WCO Research Paper No. 45

Unveiling the Potential of Blockchain for Customs

(June 2018)

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Abstract

The World Customs Organization (WCO) has initiated work to identify possible case studies and uses of blockchain for Customs and other border agencies with a view to improving compliance, trade facilitation, and fraud detection (including curbing of illicit trade through the misuse of blockchains and Bitcoins), while touching on associated adjustments in legal and regulatory frameworks. The objective of this paper is thus to discuss ways in which Customs could leverage the power of blockchain and the extent to which the future of Customs could be shaped by the use of blockchain-based applications. A conclusion that has been reached after discussion is that Customs would be able to have a broader and clearer picture of international trade particularly in terms of the movement of cargoes and consignments as being tied with the flow of capital. With blockchain-based applications, therefore, Customs could become a full-fledged border regulator with greater capabilities in the future.

While working on this paper, the author received generous support from Mr. Thomas Cantens (Head of WCO Research Unit), Mr. Pashupati Pandey (Technical Officer, Compliance and Facilitation Directorate, WCO) and Ms. Rachel McGauran (Research Analyst, WCO). Without their persistent help, this paper would not have materialized.

Key words

Customs, Blockchain, Technology, Distributed ledger, Smart contract, Trade finance

Acknowledgements

This paper was written by Yotaro Okazaki of the WCO's Research Unit.

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Unveiling the Potential of Blockchain for Customs

Executive Summary

"Blockchain" refers to a type of data structure that identifies and tracks transactions digitally and shares this information across a distributed network of computers, thus creating a sort of distributed trust network. "Smart contract" is another term to characterize the blockchain technology: a computer protocol allowing the performance of contracts without the involvement of third parties. The advantages of blockchain technology are: time and cost savings, more secure documents made all the more robust through encryption and sharing within the network (see figure 1.). There are still some concerns concerning blockchains; the first is linked to stakeholders' privacy as, unlike cryptocurrencies, smart contracts need to be linked to identities. A second concern is the relationship between trust and performance: the more numerous the nodes are within the network, the more reliable the network is, but each transaction requires more energy and time to be performed, as all processed transactions are shared by all nodes.

However, these concerns ought not be considered as obstacles. Blockchain projects are currently in the beta testing phase in the finance sector (facilitating inter-banking system processes), insurance sector (preventing fraud and accelerating coverage) and international trade. With regard to the latter, this paper focuses its attention on two initiatives. The first was launched by MAERSK-IBM as a global trade digitalization platform to which Customs administrations are expected to join (see figure 2.). A second initiative consists of an "information highway", joining the National Trade Platform of Singapore and the Trade Finance Platform of Hong Kong, with a view to creating a Global Trade Connectivity Network (GTCN).

These initiatives are examples of just two projects among a myriad of endeavours developed all over the world by trade and transport companies. In this regard, there is no doubt that blockchains will soon become part of the Customs landscape. What will be the impact on Customs administrations?

(i) Customs will become more data-driven. Through their participation in the blockchain, Customs would be able to collect the necessary data in an accurate and timely way (all data tied to the commodity like seller, buyer, price, quantity, carrier, finance, insurance, status and location of the commodity, etc.).

(ii) Customs may become part of the blockchain and become more embedded within trade processes. Data conveyed by the blockchain could be integrated automatically into Customs systems and checked against the data submitted by traders and transporters. In a more integrated version, Customs could even automatically clear the goods within the blockchain itself.

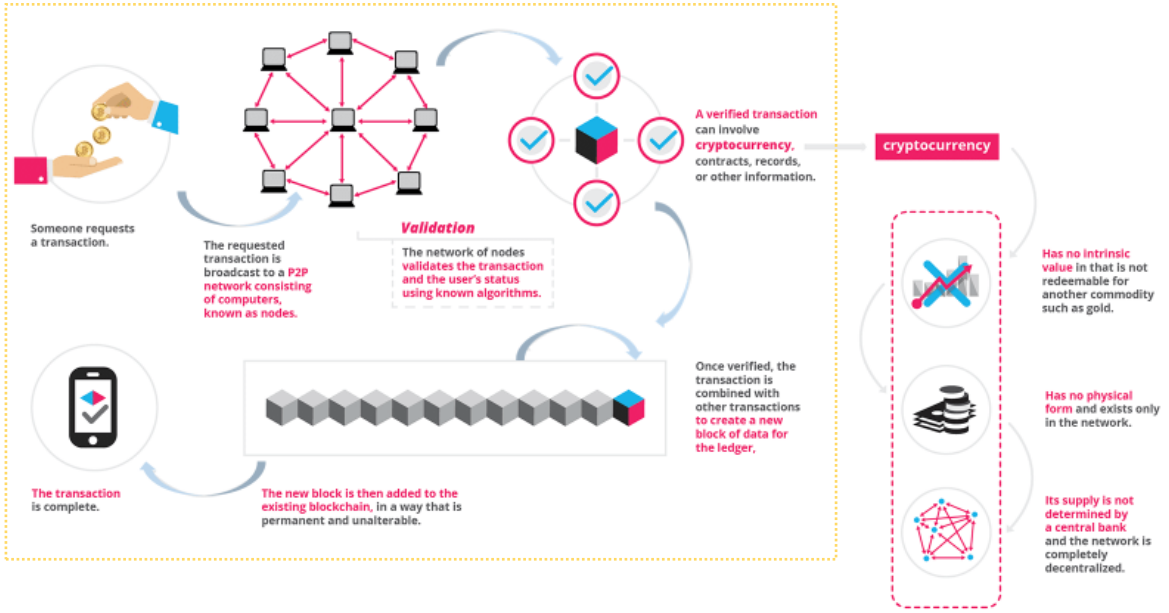
(iii) Blockchain can enhance revenue compliance and cooperation between Tax and Customs. The automated access by Customs to data lodged in export countries' systems will encourage revenue compliance in import countries. This would help Customs with issues around valuation and transfer pricing and underpin further cooperation between Tax and Customs authorities.

(iv) Blockchain can help Customs to better combat financial crimes. Customs and relevant authorities would be updated regularly on events occurring within the banking system that could be misused to conceal illicit financial flows. The iterative comparison between trade data submitted by operators and a capital transfer recorded by financial institutions would lead to a greater probability of

detecting financial crimes.

