

University of Dundee

## Switching from paper to electronic bills of lading

Hwaidi, Mohd; Ferris, Graham

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## **Switching From Paper To Electronic Bills Of Lading: Fundamental Sociological Structure, Distributed Ledger Technology And Legal Difficulties (Second Part)**

**Abstract-** *The previous part of this article proposed a conceptual framework for a sociological understanding of the uses of bills of lading. We argued that platforms that aim to facilitate an electronic format of bills of lading should be based upon the constituent components of the practices associated with paper bills of lading. In this second part of the article we suggest that Distributed Ledger Technology (DLT), including blockchains, is the best technological means for facilitating the use in practice of immaterial bills of lading. The appropriate type of DLT is then evaluated in light of expected legal difficulties.*

**Keywords—** *Electronic bills of lading; norms and law, social structure, legal issues on Distributed Ledger Technology*

### INTRODUCTION

Switching from paper to electronic bills of lading has the real potential to solve current problems of delay in the arrival of bills of lading. This is in addition to the advantages of reduction of costs, fraud protection, increased transparency and real time transfer of rights. In the first part of this article, published in the previous issue of the journal, we derived from the history of bills of lading lessons to guide the success of future platforms for electronic bills of lading. We proposed a conceptual framework for the structure of the sociological basis of bills of lading, and we argued that platforms for electronic bills of lading should be based on the elements identified in the framework for the successful worldwide launch of electronic bills of lading. On the basis of the analysis in part one of this article we identify in this second part the fundamental grounds upon which a new platform should be based, and we advocate accordingly the kind of technology that is suitable for electronic bills and the solutions for potential legal difficulties. In this second part of the article we propose that Distributed Ledger Technology (DLT) is the suitable technology for the legal and practice norms of bills of lading and we evaluate the type of DLT that could facilitate the adoption and use of electronic bills of lading. This part also identifies potential legal difficulties based on a legal comparative study, mainly from the perspective of English law and partly from the perspective of other national laws, that may face the proposed DLT, and how these difficulties may shape the type of DLT suitable for electronic bills of lading.

## **Second Part: Distributed Ledger Technology And Legal Difficulties**

### I. THE TECHNICAL PROBLEM IN CURRENT PLATFORMS

Switching from paper to electronic bills of lading is a manageable task for straight (non-transferable bills of lading), such as sea waybill, because it merely affects the characteristics of receipt for goods, evidence of the carriage contract and document of title but not the characteristic of transferability. The carrier here needs to send an electronic message, such as an e-mail instead of a paper format, to both the shipper and consignee containing the same contents as a paper bill of lading, and it is the recipient of the electronic message who is entitled to possess the goods on delivery. But even in straight bills of lading a slight technological problem may arise in relation to the characteristic of document of title whereby the shipper (as a seller of goods in the underlying sale of goods contract) wants to use the bill of lading as a security of payment

by keeping the original bill and only sending it to the consignee (buyer in the underlying contract) upon payment of the price.<sup>1</sup> Here as a solution an electronic message of the bill should be sent to the consignee by the shipper. This can be done by releasing a password to the consignee to enable him to view the message which can then be automatically notified to the carrier who will be obliged to deliver to the consignee only when he is notified to do so.

Major problems however arise in relation to the characteristic of transferability. The paper bill of lading is transferred by the mere delivery of the paper form in a bearer bill or through the process of endorsement for an order bill by both the signature - for authenticity - of the endorser and the delivery of the bill to the endorsee.<sup>2</sup> The bona fide transferee (known as holder) of the bill of lading acquires all rights of suit under the contract of carriage as if he had been party of the contract.<sup>3</sup> By delivering the paper form, the transferor gives up the exclusive possession of the bill to the transferee, and the transferor will thus no longer have access to it. By receiving the paper form of the bill, the transferee will be the only person who has access to it and he will be able to transfer it to a subsequent endorsee by delivery or by both delivery and signature without the need of interference by any third party, such as a service provider or centralised authority, to check the authenticity of the transfer. In addition, the content of the paper format is difficult to unduly alter as any change on the ink can be detectable. The paper format of the bill of lading has thus the virtue of enabling the movability of an exclusive possession of the bill without the need of the interference of a party other than the transferor and the transferee (i.e. peer to peer).

