

Is blockchain technology a silver bullet for a customs environment?

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Abstract

This paper focuses on how blockchain technology's implementation may have possible drawbacks in a customs environment. To argue this, blockchain technology and its features are summarised, then three indicators of customs duties (tariff classification, origin and value) and several case studies are used to illustrate these drawbacks.

Keywords: blockchain, customs, tariff classification, origin, value

1. Introduction

It is beyond dispute that blockchain technology will bring new opportunities to the table. Companies and governments have already started to cultivate the benefits of this technology. On the other hand, can it be claimed that blockchain technology is a flawless tool?

There are several studies indicating that blockchain technology has both implicit challenges and challenges due to its implementation.

Lielacher (2018) lists five challenges that need to be overcome before the mainstream adoption of blockchain technology: initial costs, integration with legacy systems, energy consumption, public perception, privacy and security. Marr (2018) also noted that blockchain has an environmental cost, its lack of regulation creates a risky environment and its complexity means end users find it hard to appreciate the benefits. Blockchains can be slow and cumbersome, and the 'Establishment' has a vested interest in blockchain failing (Marr, 2018).

The challenges above are implicit in blockchain technology, thus they will be discussed using case studies in a customs context. Firstly, blockchain and its features are summarised, then the indicators of customs duties are elaborated. Finally, the potential drawbacks of blockchain's implementation in a customs environment are argued via these indicators and several case studies.

2. Understanding blockchain technology

Yaren (2020) notes that 'Blockchain is a transaction platform, working in a peer-to-peer network – which eliminates the need for a trusted third party – that allows users to create and share data which has a timestamp and unique cryptographic signature. As a result of the creation and validation processes, the data created in blockchain is nearly unhackable' (p. 129). Yaren (2020) adds that 'it [blockchain] provides a transaction platform with shared, distributed, sequential and timestamped data that can be updated only by consensus between the nodes of the system. This reveals immutable, irreversible, unalterable data that provides higher transparency, traceability and, because of these, higher auditability. Also, it reduces costs and risks while increasing speed, dependability, sustainability and flexibility' (p. 131).

According to Yaren (2020), ‘The benefits of using blockchain technology in customs transactions can be summarised as follows: blockchain can be considered as an information pipeline with a single source of truth that is verifiable and immutable, and provides an opportunity for paperless trade, better risk assessment, lower administrative cost, real-time tracking and transparency for customs clearance. As a result of these attributes, blockchain can help mitigate fraud, improve compliance with regulations and documentation, and enable customs officials to distinguish legitimate and illegitimate trade and fraudulent practices’ (p. 133).

3. Indicators of customs duties

To illustrate the possible drawbacks of implementing blockchain technology in a customs environment, it is beneficial to understand how customs duties are calculated.

There are three main elements of customs duties:

1. tariff classification of goods
2. origin of goods
3. value of goods.

3.1. Tariff classification of goods

According to the European Union Customs Code (2013), Article 56 – Common Customs Tariff and surveillance, ‘1. Import and export duty due shall be based on the Common Customs Tariff.’ Article 57, the Tariff classification of goods, states ‘1. For the application of the Common Customs Tariff, tariff classification of goods shall consist in the determination of one of the subheadings or further subdivisions of the Combined Nomenclature under which those goods are to be classified.’

The European Commission (2018a; ‘Classification of goods’ section) elaborates the tariff classification of goods by explaining how it is also used for applying non-tariff measures:

The term ‘tariff classification of goods’ is defined in Article 57 of the Union Customs Code (UCC).

It means determining the subheadings or further subdivisions of the Combined Nomenclature (CN) under which the goods will be classified.

Classification is not just used to determine the customs duty rate for a specific subheading. It is also used to apply *non-tariff* measures.

