

2

Blockchain and distributed ledger technology



Blockchain and DLT are still in an experimental phase for many customs authorities, with around a third testing it through proofs of concept (PoCs) and pilot projects using mainly permissioned (i.e. private) blockchains. Only Argentina and Uruguay report full deployment of this technology.

Customs authorities hope that its use will allow for better transparency, immutability and accessibility of information and data quality, as well as the sharing of relevant information on border management procedures among all stakeholders. However, a lack of expertise and good practices, as well as the associated costs, currently pose the greatest hurdle to its introduction (Okazaki, 2018).¹

Full deployment is also hindered by the lack of standardized datasets used by government agencies and AEOs, inefficient governance systems and the potential for a proliferation of different blockchain solutions that are not interconnected.

There are a number of projects and PoCs that are intended to bring improvements in the following areas:

- information exchange and interoperability at national and international levels (including at the level of customs unions);
- development of international single window interconnectivity;
- proper validation of certificates (including certificates of origin (CoOs), quality, sustainability and non-toxicity);

- sharing information on AEOs and within e-commerce environments;
- ensuring access to logistics-related information in view of tracking and tracing goods along global supply chains.

The advantages observed by customs authorities participating in these pilot projects include expedited processing, better data quality, transaction transparency, enhanced targeting and easier access to importers. However, customs authorities sometimes lack the incentive to join blockchain projects when there are insufficient participants to provide the information required.

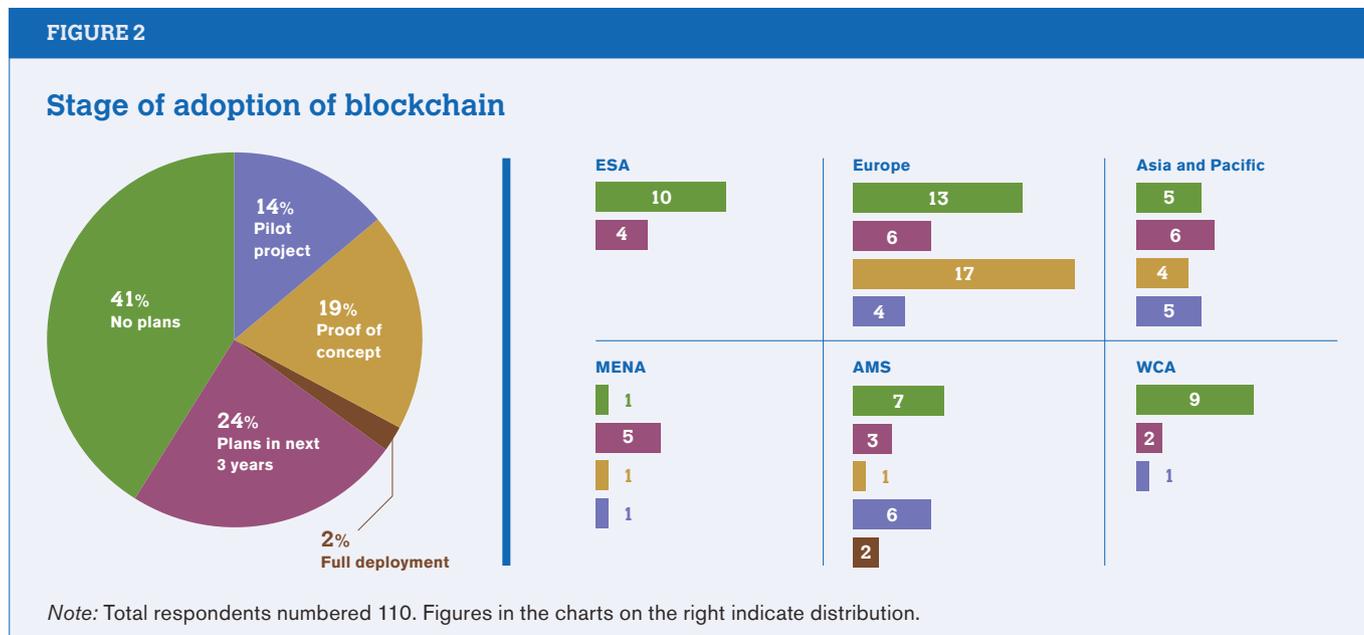
Through blockchain, customs authorities hope to achieve greater efficiency and reliability in risk management, revenue collection and trade facilitation.