The challenge with electronic bills of lading is how can the exclusive possession of an electronic format be moveable without the need for a third party, such as a service provider, to enable the transfer? For instance, an e-mail containing a bill of lading provides the recipient with a possession of the e-mailed bill, but the sender will also have a possession of the same e-mail. A technology is needed to erase or decrypt the e-mail once it is received by the recipient. Bolero, essDOCS and SEADOCS platforms were developed to provide such a service, in that the transferor of the electronic bill must notify and send part of his private key to a central registry, administered by the service provider, and once the transferee receives an electronic message of the transferred bill of lading the transferor will no longer have access to the bill.<sup>4</sup>

But the problem is that Bolero, essDOCS and SEADOCS function as service providers administering a central registry that records and monitors the title in goods and the transfer of rights. So, transferability under these systems depends on a centralised authority, and the movability of the exclusive possession of the bill is not possible via peer to peer but is done through a service provider. It also undermines information networks, as information is also centralised. Finally, it complicates responsibility for problems because all relationships are mediated. This additional layer to the transaction takes power away from international merchants making them reliant upon a centralised privately-operated authority. SEADOCS has failed and its service had been discontinued and any investment in learning how to use its systems has been wasted.<sup>5</sup> In light of various social difficulties such as the worldwide infrastructure, urgent need and insurance for electronic bills, we cannot be sure that the centralised system, as opposed to the decentralised peer to peer, of SEADOCS was the determining cause of its failure. But we are sure that the decentralised system, peer to peer and informative network to enforce social norms, was an essential factor leading to widespread use of paper bills of lading as

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1 E.g. *Jl MacWilliam Co Inc v Mediterranean Shipping Co SA (The Rafaela S)* [2005] 2 AC 423; [2005] 1 Lloyd's Rep 347 [6] 108.

2 B Harris, *Ridley's Law of the Carriage of Goods by Land Sea and Air*, 8<sup>th</sup> edn, (Sweet & Maxwell 2010).

3 S.2 Carriage of Goods By Sea Act (1992); [G Treitel, F Reynolds, Carver on Bills of Lading](#), (4th edn, Sweet & Maxwell 2017) Chs 5 and 8.

4 For Bolero: <http://www.bolero.net/home/electronic-bills-lading> (accessed 10/07/2019); EssDOCS website: <https://www.essdocs.com/solutions/cargodocs/docex/electronic-bills-of-lading> (accessed 10/07/2019).

5 M Dubovec, "The problems and possibilities for using electronic bills of lading as collateral" [2006] *Arizona Journal of International & Comparative Law* Vol. 23, No. 2.

analysed in the first and second parts of this article. By analogy, a decentralised system could also be an essential factor for a potential widespread use of electronic bill of lading.

Also, the additional layer of a service provider adds specifically legal complexity and uncertainty to bills of lading, such as the extent of the liability of the service provider and the carrier for any fault in the system. Bolero and essDOCS attempted to solve the legal difficulties that affected SEADOCS (i.e. accepting transferability of rights, the extent of liability and the applicable law) by providing a RuleBook that all parties who accept Bolero's services sign to the rules that regulate the transferability of rights, through the legal concept of subrogation, and the applicable law.<sup>6</sup> In addition, unlike SEADOCS, Bolero system managed to insure its liability to a certain extent against faults in the system.<sup>7</sup> Despite these advantages, Bolero and essDOCS have not been successful in replacing paper bills of lading universally.