The blockchain technology represents a step forward for Customs as it offers several opportunities for them, from collecting accurate data to automatically detecting fraud and collecting taxes and duties. In this regard, WCO Members and the Secretariat ought to continue their efforts to explore the potential of blockchains as well as their legal and technical constraints.

Figure 1. Blockchain: what it does and how it performs.



'P2P' means 'peer-to-peer'.

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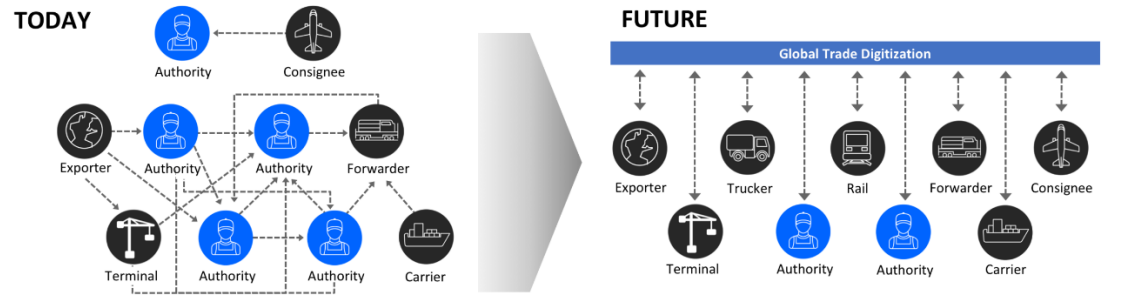
Source: https://blockgeeks.com/guides/what-is-blockchain-technology/.

Figure 2. The MAERSK-IBM Global Trade Digitization.



- Inconsistent information across organizational boundaries and "blind spots" throughout the supply chain hinder the efficient flow of goods
- Complex, cumbersome, and costly peer-to-peer messaging
- Manual, time-consuming, paper-based processes
- Risk assessments often lack sufficient information; clearance processes subject to fraud
- The administrative cost of handling a container shipment is comparable to the cost of the actual physical transport

- Fast, secure access to end-to-end supply chain information; single source of the truth
- Verifiable authenticity and immutability of digital documents
- Trusted cross-organizational workflows
- Better risk assessments and fewer unnecessary interventions
- Far lower administrative expenses and elimination of costs to move physical paper across international borders

Produced by IBM.
Source: https://www.ibm.com/blogs/blockchain/2018/01/digitizing-global-trade-maersk-ibm/.

1. Introduction

The idea behind blockchain sprang from a need to create a mechanism to secure digital currencies from the risk of replication – the holder could make a copy of the digital token[1] – and helped to create the world's first cryptocurrency, Bitcoin[2]. Cryptocurrencies, which have been steadily growing as a digitized form of exchange utilizing strong cryptography, are simply an application of blockchain; however, it is worth noting that blockchain was invented to form the basis of Bitcoin's architecture and to serve as its public transaction ledger (database).

Blockchain is expected to capitalize on its potential in a manner that revolutionizes global trade and on a greater scale since the phenomenal shift towards the standardization of shipping containers that began in the 1960s. In short, documentation and communication required for the transportation of goods across continents would be automated to a considerable extent and, what is more, with precision, security and reduction of time and costs associated with these tasks.[3]

The World Customs Organization (WCO) has initiated work to identify possible case studies and uses of blockchain for Customs and other border agencies with a view to improving compliance, trade facilitation, and fraud detection (including curbing of illicit trade through the misuse of blockchains and Bitcoins), while touching on associated adjustments in legal and regulatory frameworks. The objective of this paper is thus to discuss ways in which Customs could leverage the power of blockchain and the extent to which the future of Customs could be shaped by the use of blockchain-based applications.

2. Characterizing blockchain

Basic concepts

Blockchain is closely related to the prevalence of digital currency; it was originally developed to serve Bitcoin, which was envisaged as "[a] purely peer-to-peer version of electronic cash [that] would allow online payments to be sent directly from one party to another without going through a financial institution."[4] As the earliest manifestation of a blockchain, Bitcoin has triggered widespread experimentation of Blockchain technology in the financial services sector. As blockchain has gained traction in the public domain,

[1] Investopedia, 'Double-Spending', at: https://www.investopedia.com/terms/d/doublespending.asp.
[2] Investopedia, 'Satoshi Nakamoto', at: https://www.investopedia.com/terms/s/satoshi-nakamoto.asp.
[3] Park (2018).
[4] Anonymous author(s) Satoshi Nakamoto's article, 'Bitcoin: A Peer-to-Peer Electronic Cash System', published on 31 Oct., 2008.

businesses are exploring uses of the technology that could meet a wide range of needs in different sectors.[5]

Before discussing blockchain in the context of its application for the supply chain, however, it is important to outline a few of the very basic concepts governing the technology. Firstly, what does the term blockchain mean, and what does it signify? ,The term, blockchain, is a combination of "block" and "chain"; the "block" denotes a number of transactional records, whether financial or non-financial, which may involve the ownership of physical assets to be transferred from one to another; these records are linked altogether by the "chain" component, equipped with a hash function – with which any given data (keys) of arbitrary size can be converted into those of fixed size with another format (hashes)[6]. Once created, every transaction is subject to confirmation by a group of people taking part in the ecosystem – a category of (competing) participants called "miners" or "nodes" – before being paired up with the previous entry in a manner that ensures the consistency of all the existing data on the chain of digital blocks.[7] The "miners" work on transactions in order to export the information into a virtual block with limited recording capacity, whereas the "nodes" verify all the transactions (and hashes) by referring back to each of the prior blocks.