Despite initial hesitancy, customs authorities are reasonably optimistic of blockchain's potential. Indeed, through blockchain they hope to achieve greater efficiency and reliability in the areas of risk management, revenue collection and trade facilitation. They are also beginning to understand the importance of partnering early with industry to ensure that the projects realize the benefits of blockchain in the trading environment while simultaneously addressing any barriers.

Stage of adoption

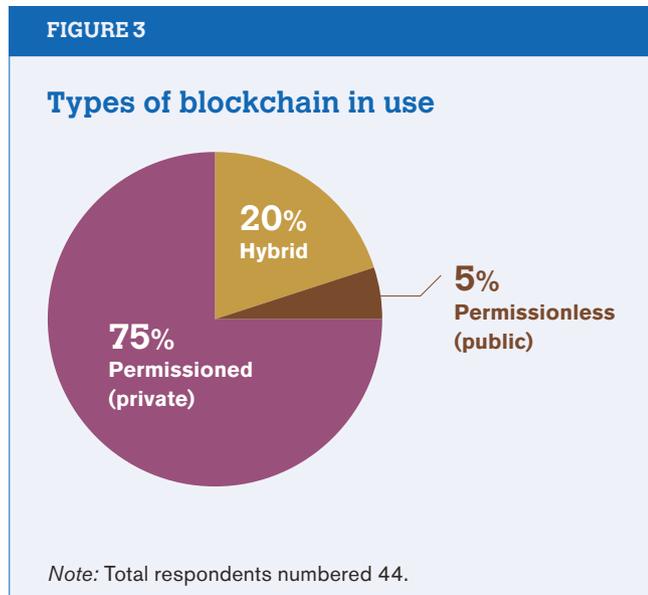
Blockchain technology has captured the attention of the majority of customs authorities (see Figure 2): 22 (19 per cent) are exploring its potential through PoCs; 15 (14 per cent) through pilot projects; and 26 (24 per cent) are planning to do so within the next three years.

However, only Argentina and Uruguay have fully deployed blockchain. The regional graphs below show that the greatest activity seems to be in the Europe, Asia and Pacific and AMS regions. Nevertheless, 26 customs authorities, from all regions, plan to introduce it in the next three years.



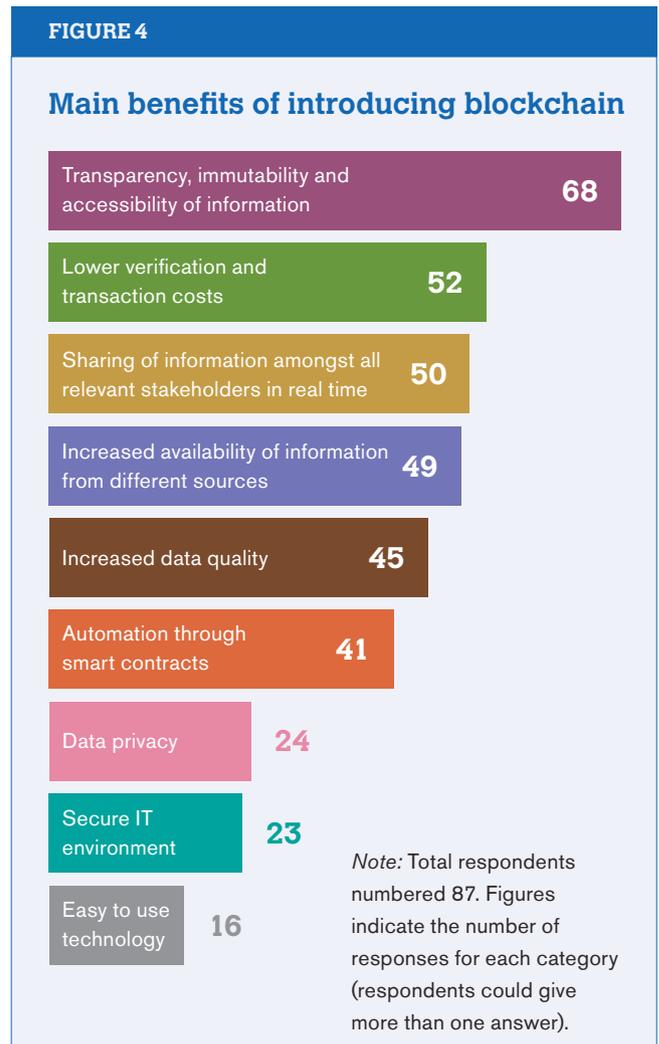
Three quarters of the 44 blockchains tested are private or permissioned (33), nine are hybrid and two are permissionless (see Figure 3):