Arguably free markets are ideally served by National laws, and the role of National laws is to make the enforceability of social norms more effective. One therefore should not solely rely on a national law or even on an international Convention as a means of enforceability for transnational transactions such as bills of lading. Traders across borders have the freedom to choose the law that reflects their expectations in commercial practices and usages. It was illustrated in part one of this paper that the characteristic of transferability has been a trade usage that prevailed over the legal doctrine in common law jurisdictions. Therefore, we argue it is necessary for any electronic system not only to accommodate the existing norms of international merchants but also the social system (decentralised and informative network of co-operators) that enables the informal enforceability of norms if it is to succeed. Specifically, this requires a decentralised and secure power to transfer electronic bills. Fortunately, Bolero has joined R3,<sup>8</sup> and very recently essDOCS entered a partnership with SWISSCOM,<sup>9</sup> to employ a Distributed Ledger Technology (DLT) technology for electronic bills of lading with the effect that the transferability of rights can occur as peer to peer without the need for a third party or central registry to execute.<sup>10</sup> The advantage of applying DLT is that it enables decentralisation in that the parties can transfer the electronic bill as peer to peer, similar to the social structure supporting paper bills, without the need of a central authority to register title. This is important because peer to peer means less legal complexity, high confidentiality and freedom to sell documents without the need of a permission of a service provider. It also empowers traders and the spreading usage will be more organically horizontal, making it more embodied in behaviour, rather than imposed vertically as top-down.<sup>11</sup> The DLT system will automatically validate the authenticity of the transfer. The role of Bolero and essDOCS as a service provider should then, we propose, be limited to licensing creators or issuers of bills of lading, but as with paper bills any trader should be able to have free access to transfer. The suitable technology and type of DLT will be explained in detail below. In the next section however we advise Bolero, essDOCS and other platforms<sup>12</sup> that they should take into account the social structure supporting bills of lading.

## II. FUNDAMENTAL GROUNDS FOR ELECTRONIC BILL OF LADING – SIX COMMANDMENTS

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6 <http://www.bolero.net/home/rulebook-and-title-registry/>; <https://www.essdocs.com/policies>; A Goulandris, "Interview with essDOCS Co-Founder" <https://www.bbh.com/resource/blob/16004/a04b55c57e3a692085b4640f90688a28/interview-with-essdocs-co-founder-alexander-goulandris-pdf-data.pdf> (accessed 15/05/2019).

7 Electronic bills of lading via Bolero, essDOCS and E-Title are insured in P&I clubs as stated in the P&I clubs website: [https://www.ukpandi.com/fileadmin/uploads/uk-pi/Latest\\_Publications/Circulars/2015/UK\\_Paperless\\_Trading\\_FAQs.pdf](https://www.ukpandi.com/fileadmin/uploads/uk-pi/Latest_Publications/Circulars/2015/UK_Paperless_Trading_FAQs.pdf) (accessed 01/05/2018).

8 <http://www.bolero.net/r3-bolero-partner-new-electronic-bill-lading-eb1-service>.

9 <https://www.gtreview.com/news/fintech/essdocs-to-launch-blockchain-solution-in-early-2019/>.

10 <http://www.bolero.net/r3-bolero-partner-new-electronic-bill-lading-eb1-service>.

11 For more explanation: see text of footnotes 14, 90-93.

12 E.g. E-title: <https://www.e-title.net/>.

To succeed in switching from paper to electronic bills of lading the deployed technology that is needed to facilitate a moveable exclusive possession of bills of lading must be based on the following fundamental grounds:

- 1- The normative force of the electronic bill of lading should depend on the distributed powers among international merchants to enact informal sanctions (as explained above in element B of the analytical framework), without being controlled by a single entity that dictates sanctions.
- 2- There should be a transparent information network enabling international merchants, as the parties in the bill and as observers of the conduct of other members of the group, to be aware of the behaviours of carriers who issue electronic bills of lading particularly as to their action of delivering the goods to the transferees of the electronic bill of lading (this is based on the necessity for a gossip network asserted above in element B of the analytical framework). This will also help the law of evidence. Transparent network is already in existence as formal enforcement via court cases available to the public and the reputation of the carrier who fails to follow constituent norms, evidenced by judgements, will be affected negatively. However, empowering transparency via technology would heighten the possibility of informal enforcement of norms amongst international merchants.
- 3- Enabling reciprocal powers amongst international merchants to passively sanction the carrier who defects from constituent norms of a bill of lading (as explained above in element B of the analytical framework); particularly regarding the honouring of the transferee's rights.
- 4- Enabling and reflecting the social roles of the parties of a bill of lading (as explained above in element B of the analytical framework). The carriers as performing parties must be able to issue the bill and to honour it by undertaking to deliver the goods to the holder or transferee of the bill. The consignees, or transferees, as parties must be able to transfer the bill. Therefore, any trader should be allowed to transfer to order bill of lading, but a trader cannot be allowed to issue a bill of lading.
- 5- Banks, insurers and traders must be able to safeguard the security of the circulation of goods as noted at point (1) above (as explained in element C of the analytical framework), for which purpose they require access to details of bills of lading transactions, to check the bill of lading alongside other digitised documents such as bills of exchange contained in the same platform.
- 6- A method of detecting fraud. The exclusive control of the paper bill of lading in its original format provides a sort of security in checking the authenticity of the bill of lading that is in the hands of the transferee. It is argued in this part that the technological problem is mainly to do with the exclusive control of electronic messages without the need of a trusted third party to check authenticity, and so there should be a method that replaces a trusted third party to check authenticity and to enable an exclusive control.

