Boosting Transition to Paperless Trade – Mapping Traditional Trade Contracts to Smart Contracts

Abstract: Distributed ledger technology (DLT), alongside smart contracts, is seen with hope by many actors involved in international trade as a new opportunity to further facilitate and digitalize international trade transactions. In order to mitigate deficiencies of the current legislation, and to avoid pitfalls that limited digitalization of trade in previous decades, a carefully planned transition needs to be conducted. For this reason, we built a solution that eases the transition to paperless by allowing for unobtrusive coexistence of traditional trading contracts and corresponding smart contracts running on the blockchain. Coexistence is achieved by automatically translating relevant trade terms and conditions specified in traditional trading contracts to the corresponding logic implemented in smart contracts.

1. Motivation

International trade can be defined as a business transaction between parties stationed across separate countries. A transaction is not limited to goods, but also encompasses the transfer of services, technology - through license agreements, and even bonds and other investment vehicles. Challenges in international trade occur because individual countries' regulations may collide with each other. Different countries have distinctive economic and political systems, as well as different degrees of development and, accordingly, varying domestic private laws and commercial practices. These discrepancies have led to a set of international private rules guiding inter-country business transactions, which has created a fair set of practices and regulations to securely facilitate business transactions internationally.

However, the paperwork and processes vital to global trade, including the costs involved, as well as the complexity of the documents and the procedures, are a major burden for both governments and businesses. Globalization has brought most advanced trading networks the world has seen, but they all still rely on millions of paper documents. For small and medium-sized enterprises (SMEs), these costs act as a major disincentive to engaging in international trade. This is why, after several government-led initiatives, in June 2005, the United Nations Economic Commission for Europe (UNECE) held its international forum entitled "Paperless Trade in International Supply Chains - Enhancing Efficiency and Security". As a result, a document named "A roadmap towards paperless trade" was drafted, which set out the key issues and made recommendations and policy-oriented suggestions on what governments and business need to do to move towards paper-free trading [1]. Despite the efforts, almost fifteen years later, international trade transactions continue to rely extensively on paper. Going paperless requires more than simply the technology and technical interoperability. It requires a conducive regulatory framework that provides for e-authentication methods and the recognition of e-signatures, e-documents, and e-transactions; that recognizes the authority of other government entities (both domestic and foreign) to issue required documentation, such as certificates; and that allows for the sharing of certain types of information between government authorities.

Blockchain, alongside with the smart contract technology, is seen with hope by many actors involved in international trade as a new opportunity to further facilitate and digitalize international trade transactions [2]. By increasing transparency and making it possible to automate processes and payments, blockchain has the potential to reduce trade costs significantly, including verification, networking, processing, coordination, transportation, and logistics, as well as financial intermediation and exchange rate costs. The automatic nature of smart contracts makes them a particularly interesting tool to use in trade to automate transactions. Cost reduction estimates in the financial sector and the shipping industry

range from 15 to 30 percent of total costs. According to the World Economic Forum, the removal of barriers due to application of blockchain could result in more than US$ 1 trillion of new trade in the next decade. Although blockchain can help accelerate the digitalization of trade and enhance the efficiency of border procedures, the road to truly paperless trade remains long. High-level political support is needed to drive trade integration and help establish a legal framework conducive to paperless trade. In order to mitigate deficiencies of the current legislation, and to avoid pitfalls that limited digitalization of trade in previous decades, a carefully planned transition needs to be conducted.

2. Research questions

Since the current regulative framework doesn't recognize smart contracts and blockchain transactions as legally binding, we built a solution that eases the transition to paperless by allowing for unobtrusive coexistence of traditional trading contracts and corresponding smart contracts running on the blockchain. Coexistence is achieved by automatically translating relevant trade terms and conditions specified in trading contracts to the corresponding logic implemented in smart contracts, and, afterwards, installing resulting code on the peers of the blockchain network. By generating code, parties involved in business transactions are relieved of the cost and burden of implementing smart contracts. In addition, automatic translation lowers the chance of occurrence of unintended mistakes and security vulnerabilities, which increases trust in the newly introduced technology.

There are many ongoing projects that are trying to leverage blockchain technology and smart contracts to streamline financial flows between buyers, sellers, and financiers, and, as well, enhance security, speed, transparency, and reliability of supply chain financing. An example of such project is the We.trade initiative, a blockchain-based "bank-centric platform". Traders register to the platform via their banks. Importers and exporters can then record their transactions on the platform after having agreed on the terms of their contract (goods concerned, price, payment term, settlement conditions). A smart contract provides the guarantee of payment and automatic settlement when the conditions determined between the parties are met. However, this project is still in the early stages of development and doesn't fully comply with the current legislation.