So, even if all goods were zero-rated for customs purposes, classifications could still be necessary if you need to:

- apply for an import or export licence
- find out if import or export restrictions apply
- issue a certificate of origin
- claim an export refund or similar
- determine whether or not a product is liable to excise duty
- find out if a reduced value-added tax rate applies (insofar as the CN is used as a basis of reference).

3.2. Origin of goods

The European Commission (2018b; ‘What this section is about: the concept of origin’ section) explains origin as follows:

Origin is the “economic” nationality of goods in international trade. There are two kinds, non-preferential and preferential.

Non-preferential origin confers an “economic” nationality on goods. It is used for determining the origin of products subject to all kinds of commercial policy measures (such as anti-dumping measures, quantitative restrictions) or tariff quotas. It is also used for statistical purposes. Other provisions, such as those related to public tenders or origin marking, are also linked with the non-preferential origin of the products.

Preferential origin confers certain benefits on goods traded between particular countries, namely entry at a reduced or zero rate of duty.

In terms of regulation, the European Union Customs Code (2013; in Article 60, the Acquisition of origin section) details origin as:

1. Goods wholly obtained in a single country or territory shall be regarded as having their origin in that country or territory.
2. Goods the production of which involves more than one country or territory shall be deemed to originate in the country or territory where they underwent their last, substantial, economically-justified processing or working, in an undertaking equipped for that purpose, resulting in the manufacture of a new product or representing an important stage of manufacture.

3.3. Value of goods

According to the European Union Customs Code (2013; in Article 70, the Method of customs valuation based on the transaction value section):

1. The primary basis for the customs value of goods shall be the transaction value, that is the price actually paid or payable for the goods when sold for export to the customs territory of the Union, adjusted, where necessary.
2. The price actually paid or payable shall be the total payment made or to be made by the buyer to the seller or by the buyer to a third party for the benefit of the seller for the imported goods and include all payments made or to be made as a condition of sale of the imported goods.

The European Commission (2018c) explains the value of goods in the customs context as ‘Customs valuation is the determination of the economic value of goods declared for importation’ (in the ‘Introduction to Customs Valuation’ section).

Having a standard set of rules for establishing the value of goods is of great importance for several reasons. Customs duties and value-added tax (VAT) are calculated as a percentage of the goods’ value. Economic operators and customs authorities need to have clear rules on how to make this assessment, as a commonly agreed and accurate measuring standard is vital for the purposes of:

- economic and commercial policy analysis
- application of commercial policy measures
- proper collection of import duties and taxes
- import and export statistics.

The value of imported goods is also one of the three ‘elements of taxation’ that provides the basis for assessment of the customs debt, which is the technical term for the duty that has to be paid, the other ones being the origin of the goods and the customs tariff classification. Once these elements are determined, customs duties can be calculated.

4. Analysis of blockchain technology in a customs environment via case studies

4.1. Wood supply chain case study

Figorilli et al. (2018) combined blockchain, RFID (Radio-frequency identification) and different kinds of IoT (Internet of things) to create a solution for the traceability of wood along the whole supply chain. In this study, ‘the entire forest wood supply chain was simulated in the Calabria Region in Southern Italy, from standing trees to the final product passing through tree cutting (felling, harvesting, processing) and sawmill process’ (Figorelli et al., 2018, p. 3).

According to Figorilli et al. (2018, p. 4) the journey starts with the timber marking phase and ends with the final consumer:

- Timber marking: application of the first RFID (RFID1) of the Class 1 Gen 2 (coin shaped with central hole) above the cut at the moment of the tree identification. This first tag associates the information on the database of the standing tree: tree marking date, tree GPS point, species, diameter at breast height, qualitative class, other information;
- Cutting: additional RFID (RFIDn) tags (one for each derived log; the same used for the timber marking), were applied on the cutting portion for each log (excluding branches and pieces of lesser quality). Each RFID is uniquely associated with the tree, thus preserves the association with the RFID information applied in the first phase, and adds the following data related to each single log: cutting date, log length, log average diameter, wood quality categories, other information.