### III. SUITABLE TECHNOLOGY - DISTRIBUTED LEDGER TECHNOLOGY (DLT)

Distributed Ledger Technology (DLT) is the most suitable current technology to implement the above fundamental grounds for electronic bills of lading. There can be various kinds of DLT and this section proposes the one that can fulfil the fundamental grounds which is a hybrid DLT that is permissioned (closed) to carriers in issuing bills of lading and unpermissioned (open) to the public to receive and transfer bills of lading.

#### *A. Definition*

DLT is defined as a technology that is "built upon a series of networks of databases that allow participants to create, disseminate and store information in an efficient and secure manner".<sup>13</sup> The networks of databases under DLT operate efficiently and securely without the need for a central trusted party or administrator. Unlike conventional ledger system,

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13 Hong Kong Government, Whitepaper 2.0 on Distributed Ledger Technology: [http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) (accessed 11/2/2017).

all participants in DLT, through their computers known as "nodes", have a copy of the same ledgers and they are collectively maintained by participants. All databases are permanently stored by, and transparent to, all nodes and can be traced back to the first time of creation. Unauthorized changes to databases and their history are very difficult, if not impossible. Typically, there are two platforms of DLT: unpermissioned and permissioned. Unpermissioned DLT is open to public so any one can participate as a node in maintaining and accessing the databases. It is employed in Bitcoins and other virtual currency.<sup>14</sup> Permissioned DLT is only available to restricted participants who fulfil certain criteria, so there is a central authority to accept who can participate and it can be either the central authority or all the permitted participants (and not the central authority) who run and validate the networks of databases.

## *B. Process of DLT*

Once a transaction takes place through DLT (e.g. issuing an electronic bill of lading by the carrier who has created an account in the DLT platform), the information is exchanged between all nodes registering the transaction as an entry of information that creates a block. Each time the information of the same entry (transaction) is changed a new block is created and chained securely to the previous one in order to ensure the authenticity of the audit trail.<sup>15</sup> This is done instead of overwriting the old page in a ledger as in conventional ledger systems.<sup>16</sup> The process is repeated whenever a change takes place. Typically, a blockchain process is employed in DLT, although nowadays new inventions are coming up with solutions other than blockchain process.<sup>17</sup> In a blockchain a new block (contains information of transaction) is linked to all the previous blocks. Each block is chained to - linked in a way that cannot be decoupled, with other blocks in the network.<sup>18</sup> So, all information about a transaction are linked and all transactions are also linked and recorded in the general ledger. Each node has the same recorded general ledger.<sup>19</sup>