Blockchain is characterized by its decentralized structure within a certain computerized network; no single entity, whether inside or outside the network, has the authority to administer the network by monitoring, checking and validating all the transactions taking place between and among the participants of the network. This is because blockchain is a form of "distributed ledger" technology, with which all updates to a single ledger (database) are automatically shared with other ledgers being distributed to each participant node of the network, rather than being held in a single host commuter or a central server. The fact that each node replicates and saves identical copies of ledgers undoubtedly ensures the integrity and resilience of the entire data network. While each node constructs and records updates to a copy of the ledger independently, these updates are subject to voting by nodes and need to be agreed upon by the majority. The 'voting and agreement' is called "consensus", which needs to be agreed upon before the distributed ledger updates itself and saved on each node.[8]

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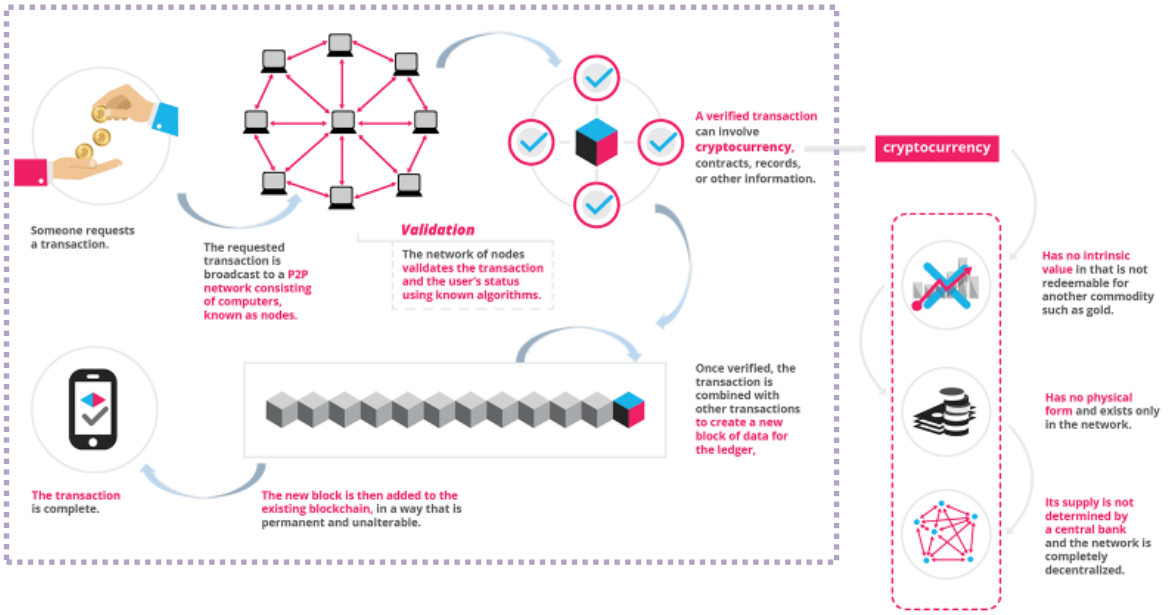
[5] Deloitte (2017), 5.

[6] "A hash is a function that converts an input of letters and numbers into an encrypted output of a fixed length". "Using a fixed length output increases security, since anyone trying to decrypt the hash won't be able to tell how long or short the input is simply by looking at the length of the output". Investopedia, 'Hash', at: https://www.investopedia.com/terms/h/hash.asp.
Hashing is "used to encrypt and decrypt digital signatures". "The digital signature is transformed with the hash function and then both the hashed value (known as a message-digest) and the signature are sent in separate transmissions to the receiver. Using the same hash function as the sender, the receiver derives a message-digest from the signature and compares it with the message-digest [he/she] also received. (They should be the same.)" Rouse, M., 'hashing', Techtarget website: https://searchsqlserver.techtarget.com/definition/hashing.

[7] See Martindale (2018).

[8] See Ray (2018).

Box 1. The image of blockchain: what it does and how it works



'P2P' means 'peer-to-peer'.

Source: https://blockgeeks.com/guides/what-is-blockchain-technology/.

"Smart contract" is another term commonly used to characterize the blockchain technology; this is a computer protocol which aims to allow the secured and facilitated performance of contracts without the involvement of third parties and thus reduces the transaction costs associated with contracting. The very prototypic application of this idea is a real-world 'vending machine' which automatically provides users with a finite item of goods (such as drinks, snacks, stamps and tickets) only after it has received certain data (on their specific choices) and values (the equivalent amount of cash or credit for the item). As with the case of the vending machine, smart contracts enable the automatic execution of various contracts involving the transfer of financial values and properties (e.g. an option contract which executes itself only when certain triggering events in terms of date and price are hit according to its specific terms). The US Congress' 2018 Joint Economic Report (where cryptocurrencies and the related technologies are highlighted) describes it as follows: "[T]he concept is rooted in basic contract law. Usually the judicial system adjudicates contractual disputes and enforces terms, but it is also common to have another arbitration method, especially for international transactions. With smart contracts, a program enforces the contract built into the code".[9] Smart contracts is merely a phrase to describe the code being used to facilitate the exchange of financial means or assets and

[9] US Congress Joint Economic Committee (2018), 210.

properties with certain values; however, it functions as a self-performing computer program when running on Ethereum, a distributed public blockchain network. According to the Ethereum Foundation, a Swiss non-profit organization whose developers have created the network, "Ethereum is a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third-party interference".[10] Blockgeeks, an educational platform on blockchain, denotes the 'Ethereum blockchain' as being focused on "running the programming code of any decentralized application", in contrast with the 'Bitcoin blockchain' being simply and specifically "used to track ownership of digital currency (bitcoins)." Furthermore, they assert that "Ethereum allows developers to create whatever operations they want."[11]

Many of the current blockchain-based applications run on Ethereum-engined technology, the execution of which is managed automatically by the network; the parties, having formed an agreement, do not need to rely on third party intermediaries to confirm it, thereby saving a substantial amount of time and cost. In addition, the digital documents relevant to the agreement are encrypted on a shared ledger; there is no way to lose them. Similarly, assets or transactions once featured on the blockchains can never disappear. Automated contracts are not only faster and cheaper in terms of performance but are also a useful mechanism to ensure the accuracy of the information contained therein.[12]

Concerns raised

Many issues need to be discussed in view of the challenges in bringing the blockchain technology into practice. First of all, questions about security and privacy have yet to be fully answered. Each ledger is cryptographically secured so that people are prevented from tampering with current and past transactions. Such a tamper-proof record of transaction has become a source of trust in all the data on transaction history embedded in a certain computerized network. Unlike cryptocurrencies (represented by Bitcoin), whose owners do not behave as individuals within the network, other kinds of blockchain applications are not immune to the possible outflow of personal or confidential information. In the words of a Deloitte report, many such applications "require smart transactions and contracts to be indisputably linked to known identities, and thus raise important questions about privacy and the security of the data stored and accessible on the shared ledger".[13] Another concern relates to the decentralized nature of blockchain; the network lacks its centralized oversight function and it thus has no effective troubleshooter which should work in the event of contingency, thus reducing the resilience