- Private and permissioned blockchains allow only selected entry of verified participants.
- A hybrid blockchain is a combination of a public blockchain (accessible to all) and a private network that restricts participation to those invited by a centralized body and can control access to the modifications in the ledger.
- A permissionless blockchain, also referred to as a public blockchain, is a network open to everyone. Everyone can participate in the consensus process that the platform uses to validate transactions.



Benefits

In terms of the benefits that customs authorities are looking to achieve, responses are diverse but generally focus on information availability and costs and data quality. Respondents usually opted for at least two of the benefits listed in the ACS (see Figure 4).



Respondents also mentioned a general improvement in the efficiency of trade processes when using blockchain. Furthermore, access to transactional data from a trusted source is seen as a means to reduce processing time and to allow real-time approval from customs authorities.

Obstacles to adoption

The main obstacles to introducing blockchain and DLT technology respondents give include a lack of expertise, the cost, poor adoption by other stakeholders and the need for good practices (see Figure 5). Obstacles less often cited include: a lack of a standardized datasets; the absence of a government strategy; existing legacy systems; and a lack of trust in using data-sharing platforms.

Customs authorities hope that blockchain will allow for better transparency, immutability and accessibility of information and data quality, as well as the sharing of relevant information on border management procedures.

FIGURE 5

Main obstacles to adopting blockchain



Note: Total respondents numbered 95. Figures indicate the number of responses for each category (respondents could give more than one answer).

A lack of standards and the problem of energy consumption were also raised, as well as the fact that other reliable technology may be adopted by AEOs, which could subsequently marginalize the potential of blockchain and DLT.

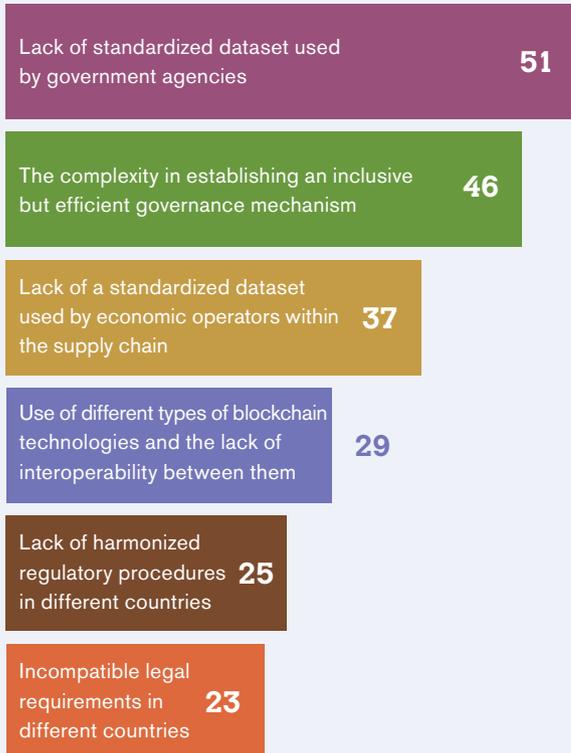
With regard to the challenges of deploying blockchain more broadly and efficiently, respondents mainly list problems of dataset standardization and the harmonization of both technical specifications and legal and regulatory frameworks (see Figure 6).