3. Methodology

For proper transactions to be made, detailed and specific sales contracts should be carefully negotiated to specify the relevant trade terms and conditions. These include the determination of the quantity and quality of the contracted items, the time and means of transportation, foreign exchange stipulations, and other safeguards with banks and insurers. In addition, it is advisable for the contracting parties to specify in detail what qualifies as a fundamental breach. Inspectors may also be required, for example, at the stage of enforcing the contract, through the pre-shipment inspection, to inspect the goods to ensure that they are indeed prepared for appropriately contracted delivery.

To support sufficiently detailed specification of a contract, our solution is based on the Model International Sale Contract provided by the International Chamber of Commerce (ICC) [3]. ICC is the largest and most diverse business organization in the world. It offers a large array of voluntary rules, guidelines, and codes which facilitate cross-border transactions and help resolve disputes when they arise in international commerce. ICC Model Contracts comprise lists of terms, with the responsibilities of the parties clearly set out. They are flexible enough to allow users either to incorporate only the general conditions common to all contracts or to include the specific conditions, which set out standard terms

common to all contracts incorporating the ICC General Conditions of Sale. The ICC Model International Sale Contract is of particular interest for this paper, because it was specifically developed for sales of manufactured goods intended for resale, where the purchaser is not a consumer and where the contract is an independent transaction rather than part of a long-term supply arrangement.

After the contract has been specified and signed, it should be translated into a smart contract, that is further going to be installed and instantiated on the blockchain network. In general terms, a blockchain is an immutable transaction ledger, maintained within a distributed network of peer nodes. In our work, we used Hyperledger Fabric, an open source enterprise-grade permissioned distributed ledger technology (DLT) platform, designed for use in enterprise contexts [4]. Nodes of the network maintain a copy of the ledger by applying transactions that have been validated by a consensus protocol, grouped into blocks that include a hash that binds each block to the preceding block. A smart contract, also called "chaincode" in the context of Hyperledger Fabric, functions as a trusted distributed application that gains its security/trust from the blockchain and the underlying consensus among the peers. It is the business logic of a blockchain application.

4. Solution/Discussion

In this paper, we present a permissioned blockchain solution for international trade that eases the transition to paperless by enabling seamless concurrent use of both traditional trading contracts, which ensures compliance with the current legislative, and corresponding smart contracts, which are deployed to the blockchain network. This is achieved by automatically translating relevant trade terms and conditions specified in trading contracts to the corresponding logic implemented in smart contracts. After signing the traditional contract, the typical trade starts with issuing a Letter of Credit (LC) that the buyer's bank sends to importer's bank as a guarantee for payment. The next step is issuing a Certificate of Origin that the producer sends to the exporter as proof of the quality of goods. Afterward, a shipping step takes place with all transport documents needed such as a Bill of Lading. In this step, the transporter has also a role of the validator, so exporter is able to monitor the transportation of goods. After the transportation process is done, the importer provides documents required for import clearance. After completion of import customs formalities, importer receives the shipment and initiates payment after finishing the validation process. All document types mentioned above are created using well-defined templates and automatically populated with data retrieved from blockchain. Every step in the international trade process should be validated by relevant network members authorized within smart contract definition and results with the creation of related documents on the blockchain. The whole process would be presented as a sequence of high-level abstracted steps performed as the execution of smart contracts.

The main impact of applying blockchain technology is in providing payment certainty to sellers, by automating payment methods, as well as providing delivery assurance to buyers, through trade asset tokenization [5]. Payment methods and the underlying trade contracts are modeled as smart contracts on the blockchain to provide payment certainty to the seller. This leads to automation of compliance verification with contract terms and guarantees faster payment to sellers by preventing disputes from the start due to ambiguities in the payment contracts. Trade shipment documents and other trade-related documents can be tokenized on the blockchain to provide delivery assurance to the buyer. Using distributed ledgers, the trade asset can be represented as crypto-tokens in order to indicate supervision or ownership of the goods and link their transfer between trade transaction participants on the blockchain network with the movement of the physical asset, establishing a clear chain of provenance.

5. References

[1] UNECE. "A Roadmap Towards Paperless Trade." (2006).

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