[10] Ethereum Foundation website: https://www.ethereum.org/.
[11] Blockgeeks website, 'What is Ethereum? A Step-by-Step Beginners Guide', at: https://blockgeeks.com/guides/ethereum/.
[12] Id., 'Smart Contracts: The Blockchain Technology That Will Replace Lawyers', at https://blockgeeks.com/guides/smart-contracts/.
[13] Deloitte (2016), 12.

of the entire system. In other words, each participant could suffer directly from some external shocks.[14]

Caveat 1

- ✓ Even if individual entities within a certain network are vulnerable to external disruptive forces, it would be impossible for every single entity within the network to be accessed and disrupted at the same time. It is therefore probable that the entire system of the network would continue to work (due to the lack of Single Point of Failure[15]).
- ✓ According to Miles (2017), "[t]here has been some debate about whether this means smaller blockchain networks could be vulnerable to attack, but a verdict hasn't been reached". That being said, "the bigger your network is, the more tamper-resistant your blockchain will be."[16]

The problem of scalability is also a point of discussion with regard to the challenges of blockchain. By doing away with centralized processing, blockchain-driven networks make transactions happen in a highly efficient manner. This nonetheless means that individual nodes – computers collected to the network – always and simultaneously perform the common tasks of validating and relaying transactions, without having or relying on the host computer. The creation of a new industry-wide ecosystem making the most of the distributed leger technology represents nothing but the expansion of the given network with an increasing number of (new) participants – nodes and their users, which will place further stress on that network when it processes transactions. This may cause delays in transactions, reduced performance and increased fees and charges (associated with the 'rewards' for processing). In a nutshell, such a duplication of effort as reflected in the 'usability' of networks casts a shadow over the potential for blockchain applications to be developed for use at large scale.[17]

Caveat 2

- ✓ From a technical perspective, the blockchain-based network does not work in a manner that reduces cost per performance in itself. Furthermore, there is still much work to be done in order to optimize its processing speed and free it from the problem of energy consumption.

Caveat 3

- ✓ In theory, blockchains have a notable security flaw: if more than half of the computers working as nodes to serve the network tell a lie, the lie will become the truth. This is called a '51% attack' – the potential defect of blockchains, inter alia, of Bitcoin – that could occur particularly in the process of "mining".[18] More specifically, the majority of the network's computing power that has been taken over by a (group of) attacker(s)

[14] Id.
[15] A Single Point of Failure (SPOF), if hit effectively, will prevent the entire system form working. That is to say, the community (network) being comprised of a number of participants (computers) cannot stop working unless all of them are 'captured' at once. This will deliver the highest level of assurance to the current and potential blockchain users.
[16] Miles (2017).
[17] O'Donnell (2017)
[18] This concern was highlighted by Satoshi Nakamoto when he launched Bitcoin.

prevents it from spotting and rejecting a fraudulent version of public ledger.[19]

3. Blockchain from the business perspective

Traders' benefits

The Financial Times has highlighted the impact of blockchain on trade: "It records transactions in sequential blocks, creating encrypted data that can be shared between several parties through the supply chain, updating them instantly without risk of fraud."[20] With blockchain, which keeps an immutable or unchangeable record shared among network participants and updated in real time, all participants in a 'certain supply chain network' (as driven by blockchain) can have access to and trace the reliable and real-time data relating to the flow of cross-border trade and the distribution of shipments. Deloitte, a multinational professional services network, provides a brief explanation of blockchain in this context as follows: "Businesses can improve their supply chain management through more transparent and accurate end-to-end tracking. […] With blockchain it is possible to digitize physical assets and create a decentralized, immutable record of all transactions, making it possible to track the asset from production to delivery or use by the end user and provide greater product history and transparency".[21] As such, applying blockchain results in traceability and end-to-end visibility, enhancing the supply chain security and connectivity.

In the private sector, there are multiple parties engaged in cross-border trade; all of whom could avail of the blockchain technology to disrupt their regular and day-to-day business processes. Assuming that a seller (exporter) and a buyer (importer) agreed on a certain trade transaction internationally, the seller needs to be sure that the buyer will fulfill its payment liabilities and the buyer wants to pay as late as possible and only when the seller's liabilities are discharged in full. Both parties will probably be able to achieve their respective objectives by means of smart contracts, inter alia with the function of self-execution, that should be embodied in trade-related blockchain applications. With distributed ledgers, they will be allowed to see the same information regarding the status of consignments simultaneously; therefore, it will be easier for them (even if not having a relationship of mutual trust) to directly communicate for prompt and timely reconciliation in case of issues with shipping, e.g. deficiency of ordered goods to be delivered. By including banks (financing partners for trade) and distributers (shipping companies, freight carriers), manufacturers (sellers) will be able to show that these parties have agreed on the receipt

[19] Investopedia, '51% Attack', at: https://www.investopedia.com/terms/1/51-attack.asp.
[20] Investopedia, '51% Attack', at: https://www.investopedia.com/terms/1/51-attack.asp.
'51% Attack', at: https://www.investopedia.com/terms/1/51-attack.asp.
ovation.pdf" |https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-blockchain-to-drive-supply-chain-innovation.pdf}.

of ordered goods, thereby giving clients (buyers) the assurance that the shipments will arrive in due course. This can be associated with every step of payments in return for services rendered (trade finance provided by banks, carriers and forwarders' logistics); manufactures will get paid for the shipments faster and their banks will be repaid without delay. On the whole, all the parties involved will be able to increase their financial liquidity while reducing transaction costs (commissions and spreads) that are incidental to trade in a financial sense.[22]

Financial institutions

Furthermore, bank-to-bank payments would be significantly facilitated by blockchain technology. In particular, distributed ledgers would enable real-time and cross-currency payments while minimizing the costs associated with these transactions.