In particular, the absence of standardized datasets impedes not only blockchain deployment but also the introduction of any data-sharing solutions. The complexity of establishing an inclusive yet efficient governance mechanism is also high on the list of challenges cited by respondents.

Interoperability is a major concern for decision-makers seeking to develop blockchain solutions. Customs authorities might avoid using a blockchain platform that could limit their options of external collaboration in the future. Consequently, it will be necessary to build scalable solutions that can evolve not only within one single administration, but also, if required, within an extended ecosystem of many administrations. The proliferation of different blockchain solutions that are not interconnected is a major limitation to building scalable systems.

FIGURE 6

Challenges to improving blockchain efficiency



Note: Total respondents numbered 100. Figures indicate the number of responses for each category (respondents could give more than one answer).

Examples of use

Most of the projects aim to improve the exchange of information at the national level (among government agencies) as well as at the international level (see Figure 7). More specifically, respondents are looking to overcome the challenges of the e-commerce environment, including through improving e-certification, the single window and end-to-end supply chain interconnectivity. This will ultimately lead to better risk management and targeting as well as improved trade facilitation overall.

Most of the 44 projects and PoCs reported in the ACS are in Europe, Asia and Pacific and AMS (see below). In the ESA region, however, Mauritius is discussing with potential suppliers the implementation of a project to track CoOs using blockchain; and in the WCA region, members are waiting for the relevant capacity and knowledge to be developed before moving forward with blockchain.

The proliferation of different blockchain solutions that are not interconnected is a major limitation to building scalable systems.

FIGURE 7

Project areas



Note: Total respondents numbered 44. Figures indicate the number of responses for each category (respondents could give more than one answer).

Europe

In Europe, blockchain is used to collect value added tax (VAT), protect geographical indications and certify product origin. There are several ongoing pilot projects and PoCs being tested.

European Union

EU member States are exploring the use of blockchain to share VAT information between taxation and customs authorities. From 1 July 2021, companies opting for the Import One-Stop Shop VAT identification number are no longer required to register with the tax authorities of each importing EU member State to declare and pay the VAT due. Instead, VAT declaration and payment take place in one EU member State, and this information is then shared among the other EU member States.

Blockchain helps to ensure both the integrity of the information shared and the identity of the VAT contributors. In addition, blockchain can automate VAT payments via smart contracts, including the payment of VAT to tax authorities and transfers from tax authorities to companies, thus accelerating VAT collection and reducing payment delays.

SEED-on-Blockchain is a European Commission research project by DG TAXUD – the department responsible for EU policies on taxation and customs – to assess the technical and organizational feasibility and benefits in blockchain for customs and taxation applications. The first PoC demonstrated that even with limited knowledge of blockchain, it is feasible for DG TAXUD and EU member States to deploy and operate blockchain applications to share data. The European Commission is to expand the initial scope of the project in a second PoC to include backup and restore, and integration with the Identity Management Systems. The second PoC aims to integrate and address these issues.

The application employed by DG TAXUD replicates authorizations and reference data across EU member States, using a centrally managed message queueing system and a custom central replication application. The operating model employed was formed around these technologies, with the following inherent limitations:

- the need for implementing, operating and maintaining a central application for replicated business data;
- no reuse in sending, receiving, storing and processing the data;
- the need for conformance testing to verifying interoperability;
- the need for a centrally managed messaging system.

DG TAXUD assessed the suitability of blockchain to eliminate these limitations and established that there are technical and operational benefits in the short term, as the replication of authorization and reference data can be implemented without the use of a centrally managed messaging system or custom central applications.

The operational processes necessary for the installation, operation and maintenance of a blockchain network bring no significant complexity compared to any regular IT system. In the long term, blockchain offers the possibility of decentralizing the operating model and the governance of the European Union and can be provisioned to require no central authority for its configuration, maintenance and operation.

