findings, the Hyperledger Fabric Permissioned network offers greater security than the open Ethereum implementation. Thus, the necessary network is built using Hyperledger Fabric.

III. Proposed Methodology TPF-SCM Model

3.1. Objective:

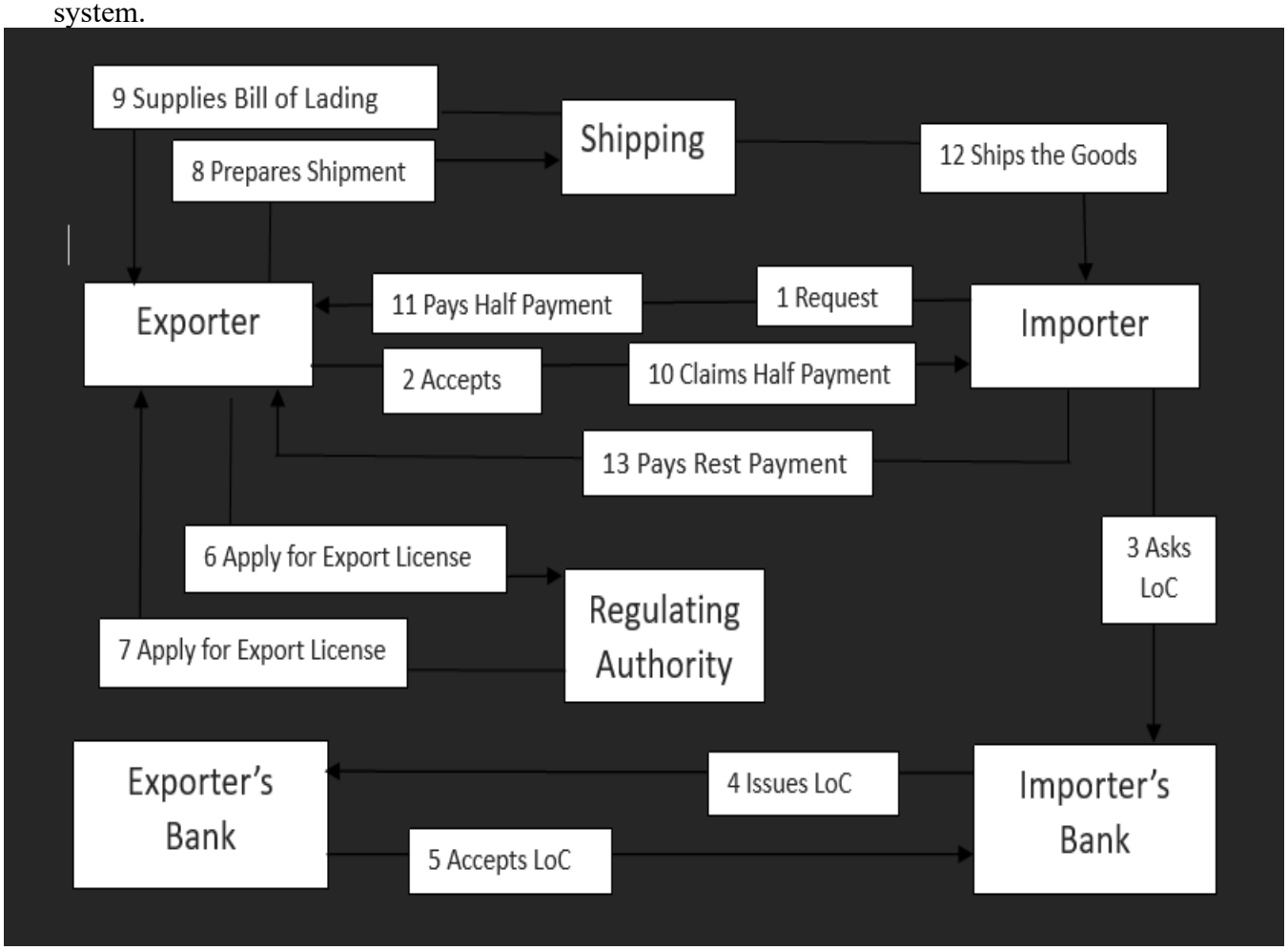
The main goal of this research is to create a framework that supports logistics traceability and consistency and can automate market transactions and business relationships through robustly protected import and export scenarios in global business networks by letter from the credit system without relying on third parties in the supply chain model.