Conventional banking systems associated with cross-border trade are characterized by 'correspondent banking'; where a financial institution conducts business transactions, accepts deposits and gathers documents on behalf of another financial institution. Correspondent banking is a chain of links and, by its very nature, prone to some problems in completing transactions and lacks end-to-end visibility in a series of transactions. Banks have to pre-fund their accounts held at the correspondent banks; liquidity costs directly affects their working capital which represents their operating liquidity. Distributed ledgers would be the solution to these problems since such a system could enable the transfer of value without requiring that capital be placed into a corresponding bank. Banking institutions would bear no cost for transaction fee, transfer funds in seconds instead of days, and ensure the visibility of their all transaction processes.[23]

We are, nonetheless, a long way off solutions based on the blockchain technology being offered worldwide to disrupt the banking sector's business model for trade finance. McKinsey & Company (2015) mentions: "it will take time for [banks] to achieve universal reach in destination and currencies, resolve compliance questions, and equip themselves to handle the high-volume payments required for international trade".[24] Higginson (2016) recognizes that "tokens of payment value" featured in the blockchain-based trade finance mechanism "enable real-time messaging and clearing within a cryptographically secure and resilient environment"; however, he asserts that bank-to-bank real-time settlement by means of the direct exchange of such tokens "remains a challenge, requiring commercial and central bank money to honor [them]".

In this regard, McKinsey & Company (2015) also points out that solutions leveraging the power of blockchain technology "still require banks to make correspondent-like agreements to define the right and obligations of participants" in the settlement

[22] Mearian (2018).
[23] McKinsey (2015), 20.
[24] McKinsey (2016), 9.

systems, thus implying that “existing correspondent banking relationships” would remain in an era of distributed leger technologies.

Caveat 4

- ✓ Blockchain could provide impetus to global trade by eliminating inefficiencies that limit the value of the letter of credit (LC) – a financial instrument with which a seller is guaranteed a buyer’s payment that needs to be received on time and for the correct amount. As international dealings inevitably involve uncertainties that derive particularly from physical distance between both parties located in different countries, differing national laws of those countries and the difficulty for both parties to assess each other’s trustworthiness. If a buyer is unable to deliver payment on the purchase, the issuing bank (buyer’s bank) is required to cover the full or partial amount[25] as long as the terms and conditions specifically shown in the LC have been met. The issuing bank therefore needs to carefully evaluate whether the documents submitted by the seller comply with such terms and conditions, which may raise the time and cost for trade.
- ✓ This is where blockchain’s smart contract comes in to play as it “codifies the terms and conditions of trade by abstracting and expressing conditional clauses […] as separate, independent or interdependent functions that provide pass/fail outputs based on the [exporter/seller’s] input information”, Cognizant (2017) explains.[26]

Insurance companies

Cargoes moving internationally by sea or air need to be insured against risks as set forth in the Institute Cargo Clauses[27]. The profitability of insurance companies dealing with risks concerning freight in transit depends on how accurately they can calculate the insurance premiums on each flow of goods, as well as on how cautious they may be in tackling their own risks: fraudulent insurance claims.

Better coordination between and among different insurers would be enabled by the blockchain technology. Being equipped with the immutability of a distributed ledger, with proper access controls to protect data security, insurers could record every transaction on it in a secure and permanent manner, thus collaborating with each other to identify suspicious behavior or clues leading to the detection of fraud within and across the ecosystem of the industry. It is nonetheless necessary to note that the insurers’ current efforts, including a substantial financial investment, to share the data to prevent fraud seems to be largely unrewarded due to the difficulty in handling these data. More specifically, developing such an industry-wide network will inevitably raise concerns and

[25] Investopedia, ‘Letter of Credit’, at: https://www.investopedia.com/terms/l/letterofcredit.asp.
[26] Varghese and Goyal (2017), 8.
[27] “Set of terms for cargo insurance policies voluntarily adopted as standard terms by many international marine insurance organizations, including the Institute Of London Underwriters and the American Institute Of Marine Underwriters.” Business Dictionary: http://www.businessdictionary.com/definition/institute-cargo-clauses.html.

come up against constraints with regard to the use of clients' sensitive (or personally identifiable) information – in particular sharing between and among different and competing firms – and thus often gives rise to an inconsistent outcome.[28]

Assuming a paper-based contract on tangible assets that is insured is turned digitally into a certain programable code by the blockchain technology, the insurer would fully recognize the advantage of smart contract when an insurance claim is filed. In cases where the code would enforce the contract, a smart contract would automatically apply the terms and conditions (i.e. the coverage) of the insurance policy and consult with a third party to ascertain the losses alleged by the policy holder. When it comes to cargo (or marine) insurance, a smart contract would be linked to the carrier (vessel operator)'s cargo management system whose latest cargo information could be used for the objective assessment of damages over the losses of certain shipments in transit.[29]

As such, the blockchain technology would enable insurers to process a substantial number of insurance claims in a paperless and prompt manner. They would further feel the benefit if they were equipped to automate the verification of these claims – the most burdensome and time-consuming process – in a manner that ensures some degree of objectivity in calculating damages or their liabilities in each case.

Caveat 5

- ✓ In addition to the financial sector, applications of blockchain could range over various domains. According to Mendling et al (2018), blockchain's capabilities being embodied in (i) its function as an immutable public ledger, (ii) smart contracts and (iii) encryption "demonstrate how blockchains can help organizations to implement and execute business processes across organizational boundaries even if they cannot agree on a trusted third party". The authors specifically refer to "the management of entire supply chains, tracking food from source to consumption to increase safety", and "sharing personal health records in privacy-ensuring ways amongst medical service providers".[30]

4. Ongoing pilots/initiatives related to cross-border trade and utilizing blockchain

The Maersk-IBM joint venture

Maersk, a Danish sea freight company, and IBM, are now collaborating to maximize the potential of blockchain in order to digitalize global trade.[31] Maersk expects

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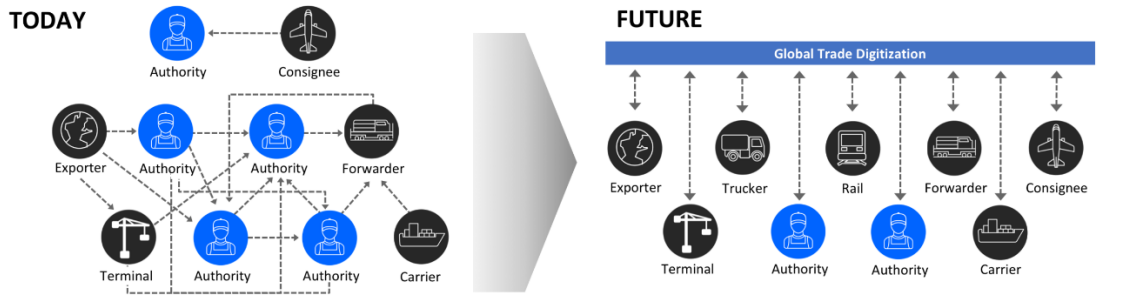
[28] CB Insights (2018).
[29] See, id.
[30] Mendling et al (2018), 6.
[31] On 16 Jan., 2018, Maersk and IBM announced a joint venture to develop a global trade digitization platform that applies blockchain to facilitate global trade.