The EU-funded blockchain project TRICK (Traceability Information Management by Blockchains Interoperability)

provides an affordable and standardized platform for small and medium-size enterprises to collect product data on the approaches taken to promote sustainability across the whole value chain. In two pilot projects in the textile and perishable food industries, blockchain is being used to document the whole process, from raw materials to recycling, which forms part of a national strategy to support.

Italy

The “Made in Italy” initiative uses blockchain to certify high-quality manufacturing products and place products on the market that have already been certified at various levels, from sustainability certification, with materials from sustainable means, to chemical certification of non-toxicity and to CoOs of the goods.

In February 2019, the Italian Parliament passed a law that provides a legal definition of DLTs and smart contracts and recognizes their full legal validity and enforceability. Italy is one of the first countries to introduce legislation rendering smart contracts legally equivalent to traditional contracts for certain purposes (e.g. consensus formation, evidentiary value).

Nevertheless, the law establishes that smart contracts meet the requirement for the written form by having the interested parties identified digitally according to Agenzia per l'Italia Digitale (AGID) guidelines. The lack of international norms and technological standards of reference weighed on the AGID so much when developing the guidelines that it advises particular caution in relation to indications or options that could compromise the necessary technological neutrality of the rules to be adopted.

Georgia

A new blockchain initiative in Georgia issues preferential CoOs by the Georgia Revenue Service which display a QR code providing a link to the transaction on the Ethereum Blockchain. Customs authorities in partner countries can either scan the QR code or search manually to access all the data in the CoO as well as confirm that it was issued by the Georgia Revenue Service.

Asia and Pacific

In the Asia and Pacific region, blockchain is used to exchange customs declarations and documents as well as logistics-related information to track and trace goods and transport units throughout global supply chains.

Australia and Singapore

A blockchain PoC was conducted under the Australia–Singapore Digital Economy Agreement to achieve document interoperability for paperless cross-border trade. In collaboration with the Infocomm Media Development Authority, Singapore Customs, the Australian Border Force and private-sector participants, CoOs were issued in accordance with the TradeTrust framework.

These CoOs were then authenticated and their provenance assured to all in an entirely transparent manner through TradeTrust's reference implementation as well as on the Australian Border Force's digital verification platform, the Intergovernmental Ledger (IGL). The trial successfully tested the interoperability of the two systems and showed that TradeTrust removes the need for traditional approaches of using direct digital connectivity

to enable data exchange among supply chain participants, which are slow and expensive to build.

Similar to Australia, digital trade initiatives in many countries will form part of a broader suite of legislative and regulatory changes to facilitate a transition to paperless processes. A key lesson is the importance of partnering early and meaningfully with industry to ensure PoCs capture genuine benefits and barriers in the trading environment.

The Australian Border Force is now seeking government approval to implement the Intergovernmental Ledger to production quality and to conduct further PoC trials and pilot projects, with the goal of making it a permanent feature of Australia's trade practices.

China and Singapore

China and Singapore customs authorities are developing an international trade single window blockchain to exchange information on clearance, and logistics and cargo status to improve the port business environment and trade facilitation.

Hong Kong, China

The customs authorities are conducting a PoC study in applying blockchain to a licence management system.

Indonesia

The customs authority aims to use blockchain and the TradeLens platform to simplify the exchange of goods, automate documentation and increase cooperation and

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communication. The platform connects supply chain partners (e.g. cargo owners, carriers, freight forwarders, logistics providers, ports and terminals, customs authorities) to a secure audit trail of millions of shipment events and documents with authorized parties.

Malaysia

A pilot project for AEOs is in a preliminary study phase. This project is being carried out in collaboration with the national R&D centre MIMOS, under the Ministry of Science, Technology and Innovation, to develop an alternative option to industries in addition to the current AEO service provided by the Royal Malaysian Customs Department. The new blockchain service will ensure a high level of system compliance while increasing efficiency in the supply chains of companies under the AEO programme, making them more competitive.