3.2. LoC based SCM model:

The import-export scenario used in this Supply Chain Management model will represent the straightforward sale of items from one party to another. Block-chain technology has shown to be valuable in this transaction by enabling an open and safe trade. The importer's bank promises to pay the exporter's bank in two installments. The exporter transfers the products to the carrier, gets a clearance certificate from the regulatory body, and gets a receipt. The first payment installment from the bank of the importer to the bank of the exporter is started when the receipt is produced. The second and final installments of payment are made, and the transaction is complete, once the consignment has arrived at the target port.

3.3. LoC-SCM Architecture and the algorithm:

The workflow diagram presented in Fig. 1 clearly illustrates and explains the proposed LoC-based SCM system.



3. 3. 1. **Streamlining Letter of Credit-Based Trading in the Supply Chain**

In the trading situation we're taking a look at, the following terminology are used to describe certain tools and artifacts. The tools used by the created application are as follows:

• An importer is a party that pays for a good or service after requesting it from an exporter.

• An exporter is a party that provides an importer with the specified good or product in exchange for a set payment.

• Bank of Importer: Provides a LoC to the exporter upon request from its client, the importer.

• Bank of Exporter: This bank takes a Letter of Credit on the exporter's behalf.

• Regulatory Authority: It issues LfE as a permit for the export of particular products into the exporter's country.

• Carrier: Once it has taken custody of the package, the carrier is the one that issues the exporter with the BoL document.

• Letter Credit: This refers to a bank's guarantee to pay an exporter in exchange for documentary evidence that the items have been sent. This document, known as a Letter of Credit, is issued by the bank of the importer upon the importer's request. The LoC specifies the list of documents that comprise shipment proof, the payment amount, and the beneficiary (in this example, the exporter) of the payment.

• License for Export (LE): This denotes permission granted by the exporter's country's regulatory body for the shipment of the designated products.

• Bill of Lading (BoL): Once the shipment has been delivered, the carrier issues this document to the exporter. It functions as a receipt, a contract requiring the carrier to convey the items to a particular location in exchange for payment, and a title to the commodities all at once. This document, which is also mentioned in the L-C, serves as evidence of shipment and will instantly cause a payment clearance.

The proposed blockchain network's transaction sequences between the aforementioned parties are outlined in the stages below and shown in Fig 1. These deals are made in an unchangeable and unrepudiable way. In this series of events, we assume a straightforward linear narrative in which the parties engage with one another and nothing unexpected happens; guards are built into the process solely to catch mistakes.

3.4. Algorithm:

The system's parties' interactions to implement LoC-based SCM

1. The importer pays the exporter in exchange for the goods.
2. The exporter agrees to the contract.
3. The importer requests an Exporter LoC from his bank.
4. The bank of the importer issues a LoC payable to the bank of the exporter for the importer.
5. The Bank of Exporter accepts the LoC on behalf of the exporter.
6. The exporter requests an export licence (EL) from the regulatory authorities.
7. The exporter must receive an EL from the regulatory authority.
8. The exporter packages the shipment and gives it to the carrier.
9. After the carrier has validated an EL and given an exporter a Bill of Lading, all products have been certified.
10. The exporter's bank requests a half payment from the importer's bank.
11. The importer's bank transfers half of the money to the exporter's bank.
12. The transporter delivers the product to its intended location.
13. The bank of the importer charges the bank of the exporter with the remaining sum.

3.5. The Steps of Letter of Credit Process Transaction

A facilitated this transaction through the letter of credit procedure. He was able to feel secure knowing that he would get paid in his home currency for his items thanks to the letter of credit procedure. Every stage of the business process was immediately known to them.

The Letter of Credit Process Transaction Steps are listed below.

Step 1: Preparing a letter of credit request.

Step 2: Making a letter of credit request.

Step 3: Importing the bank's endorsement and approving of the same.

Step 4: Transferring the bank's approval.

Step 5: Exporter receives a letter.

Step 6: Shipment.

Step 7: The good has arrived.

Step 8: Payment

Step 9: I'll end this letter.

Step 10: Bob is given the money.

IV. Conclusion

In this work, a trading and letter of credit process system with implicit trust was constructed using the Hyperledger Fabric using blockchain technology. Various applicable technological constructs, including cryptography, encryption, smart contracts, and consensus, fundamentally establish gates to not only minimize risks but also infuse additional security in the supply chain system. This trust system results in reduced risks.

V. References

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[6] supply chain at https://www.ibm.com/blockchain/industries/.