that blockchain will also enable regulatory authorities including Customs (Dutch Customs and US Homeland Security in this instance) to closely monitor the flow of goods, carry out risk assessment effectively and perform regulatory processing in an efficient manner.[32] A global trade digitalization platform the companies have been developing using blockchain technology will most likely leverage other cloud-based, open-source technology, including artificial intelligence, the internet of things (IoT) and data analytics, to allow for tracking of traded goods across borders. The platform will be equipped initially with two core capabilities: a 'shipping information pipeline' granting end-to-end supply chain visibility; and 'paperless trade' with digitalization and automated filing of all trade paperwork.[33]

With regard to visibility, the digital infrastructure connecting multiple participants in a supply chain ecosystem will enable them to keep track of the containerized shipments' real-time progress through the supply chain. The participants will thus be readily informed of where an in-transit container is located and be able to check the status of Customs documents while reviewing Bills of Lading and other shipping documents' data. The blockchain technology will ensure no party can modify, delete or even append any record without the required consent from others (consensus) on the network.

Box 2. The image of Maersk-IBM Global Trade Digitization



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Produced by IBM.
Source: https://www.ibm.com/blogs/blockchain/2018/01/digitizing-global-trade-maersk-ibm/.

An advisory board comprising industry experts and government officials is in the process of being formed with a view to addressing the specific needs of industry and adapting the platform accordingly. The platform is now being tested by a number of

[32] This platform is built on open standards and designed for use by the entire global shipping ecosystem, which allows for the use of blockchain technology to help companies move and track goods digitally across international borders. Singapore Customs would be participating in the next phase of the development of the new platform.
[33] https://aircargoworld.com/allposts/maersk-ibm-partner-on-logistics-blockchain-jv/.

selected partners who are specifically interested in developing smarter processes for trade. Discussions with governments, including Customs administrations, are underway in order to elaborate on the specification of the platform, particularly in dealing with issues surrounding intelligence (e.g. the scope of data to be shared, the ownership of data, the duration for retaining data). There are concrete legal issues which could be considered as obstacles (e.g. hard copy documentation requirements, the lack of blanket data sharing approval mechanism) in transforming the project from pilot to a fully-operational reality.[34]

Caveat 6

- ✓ DP World Australia, a container port and supply chain operator, and DB Schenker[35] (both being logistic and supply chain giants) have created a consortium to utilize blockchain architecture developed by the Australian-based company TBSx3, a blockchain startup, to address the issue of counterfeits on a global scale while protecting global supply chains. The ultimate aim of this initiative is to help companies to restore consumer trust in supply chains.[36]
- ✓ Hamburg Süd, a container shipping company, has also joined this project. Supply Chain Dive reports: "For a while, Maersk has been the pioneer of new technology for ocean shipping with its IBM blockchain alliance. Even though Maersk owns Hamburg Sud, the launch of another blockchain initiative signals a wave of change for the industry."[37]

User cases in Singapore

In terms of trade finance, the Monetary Authority of Singapore (MAS) and the Hong Kong Monetary Authority (HKMA) – both are the regulators responsible for maintaining the stability of the currency and financial system in the respective territories – are currently working together to jointly develop the Global Trade Connectivity Network (GTCN) which will enable cross-border flows of digital trade data using the distributed ledger technology.[38] For starters, the project will connect the GTCN with the National Trade Platform (NTP) in Singapore[39] and the Hong Kong Trade Finance Platform, with the aim of building an 'information highway' between the two platforms. Further connections with the platforms of other jurisdictions and communities (e.g. Japan as discussed below, South China via Shenzhen, Thailand before long) will be pursued in the near future.[40]

As a matter of fact, the Bank of Tokyo-Mitsubishi UFJ (renamed MUFG Bank in April 2018), Japan's biggest private lender, and NTT Data Corporation, a Japanese major

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[34] Inquiry from different actors working on this project.
[35] A Germany-based logistics company and a division of the German rail operator Deutsche Bahn AG.
[36] Burnson (2018).
[37] Patrick (2018).
[38] MAS and HKMA signed a Memorandum of Understanding on 15 Nov. 2017.
[39] "[A] national trade information management platform that provides the foundation for Singapore to be the world's leading trade, supply chain and trade financing hub." Singapore Customs website: https://www.customs.gov.sg/about-us/national-single-window/national-trade-platform.
[40] 'Hong Kong-Singapore blockchain trade platform to go live in 2019', Global Trade Review, 15 Nov. 2017, at: https://www.gtreview.com/news/asia/hong-kong-singapore-blockchain-project-to-go-live-in-2019/.

system integration company, have initiated a Proof-of-Concept (PoC) pilot which will connect the NTP in Singapore with a prototype blockchain trade platform to be developed by a consortium of Japanese companies. This can be seen as a continuation of the aforementioned GTCN project. By integrating the digital platforms between these two trading nations using Application Programming Interfaces (APIs), the pilot will endeavor to provide digital solutions to technical challenges prevalent in international trade, including regulatory disparities and (differing) documentation standards. One of the expected deliverables is ensuring that cross-border trade between the two countries is virtually paperless. The pilot aims to make cross-border flows more secure, efficient and transparent, with the long-term goal of fostering greater trade and supply chain integration across the region. From the Singaporean perspective, "this PoC with NTT Data" has been considered "an important building block" of "[their] overall strategy to enable the flow of digital trade data with [their] trade partners globally" (HO Chee Pong, Director-General of Singapore Customs, Ministry of Finance).[41]

5. Implications of blockchain for Customs

As discussed in the previous sections, blockchain undoubtedly has the potential to cause a sea change in the landscape of international trade. First and foremost, trade-related applications driven by the digital ledger technology would help to reduce the huge volumes of paperwork and multiple bureaucratic interventions which are considered necessary in pursuit of legitimate trade. Furthermore, blockchain case studies rooted in financial services have expanded to the domains of transport or the 'physical' flows of goods, while digitizing not only financial instruments but traditional trade and shipping documents.[42]

Customs would become more data-driven

A focus on technicality might help to understand why such a promising development with respect to the utilization of blockchain is foreseen from the standpoint of trade. As described by Botton (2018), "[i]nformation on any shipment – whether it be a proof of purchase, a clearance form, a bill of lading, insurance – can be made part of a block, a transparent chain of custody, and be accessible to suppliers, transporters, buyers, regulators and auditors."[43] Therefore, Customs would be able to see the necessary and accurate data (seller, buyer, price, quantity, carrier, finance, insurance etc.) that have been tied with the goods to be declared and also keep track of the location and status of such goods in real time. Such a complete visibility, if built into the sphere of regulatory oversite,

[41] Antonovici (2017).
[42] Id.
[43] Botton (2018), 2.

would ensure a better-informed and more data-driven Customs function in terms of its day-to-day operations.