North of Africa, Near and Middle East

In the MENA region, blockchain is used to exchange customs declarations and documents, such as CoOs.

Morocco

The customs authority has launched a cooperation project with DHL and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to develop a blockchain platform to collect and share international transaction data on traders, express mail service, customs authorities and other stakeholders.

The aim is to simplify procedures and to enhance risk management, in particular with regard to customs valuation. The project is spread over two and a half years and is now at the design stage, preceding development and deployment.

Kingdom of Saudi Arabia

The customs authority is exploring with other customs authorities adoption of a common blockchain platform that would accelerate customs clearance by exchanging customs declarations and documents in real-time.

United Arab Emirates

The Federal Customs Authority and Dubai Customs have developed a cross-border e-commerce blockchain-based platform to facilitate and track commerce within the network of customs authorities, e-commerce companies, ports, couriers, third-party logistics, free-zone authorities

and permit-issuing authorities. The platform was built in line with the WCO Framework of Standards for Cross-border e-Commerce. It helps to develop mutual trust, collaboration, automation and a fair e-commerce market, with benefits to all the stakeholders involved, including:

- end-to-end real-time visibility of orders;
- goods return issues solved by linking e-commerce orders and return orders with the customs declaration;
- increased efficiency by eliminating declaration preparation time;
- paperless transactions;
- controlling safety and security risks and increasing compliance;
- prevention of revenue leakages and improved valuation and classification of goods;
- reduced delivery time due to automated declarations, automated returns, refunds and automated low value goods declaration consolidation.

South America, North America, Central America and the Caribbean

In the AMS region, blockchain is used for a registration system of AEOs to facilitate the exchange of information on AEOs and container movements. One long-standing blockchain project is CADENA, which is being implemented by customs authorities in the Plurinational State of Bolivia, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico and Peru, with the support of the Inter-American Development Bank. CADENA has accelerated the processing of goods in destination countries, and the established information flow supports

not only customs authorities but also other stakeholders and systems that use the information.

As of August 2021, CADENA became fully operational, and customs authorities validated it with real data over a two-month period. The general benefits have been improvements to the operational implementation of bilateral or multilateral mutual recognition agreements (MRAs) and to the management of AEO programmes.

It has also contributed to strengthening the security of supply chains by ensuring that AEO information on certifications, suspensions and cancellations executed by a customs authority is shared in real time with customs authorities of MRA partners, which allows them to take appropriate action.

CADENA also provides the following benefits:

- point-to-point automation to exchange data through the digitization of AEO certificate status;
- a secure, reliable and traceable mechanism to exchange data on AEO certificates and to maintain an historical record of all shared information relating to each certificate;
- data integrity and access control through authentication of customs officers assigned to specific roles and authorizations;
- transparency of exchanged data;
- potential reduction of time and costs for AEOs by guaranteeing that the application of the benefits both at origins and destinations will be automatic from the moment they receive the AEO certification from customs authorities of MRA partners.

Mercosur's bConnect Project is fully deploying Blockchain Private Hyperledger Fabric 1.4 for Mercosur members' customs authorities and AEOs to exchange information while ensuring the integrity of any information shared and verifying the identities of those inputting information onto the platform. The platform makes sharing information by customs authorities faster, more efficient and safer, and includes Argentina, the Plurinational State of Bolivia, Brazil, Paraguay and Uruguay. The model is currently being reviewed and private data collection is being evaluated. Certain data could be shared by subsets of platform members, which could increase its use and the number of cases implemented through blockchain.

Canada

The Canada Border Services Agency (CBSA) is participating in pilot projects to evaluate the capacity of blockchain to provide a faster, more reliable and more transparent supply chain. These projects will run parallel to current CBSA processes, which means participants must follow established processes while also publishing events relating to each blockchain-based product.

The pilot projects are to evaluate the capacity of the blockchain solutions and determine whether the platforms could play a role in the CBSA's business processes. However, full integration is beyond the scope of the pilot projects.