To check the authenticity of transactions (blocks), the updating of transactions depends on the process of consensus among all nodes. This is done by both the processes of validation and broadcasting for consensus. For instance, a carrier will have an account, known as wallet in the language of blockchain, in the DLT platform and will accordingly have a private key (code or password to access the account) and a public key (code of the account available to anyone in the platform). Once the carrier issues a bill of lading and sends it from his account to the shipper or consignee who must also have an account (its public key is known to the carrier), a mathematical problem that is computationally demanding is broadcasted to the networks in the platform. According to the mechanism of proof-of-work the participants (nodes) who want to engage in validation, known as miners, will compete to solve the problem. The node that solves the problem first will add a block in the ledger, and it will be rewarded as an incentive to mine, usually in virtual currency such as Bitcoin. Then the process of broadcasting for consensus enables all the nodes to reach a consistent view of the new entry. The transaction is authenticated once all nodes reach consensus so its block will permanently reside in the networks of the platform.<sup>20</sup> The main technical problem is that the increase of the amount of transactions leads to an increase in the demand for the computing power, which will add cost, and once the amount significantly increases the network may become very slow and may

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14 S Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System" [2008] [www.bitcoin.org](http://www.bitcoin.org).

15 Hong Kong Government, Whitepaper 1.0 on Distributed Ledger Technology: [https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) page 5 (accessed 11/2/2017).

16 Hong Kong Government, Whitepaper 1.0 on Distributed Ledger Technology: [https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) page 10 (accessed 11/7/2017).

17 Natarajan, Harish; Krause, Solvej Karla; Gradstein, Helen Luskin, "Distributed Ledger Technology (DLT) and blockchain" [2017] FinTech note; no. 1. Washington, D.C: World Bank Group.

18 Hong Kong Government, Whitepaper 1.0 on Distributed Ledger Technology: [https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) page 10 (accessed 11/7/2017).

19 <https://lisk.io/academy/blockchain-basics/how-does-blockchain-work> (accessed 02/06/2019).

20 <https://lisk.io/academy/blockchain-basics/how-does-blockchain-work> (accessed 02/06/2019).

even collapse.<sup>21</sup> Also the significant demand for electrical power in the proof-of-work has led miners to form pools to control the mining which may subsequently lead to a centralisation as merely few pools will be successful in mining.<sup>22</sup> Proof-of-stake is another mechanism, to validate blocks, that was subsequently invented to be less energy consuming and less costly and so durable, whereby only randomly limited selected nodes, who paid a stake (security deposit) so if they are fraudulent their stake will cover the costs, are permitted to validate new or a change of entries.<sup>23</sup>

### C. Why DLT for electronic bills of lading and what kind of DLT?

To answer this question, one needs to examine the ability of DLT to cater to the fundamental six grounds identified above.

**1- Distributed power and peer to peer.** It sits at the heart of DLT that a transaction is facilitated as peer to peer without the need for a central authority. A carrier can issue the bill of lading and send it to the shipper and consignee without the need for a central authority. More importantly, as with paper format, the bill of lading in DLT can be transferred from the holder to the transferee without the need for the approval of the carrier (or a central register as in Bolero and essDOCS systems). This is only available if the DLT is open and unpermissioned, for the transfer of bills, so any trader can create an account in the relevant DLT without any serious costs and complications. The fact that current systems being piloted, such as Voltron platform,<sup>24</sup> tend to be controlled by consortia does not mean that power is not really distributed. This is because in our suggested DLT in point 4 under this heading such consortia should merely control who is permitted to register as a carrier to issue bills and the validation should be automatically progressed by computers of various carriers or the service provider. The transfer of bills will be made peer to peer. If various carriers, through their computers as nodes, validate the entries of the network then surely carriers who have issued bills will have reciprocal interests to maintain the validation of the transfers of the bills they have issued. The problem would be when the entries to the network are validated by a central service provider (so there is no distributed power in maintaining the network) and its business is no longer profitable. It may stop validating - through its computers - entries and changes and so the network will collapse. Here, for such a systemic risk the users should have access to paper format of the electronic bill to protect the rights of the last holder as suggested below.<sup>25</sup>

The technical challenge is to find a way in which an exclusive possession of electronic contents, standing as a bill of lading, can be transferred so that once the transfer takes place the transferor will be no longer able to access the electronic bill and the transferee will have exclusive access.