With the blockchain technology, Customs administrations and other border agencies would significantly improve their capacity for risk analysis and targeting, thus contributing to improved trade facilitation. Conventional blockchains called “Permission-less” (e.g. Bitcoin) have been made accessible to anyone wishing to participate in the “mining” process required to validate transactions; such an open and transparent network could lead to problems in handling confidential information and administering the whole network (e.g. changes in specification). Particularly through “Permissioned” (or private) blockchains for which certain administrators clearly define roles, responsibilities, levels of access, and rights of validation for the participants, Customs administrations could be equipped with an unbiased tool which is essentially designed for uploading and sharing information between unrelated parties. This might result in the fully integrated, end-to-end supply chain management functioning in a transparent and trusted manner.

Customs could automatically extract information from the primary sources for declaration purposes, thereby enhancing the accuracy and quality of their data and immutability thereof as well. Reducing the burden of manual verification and the resources required to validate declarations would lead to faster Customs declaration processing and reduced end-to-end lead time.

Sharing the relevant data through Permissioned blockchains can help Customs and other border agencies realize the envisaged end-to-end “data pipeline”. Utilizing such blockchains that can be operated by supply-chain consortia, and continuously accessed and updated by all participants, these regulatory authorities would be able to ensure they have accurate and reliable data at hand and obtain such data from the right sources. By using a common distributed technical platform, they could leverage the power of blockchain technology to open up new possibilities to share information and resources, particularly in a Single Window environment and for cross-border data exchange purposes.

There are growing concerns about product quality and safety. The relevant licenses, permits, certificates and other authorizations (that can be referred to as “LPCO” all combined) may be required at the time of Customs clearance, depending on the nature of declared goods and related national regulatory requirements. Blockchains enable a holistic product life-cycle data management by providing a common platform where the producers, laboratories, logistics operators, regulators and consumers can have full access to and share all related information such as provenance, testing, certification, and licensing. It could also ensure that an e-certificate is appropriately issued, and properly and digitally signed by a valid regulatory/issuing agency, while protecting the certificate from any risks of alteration or manipulation of its content or misuse of it.

Customs would be more embedded within the trade process

In practical terms, the blockchain technology could be embedded into Customs' practices through a common platform which would embrace trade-related commercial entities (e.g. banks, shipping lines, freight forwarders, Customs brokers) as they are regularly engaged in trading business, and thus would enable the sharing of information among them.

The participation of innumerous (or at least a great number of) shippers (exporters) and consignees (importers), whether corporate or individual, is not necessarily a key to the success of such an initiative so long as the information on related documents by consignment, as recorded by aforementioned business entities on a common and distributed ledger, has been made accessible to Customs. Such information, once incorporated into the chain of blocks, cannot be erased or tampered with by anyone; therefore, regular Customs procedures would be limited to checking the submitted data against their own database.

If it becomes a part of the network as a node, Customs could automatically clear goods that have been 'pre-screened' by Customs on its ledger at an earlier stage, even without withholding them at the time of declaration. In other words, Customs would be able to direct their limited resources to the handling of a category of trade which involves operators and financiers as being 'outside' of the given framework of public-private partnership.

Blockchain would favour revenue compliance and cooperation between Tax and Customs

The Blockchain technology could provide Tax authorities with sufficient ammunition to narrow the gap between expected value-added tax (VAT) revenues and those actually collected; a gap engendered by taxpayers' possible fraud and evasion.[44] According to PwC UK experts, having discussed the technology's implications, "blockchain makes fraud and errors far easier to detect because the system provides clear and transparent information about transactions and items in the network"; "this could be particularly useful in tracking if and where VAT has been paid, and in doing so reduce VAT fraud."[45] However, such a dynamic leap would hardly be seen in the real Tax domain, according to one such expert who tells: "A tax authority […] would need to obtain information from every taxpayer. Mandating digital data from […] every VAT trader in the country, even those that don't own a computer and keep their receipts in a plastic bag, will be an enormous step".[46]

The same is true of trade-related applications that could be developed for the sake of Customs particularly in revenue compliance. Once the data on certain transactions as

[44] Ajienka, N., 'Blockchain and Tax Fraud', Fintricity website: http://www.fintricity.com/blockchain-tax-fraud/.
[45] PwC (2017), 3.
[46] Id.

between an exporter (seller) and an importer (buyer) are recorded on the blockchain and thus made accessible to Customs, importing country's Customs, for example, will collate the importer's declaration with the relevant data that can be retrieved from the network involving the two parties. If these transactions are taken over by smart contracts which self-execute, the importer's purchase of goods, which is never completed without the remittance of the equivalent value of funds (money transfer) to the exporter, can be automatically followed by the duty payment at the time of goods clearance. This is what could be deduced from the case of payroll tax which, as viewed by WU Global Tax Policy Center, "can be automatically withheld and paid into the treasury at the time of salary transfer, thus removing the duty of the employer to act as a tax collector."[47] However, it is difficult to imagine that countless traders, together with private sellers and consumers who have already familiarized themselves with the E-commerce companies' online services, would avail themselves of smart contracts in such a systematic fashion.

Finally, applications of common and distributed ledgers could transform the existing or planned mechanism for reliable and real time exchange of information (EOI) between Customs and other relevant authorities, thereby enhancing Customs' capabilities to identify fraudulent practices. A possible application would relate to the EOI between Customs and Tax authorities aiming to ensure a more harmonized approach with respect to revenue collection. This would help to deal with the issue of Customs valuation and transfer pricing; i.e. enabling Customs to better assess the veracity of import/export declarations, thus rejecting the 'price actually paid' (as declared) and applying alternative methods for Customs valuation in some cases involving profit shifting.