The CBSA also participated in the pilot project TradeLens. Phase 1 took place in April and May 2019 with the monitoring of maritime container movements

from a foreign seaport arriving through a major Canadian seaport. Phase 2 of the pilot ran in June and July 2020, which included maritime shipments of any origin to increase the sample size and the complexity of types of movement (i.e. in bond, multi-port, transshipment, multi-modal).

The desired outcome for the CBSA was to determine whether there were any achievable, valuable benefits that blockchain could offer, in particular improved data quality and security, transaction transparency and increased availability of information. While there was an increase in the visibility and traceability of a container, additional data were limited or not available. According to the CBSA's assessment, the platform currently lacks the necessary number of participants (specifically cargo owners and vendors, customs brokers and maritime freight carriers).

Furthermore, since the information provided by stakeholders was voluntary (i.e. no legal or regulatory obligations), the amount of content and the quality of data were inconsistent and relied entirely upon the submitter's technical ability to provide such information and to do so at their own discretion. While the CBSA has an interest in the movement of containers and their origin provided by TradeLens, it is not truly the information that is required for it to conduct its core mission.

Border management requires more information than is currently available in TradeLens, such as importer declarations and manifest information that goes beyond what is required to enable the movement of goods.

The CBSA continues to participate in the monitoring of container movements through a large Canadian seaport and a container examination facility.

Guatemala

Guatemala is working on the development of a new maritime and air dispatch model based on blockchain, taking as a reference the Port Community Systems. The project aims to automate exports and to develop online services to exchange information with other customs terminals. The expected benefits include the following:

- simplification, automation and transparency in the entry and exit of goods;
- interoperability between all stakeholders of the national customs system (i.e. customs authorities and other border agencies, carriers, terminal operators, consolidators, importers and exporters);
- traceability, secure data exchange and real-time information on the logistics and customs clearance processes.

Currently, partners are being approached for support in developing a feasibility study and the definition of the Port Community Systems tailored to their national requirements. Once completed, it will be shared with all relevant stakeholders for their validation, after which the software would be developed then adopted.

Peru

Peru reported on the use of LACChain to exchange information with Pacific Alliance Countries. LACChain

is a global public–private alliance supported by the IDB Lab (the innovation laboratory of the Inter-American Development Bank Group) to promote integration and economic and social development among Chile, Colombia, Mexico and Peru by providing the infrastructure to develop interoperable blockchain applications in Latin American and the Caribbean. The founding members of LACChain identified a fragmentation and dispersion of the communities and blockchain networks, which limited the efforts being made to adopt this technology.

In addition to a highly fragmented environment with non-interoperable networks, there was also an absence of international standards and protocols, and a lack of collaboration between public, private and academic entities. Today, LACChain provides three infrastructures that can be used by projects and applications: a blockchain; a self-sovereign identity system; and tokenized money allowing the digital representation of legal tender. One application using the LACChain ecosystem is CADENA, as mentioned above.

United States of America

The United States Customs and Border Protection (CBP) conducted a PoC in September 2018 on the application of blockchain technology in the submission process for entry summary declarations under the Central America Free Trade Agreement (CAFTA) and trade with Canada and Mexico.

The assessment of the application and the policy and legal issues raised by the PoC found that the use of

blockchain achieved improved communication between the CBP and traders, improved documentation of receipt and expedited processing, with the elimination of manual documentation requirements and duplicative data entry.

There was also easier access to back-up documentation, and since full data were received with the initial submission of the entry summary, potential issues were captured early on. Furthermore, in September 2019, the CBP conducted the intellectual property rights PoC, which tested a blockchain technology in facilitating shipments based on known licensing relationships (licenser and sub-licensee relationships).¹

Endnotes

¹ See also <http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/ressources/permanent-technical-committee/223-224/pc0542e1a.pdf?la=en> and http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/ressources/permanent-technical-committee/223-224/pc_0542_annex_e.pdf?la=en.

² <https://www.cbp.gov/trade/ace/whats-new-innovation>.