Figorilli et al. (2018) notes the other phases as stacking, transport, sawmill processing, production and selling, and final consumer (p. 4).

This system is perfect for traceability of wood along the supply chain, because blockchain technology allows users to be confident about the details of data entry, for example, the time it occurred and who entered the data into the system. Also, the system provides security and trust because the data cannot be changed or altered by any of the participants in the system. So, blockchain technology is perfect for securing data after it has been entered into the system.

This means that, whether the data entered is correct or not, the system will transmit the data entered. The system relies heavily on the accuracy of the very first actor who enters the data. In the above example, the first action is entering the tree marking date, the tree GPS point, species, diameter at breast height, qualitative class and other information into the system. Potential drawbacks of this issue in the customs environment can be explained by the three indicators of customs duties.

4.1.1. Tariff classification of goods

As previously mentioned, classification is important because it used to determine the customs duty rate and to apply non-tariff measures. To more easily illustrate the potential drawbacks of using blockchain technology in the context of tariff classification it is beneficial to imagine two fictional countries

and two types of trees with different tariff classifications; country X as the exporter, country M as the importer and tree 'Pure', with high quality and high value, and tree 'Cuz' with low quality and low value.

As stated above, entering accurate data initially is crucial – if incorrect information is entered into the system, it will be there until the end of the process. In terms of tariff classification, entering false information may result in fraud in a customs environment, as follows:

- a. In exporter country X, if there is an export incentive (like a tax deduction, financial aid, or export refund) for exporting Pure, the export company may cut Cuz and enter information about it in the blockchain system as if it was Pure. Until an audit reveals the truth, blockchain will keep the information as if Cuz was Pure.
- b. To protect nature and natural resources, countries limit the trade of some goods by imposing licence obligations. Companies that desire to trade these type of goods must fulfil several requirements, which is generally costly. If there is a licence obligation for both export and/or import of Pure, the initial information entered into the blockchain system can again be falsified as if the good was Cuz. In this way both exporter and importer avoid the procedures to obtain these licences.
- c. Woinarski, Burbidge and Harrison (2015) noted that endemic Australian land mammal fauna have suffered an extraordinary rate of extinction (>10% of the 273 endemic terrestrial species) over the last ~200 years because of the animals that arrived with European settlement (p. 4531). These types of experiences force governments to protect the local fauna and flora by using import and export restrictions.

Another reason for restrictions can be the rarity of a good – countries may want to limit its international trade to retain it. Let's assume Pure is a type of tree that the country in which it is indigenous does not want to be subject to international trade. The same process can be repeated in this example – the initial data entered into blockchain could identify Pure as Cuz, and the authorities trusting the blockchain data can be misled.

- d. Another example is where Pure is subject to excise duty because of its features. This time the misrepresentation may work by presenting Pure in the blockchain system as if it was Cuz. Thus, if import country authorities accept blockchain data as the only truth and do not, for example, scan or audit due to a false sense of security, problems may arise.

4.1.2. Origin of goods

In the above cases, GPS technology means that the origin of the goods is the least vulnerable to misrepresentation of the three indicators. When compared to tariff classification and value of goods, it is hard to hide or disguise the real origin of the goods.

4.1.3. Value of goods

As a result of its features, Pure should be more expensive than Cuz, so under normal conditions that means Pure would have a higher customs value to be declared. When the same manipulation process mentioned above is repeated, the first actor that enters the information into the blockchain system can manipulate the value of goods, which will result in lower customs duties and VAT.

4.2. Coffee bean supply chain case study

Verhoeven, Sinn and Herden (2018) use five blockchain cases, 300Cubits, BanQu, Bext360, Kouvola Innovation and Walmart (in cooperation with IBM), to analysis blockchain and supply chain relationships.

Instead of focusing on all these cases, it is beneficial to focus on the ones that may show the possible drawbacks of using blockchain technology in supply chains within the context of customs.