Blockchain would help to combat financial crimes

From a broader perspective, all relevant authorities combating cross-border financial crimes within a jurisdiction should explore all avenues in order to establish and strengthen cooperative relationships for the achievement of their respective and common goals. In this regard, blockchain-based applications could be developed to help tackle emerging issues such as money laundering, terrorist financing and illicit financial flows.

Criminals exploit legitimate trade (including banking systems related to trade finance) to disguise their illicit proceeds (billions of dollars annually). Such crimes, often referred to as trade-based money laundering (TBML), involve several schemes that have been worked out to complicate the documentation of legitimate trade transactions. Red flag indicators for potential TBML, which may allow Customs officers to detect the fraud in real time, include false reporting such as overvaluation or undervaluation of the goods concerned, and unusual shipping routes or transshipment points. In this regard, the Financial Action Task Force (FATF) has occasionally issued stand-alone reports that

[47] WU GTPC (2017), 7.

address TBML and best practices[48]. One of these documents specifically calls on countries to allow the investigative authorities access, directly or indirectly, and on a timely basis, to trade data and relevant financial information.

To this end, Permissioned blockchains could be utilized to create a certain networking community where Customs and other authorities in charge of criminal investigation, intelligence, revenue collection and financial services may record and share the all the relevant updates (i.e. taxpayers' trade practices and related activities for banking transactions) through the distributed ledger. This would enable all of them to take necessary actions in a timely, prompt and coordinated manner. Furthermore, having access to financial institutions' blockchain-driven ecosystem, which has been built to streamline trade finance and create a paperless working environment, would enable relevant authorities to be updated regularly on events within the banking system that could be misused to conceal illicit financial flows. In particular, Customs would be able to enrich their red flag indicators while utilizing their conventional technique of unit price analysis or trade statistics of two trading partners; the iterative comparison between their trade data submitted by operators and a series of capital transfer recorded by financial institutions would lead to a greater probability of finding the clues of possible financial crimes.

6. Conclusion

The blockchain technology can be embodied in a network application, with which all participants have access to every single record of transactions involving any one of them, and thus are able to cross-check the veracity of an ongoing update before validating it. Such a peer-to-peer monitoring mechanism – with all eyes fixed upon one – ensures the credibility of the entire network; together with smart contracts, it enables a party to transact easily and confidently with another unrelated and disparate party. Key deliverables of this type of application are: prevention of possible frauds; enhanced accuracy of recorded data; contracts' self-execution without intermediary; and immediate and permanent sharing of information. Concerns regarding data security and privacy have been raised (particularly in terms of an open network, as illustrated by the system of decentralized digital currency, in which anyone can freely participate); Permissioned blockchains which ensure that those who want to transact with trusted partners and prefer a certain degree of control by a central administrator, could be a valid response to such concerns.

Marine transport, which requires numerous documents in view of ensuring legitimate trade, is an area of business where firms could maximize the benefit of blockchain technology. A network connecting multiple parities in trade will enable them to access and share data on digitized trade and shipping documents, as well as financial

[48] Miller et al (2016), 10.

instruments relevant to trade transactions. It will significantly reduce the cost associated with the documentation of every step or process related to logistics and financing, while providing all the parties concerned with the highest level of visibility in terms of the delivery of shipments as well as the transfer of funds. In its entirety, the blockchain-based application will transform the business model of freight transportation by sea; that is, operators and financiers engaged in cross-border trade will avail of the benefits of transparency and predictability being introduced into every phase of trading and financial flows, thereby becoming integrated into a harmonized ecosystem in the era of 'digital trade' rather than functioning separately as before.

The power of blockchain could have a great impact on Customs' day-to-day operations. In collaboration with the private sector-driven initiative to enhance the 'traceability' and 'connectivity' of supply chains all the way through by leveraging distributed ledgers, Customs would be able to have a broader and clearer picture of international trade particularly in terms of the movement of cargoes and consignments as being tied with the flow of capital. This indicates the possibility of ensuring that Customs is fully informed and well-prepared in dealing with a variety of risk and threats and thus enabling knowledge-based enforcement in pursuit of stricter compliance and faster clearance. In addition, Customs could be elevated to the position of a fully-fledged border regulator endowed with a broader range of functions including but not limited to combatting cross-border illicit financial flows.

The future of Customs could be defined by how they decide to utilize the blockchain technology with a view to changing the way they work in pursuit of certain and error-free enforcement. Customs' databases do not necessarily have to take the form of a distributed ledger; by interfacing with blockchain-based platforms, Customs would significantly enhance their visibility in the supply chain from the early stages. They would then only have to check if there is any discrepancy between the data submitted by traders and those iteratively updated on the public ledger. Depending on such immutable, inerasable and trustworthy datasets that Customs could have in a network involving the private sector, they could distinguish between illegitimate and legitimate trade to the fullest extent possible without relying on their conventional risk management technique. Moreover, a series of steps for export and import, including the process of Customs clearance, could be technologically based on smart contracts which self-execute when certain conditions are met; the relevant interactions with Customs (for declaration and duty payment) as well as "LPCO" authorities (in complying with product-specific requirements) could be programmed to proceed automatically and, what is more, without necessitating any (active) interventions by traders and authorities (such as 'submission' or 'filing' of applications and 'granting' permissions).

The blockchain technology represents a step forward for Customs and Trade, both of which desire greater efficiency in their business operations. More specifically, it will help

to assure Customs of the security of a category of (legitimate) trade, thereby encouraging Customs and Trade to streamline their tasks (often called 'red tape') that have been required for compliance thus far. In the meantime, Customs will be able to concentrate their effort and attention on the rest of trade – beyond the reach of the blockchain-driven 'trusted trade'[49]. Blockchain is a giant leap for Customs in the 21st century.

[49] Miles (2017) points out that a desirable blockchain-based infrastructure should be able to: "Prevent anyone — even root users and administrators — from accessing sensitive information"; "Deny illicit attempts to change data or applications within the network"; and "Carefully guard encryption keys using the highest-grade security standards so they can never be misappropriated". It is considered that trade-related blockchain applications should be equipped with these capabilities.

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