While discussing the Bext360 case, Verhoeven, Sinn and Herden (2018) mention:

The supply chain relevant problems Bext360 tries to address within the supply chain for coffee beans can be put under the title fairness. On the one hand, farmers of coffee beans are treated badly on a regular basis. They receive either low wages, delayed payments or even no payments at all for their beans. In addition, intermediaries and resellers often take more than their fair share of the product. On the other hand, consumers must rely on the little information they get when buying coffee. The chain of information regarding authenticity of the proclaimed coffee quality or if farmers were paid and treated fairly is incomplete and vulnerable to falsification.

The supply chain relevant solution Bext360 is proposing is supposed to solve the unfair treatment by developing a complete chain of information. They propose that a robot automates the quality evaluation of coffee beans and assigns a fair price. Bext360 plans to use a blockchain implementation to bind the data from this transaction to a token per bag of coffee and, therefore, offers traceability from source to consumer down to the bag of coffee beans. With access to the information on the token they would be able to track the actual transaction of beans and payment, proving a price, which is supposed to be fair to ensure an actual living wage for the farmers, as well as the origin of the beans. (pp. 11–12)

As explained in Section 4.1, the following sections discuss how the three elements of customs duties represent potential drawbacks of blockchain technology in a customs environment.

4.2.1. Tariff classification of goods

As in the wood supply chain case study, the same problem arises here; blockchain can secure the data in the system but is vulnerable to falsification if the first data entered into the system is manipulated. This means when the first data that conflicts with the true situation is entered in the system, blockchain will secure the ‘already manipulated’ information throughout the chain.

Let’s imagine a situation in which two fictional coffee beans have the quality of A and B, where A is of a high grade and B is of low grade quality. In addition to the examples given in Section 4.1.1, the following may also occur in a customs environment:

- a. A-type high-quality coffee beans can be imported as if they were B-type low-quality beans to avoid, for example, high customs duties, VAT and excise duty collected due to the value of imported goods.
- b. one type of coffee can be entered in the system as if it was the other type to avoid tariffs and quotas.

4.2.2. Origin of goods

As mentioned in Section 3.2, there are two types of origin: non-preferential and preferential. The European Commission (2018b) notes that preferential origin confers certain benefits on goods traded between particular countries, namely entry at a reduced or zero rate of duty.

Let’s imagine three fictional countries, with the importer country A and the exporter countries B and C. Between countries A and B there is a preferential origin relationship, while between countries A and C this relationship is non-preferential. This means that if country A imports coffee from country B, the importer company will benefit from a reduced or zero rate of duty. On the other hand, if country A imports coffee from country C, the importer will not benefit from these advantages.

In this case, again, the initial data entered into the blockchain is crucial, as, if manipulated, the chain may start as if the coffee beans were produced in country B, rather than originating from country C.

4.2.3. Value of goods

In the above example, in terms of value of goods, B-type low-quality coffee beans may be exported as if they were A-type coffee beans with a high customs value, to take advantage of export incentives like tax refunds. On the other hand, in the import process, A-type coffee beans may be imported as if they were B-type, low customs value, beans.

In the coffee bean example described by Verhoeven, Sinn and Herden (2018), blockchain is a great tool to secure data, but problems may start during data entry. To solve this, the use of robots is discussed in the quality evaluation of coffee beans and in assigning them a fair price.

However, even using robots, it cannot be known if someone changes the bags or changes the contents of the bags after the robot has specified the quality of the coffee beans. In addition, even if it is documented that farmers were paid fairly, this may not represent the actual situation, as farmers can be forced to admit that they got paid. It is also possible that some part of their payment could be taken back from them by hand, which means that it cannot be detected in the system.

While crediting this system, Verhoeven, Sinn and Herden (2018) also underline the possible drawbacks as follows:

By making sure the data input is automated and, therefore, genuine, the quality of the saved data can be assured. It is, however, unclear how data manipulation at later steps of the supply chain is handled. Although manipulation or simple lack of data at this stage only influences the tracking quality and not the proof of the farmer's pay, the consumer might not have full insight into the supply chain.

...The idea only offers true benefits if the "real life" application works as planned. In detail, farmers must actually receive the pay that is documented in the blockchain and the tokenized bags of coffee beans have to contain beans of the stated quality. It is not explained how Bext360 is going to make sure of those issues. (p. 12)

4.3. Food supply chain case study

Staples et al. (2017) outlines the AgriDigital Company's product, which focuses on the early stages of grain supply chains:

...the supply chain starting with the grain being loaded onto a truck. When the truck arrives at the buyer's site, it passes a first weighbridge and a sampling station. The information from the weighbridge is the gross weight, that is the weight of the grain as well as the truck and trailers. The sampling station picks a sample of grain, which is processed in an adjacent lab to assess the quality of the grain. The quality of the grain determines the price per ton; together with the gross weight, an upper bound of the price can be calculated. The data (gross weight, quality, price) is sent to the AgriDigital frontend, which creates a blockchain transaction containing this information...

...Then the truck physically unloads the grain into the buyer's silo. Subsequently, upon leaving the buyer's site, the truck passes a second weighbridge. Here the weight of the empty truck, the *tare weight*, is measured. The second weighbridge forwards that information to the AgriDigital frontend, which in turn creates another blockchain transaction with that data. Invoked by the second transaction, the smart contract calculates the *net weight*, that is, gross weight minus tare weight. The price for the grain is then recalculated as net weight times price per ton for the grain's quality, and a title for the grain with its net weight and quality is created. The final price is transferred to the grower, and the grain ownership title is transferred to the buyer...

... The main goal of the trial was to show that the truck's appearance on the weighbridges triggered all system interactions, which was achieved. Steps that are yet to be automated are: (i) establishing that the weighbridges fulfil the conditions (having been inspected by authorities within the past 12 months and not recalibrated), and (ii) automated generation of the quality assessment message, which is currently entered manually by a technician in the sampling station's lab...

... As mentioned above, the data entry from the sampling station was done manually into the AgriDigital frontend. Ethereum is currently limited in its handling of decimal values, and thus some rounding error occurred as expected. (p. 19)

It is obvious that in this case using blockchain technology will revolutionise transactions in the early phases of the food supply chain, for example, it will lower the cost and provide shared data.

The initial data entry stage, again, is the most vulnerable of the system, as discussed in previous case studies.

In a fictional country that uses a similar system, the fraud may occur in the sampling phase. Firstly, as data entry from the sampling station is manual, data that do not represent the actual features of the grain can be entered into the system in error or on purpose. Secondly, even if it is automated as in the previous coffee bean supply chain example, the sampling phase automated system can be falsified by several techniques. All these may lead to situations in which the data of the goods in the system and the goods themselves do not match until revealed by screening or auditing, for example.

When this vulnerability is considered in a customs environment, potential drawbacks related to the tariff classification, origin and value may also appear in this example.

5. Conclusion

It is obvious that blockchain will – and has already started to – revolutionise every industry that relies heavily on data and data transfer. Supply chain management practices and the customs environment are just two examples.

As explained previously, blockchain offers shared, distributed, timestamped and immutable data, which will boost trust between user parties by virtue of increased transparency and traceability. It will be easier to switch to paperless trade, lower the costs on international trade and decrease the time consumed in customs transactions.

On the other hand, with all these new opportunities brought to the table, blockchain may have some drawbacks especially in a customs environment. As discussed above in the three case studies, in conjunction with the three indicators of customs duties, there are several vulnerabilities in blockchain technology that need to be considered.

In all three cases, blockchain technology is presented as a useful tool to secure data and share it with all users. On the other hand, the veracity of the data may be questionable. The vulnerability of blockchain starts when the initial data is entered into the system. If the data completely reflect the actual truth about the traded good, then it will be perfect for all agents in the international trade transaction. However, as outlined in the case studies, if the very first data entered into system do not reflect the actual truth about the traded good (either through error or on purpose), blockchain technology may serve only to transmit and keep secure false data about that good.

After discussing the use of blockchain (or distributed ledger) technology (DLT) in several cases, Ferrarini, Maupin and Hinojales (2017) noted that 'In principle, anything that can be reliably measured can be tracked via a DLT and reflected in a product's ultimate price' (p.19). The main emphasis in this sentence should be on the words 'reliably measured' because the vulnerability of blockchain

starts exactly at this point. If the parties in the blockchain cannot be sure about the reliability of the data, blockchain will be used simply as a transaction platform that keeps the data secure, even when falsified.

Weernink et al. (2017) mention that blockchain can add value to port logistics and digitalisation of ports regarding trust, security, visibility, network expansion and integration of supply chain flows. On the other hand, the authors raise the same question of blockchain vulnerability that is discussed above, 'In a nutshell, implementing blockchain technology raises questions concerning the reliability of data provided by the suppliers and customers: is the data provided by the supply chain partners reliable?' (p. 13). In this situation, blockchain will be just a ledger in which every agent in the system can easily see the details of the data, but if the data are not correct, it will only help in obtaining false data.

While explaining the potential drawbacks of using blockchain technology in excipient supply chain management, Shireesh and Nikolai (2016) underline blockchain technology's vulnerability, as discussed above, as the following:

While the veracity of transactional records (as distinct from actual transpired events), the chain of custody is unalterable, this fact, in and of itself, is no indication that an excipient has remained unaltered in transit or at the point of source. Indeed, just as in current supply chain verification methods, where rogue collusion exists within the supply chain there can be no guarantee that what is transacted in the blockchain (such as the attributes of a certificate of analysis) is actually congruent with the chemical make up of the excipient or material. Similarly, a chain of custody transaction records is no guarantee of the actual physical whereabouts of the material en route from supplier to end user. Just because a transacted record is computerised and 'blockchained' does not necessarily imply that its physical world counterpart material of commerce has not been tampered with; all it implies is that the transaction record cannot, and has not, been tampered with. (p. 77)

Thus, starting with false or falsified data is the main vulnerability of blockchain technology.

Pugliatti and Gain (2018) mention that blockchain presents some major challenges that go beyond technology, like fraud, 'Organized networks often operate through a complex system of false companies that create false descriptions of goods or false invoices. They could simply start a blockchain of false data' (para. 9).

To avoid these types of circumstances, Shireesh and Nikolai (2016) offer an audit mechanism, 'Of course, block chain veracity is reliant on appropriate audit processes to verify each transactional record to ensure it is accurate at the time it is entered into the blockchain' (p. 77). In the case of the examples above, the idea offered by these authors should be considered.

As discussed, it is safe to say that blockchain technology's main vulnerability lies in the hands of its users, and mainly the ones that enter the data into the system. The Organisation for Economic Co-operation and Development (OECD, 2018) explain this issue with the term 'Garbage in garbage out', adding that 'the information entered on the blockchain is only as good as its source' (Table 2).

In conclusion, blockchain technology has a wide usage in several industries, especially industries working with data. Companies related to supply chain practices and customs authorities seek ways to cultivate the benefits of this technology. Successful implementation by both the public and private sector encourages others to try this phenomenon. However, as discussed in the above case studies, blockchain technology is vulnerable at the data entry step. If the data entered into the system reflect the actual details about the good, it will be beneficial for all agents in the chain, but if the very first data entered are false or falsified, blockchain technology will serve just as a tool to share and keep secure the false/falsified data. To take blockchain technology one step further, from being a data transmitter to the single version of the truth, data entry should be designed properly and in essential cases it should be supported with audit processes.

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