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21 For the problems in the system of Ethereum and crash in its (as Ethereum virtual currency) financial value: [https://theethereum.wiki/w/index.php/Ethereum\\_Wallet\\_Syncing\\_Problems](https://theethereum.wiki/w/index.php/Ethereum_Wallet_Syncing_Problems) (accessed 15/05/2019); <https://cryptovest.com/news/ethereum-crash-eth-breaks-down-below-200-on-ico-selling-spreed> (accessed 15/05/2019); for Bitcoins crash in value: <https://www.bbc.co.uk/news/topics/c734j90em14t/bitcoin> (accessed 15/05/2019); <https://www.independent.co.uk/life-style/gadgets-and-tech/news/why-bitcoin-crash-cryptocurrency-price-spike-study-market-manipulation-tether-a8397051.html> (accessed 15/05/2019).

22 A Beikverdi & J Song, 'Trend of centralization in Bitcoin's distributed network' [IEEE/ACIS 16th International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing \(SNPD\) 2015](#). For the argument that the mining pools do not in reality lead to centralised because each pool consists of various individuals see the February report 2019 of Canadian financial services firm Canaccord Genuity Group: <https://www.canaccordgenuity.com/>; D Sui, S Ricci and J Pfeffer "Are Miners Centralized? A Look into Mining Pools" [2018] May <https://media.consensys.net/are-miners-centralized-a-look-into-mining-pools-b594425411dc> (accessed 01/05/2019).

23 <https://lisk.io/academy/blockchain-basics/how-does-blockchain-work/proof-of-stake> (accessed 02/06/2019).

24 <https://www.gtreview.com/news/fintech/second-hsbc-ing-blockchain-transaction-sees-bill-of-lading-integrated-on-voltron-platform/> (accessed 01/06/2019).

25 See sub-heading of "systematic risk" under the heading "legal difficulties".

This could be done by employing the technology of electronic signature and encryption. Here via encryption<sup>26</sup> the contents of the bill of lading are converted into codes that cannot be decrypted except by someone who has the bill of lading's key (password or code) to access the data, although the technology of encryption may in rare cases be broken by fraudsters and indeed developers are investing to improve its security.<sup>27</sup> Smart Contract Technology (SCT) permits codification of contractual terms or instructions, creating a set of rules that automatically change databases when triggered.<sup>28</sup> Using SCT rules can be installed that provide that a transfer, through signature and electronic password, will generate a new password that is available to the transferee only. This would give the transferee exclusive access to, and control of, an electronic bill. The carrier will then be notified automatically, through SCT in the DLT, by the public key (the public code of the transferee's account in the platform) of the new transferee. The carrier will be trusted and expected by traders to deliver the goods to the latest transferee. The latest transferee is the one to whom the carrier has been notified of the public key.

**2- Transparent informative network.** The information in the platform of DLT is transparent and accessible to public if it is unpermissioned DLT. Refusing to honour a paper bill of lading, by not delivering the goods to the transferee presenting the bill, exposes the carrier (alongside the legal consequences before courts) to reputational damage (particularly if the transferee is well known trader and can publicise what happened) that may decrease the number of its customers.<sup>29</sup> With DLT such publicity can be empowered by inserting the time of delivery of both goods and bill without giving access to the information about the goods and the underlying deal in the platform, subject to the acceptance of carriers who are permitted to issue bills, which can be available publicly in order to review the performance of carriers. Online reviews have become a factor in enhancing customers' confidence in, and trustworthiness of, businesses.<sup>30</sup> Therefore, enhancing transparent informative network through DLT on both the performance of carriers and the quality of DLT platform may play an essential role enhancing the confidence in electronic bills and so increasing the chance of their widespread use.

**3- Enabling reciprocal powers of the members of the group of bills of lading.** It will be a mistake if carriers attempt to create a DLT platform (permissioned) whereby they can monopolise information, particularly in relation to delivery of goods against bills of lading. International merchants (including banks and insurers) should be allowed to have news as to the performance of carriers and to develop their own views on, and perceptions of, carriers.

**4- Enabling the significant differences in the social roles of the members of the group of bills of lading.** To fulfil that, a DLT platform for electronic bill of lading should be a hybrid type of permissioned and unpermissioned.

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26 Encryption is the translation of information into a secret code to achieve a security of information being only read by the one who has a key or password to encrypt the data: <https://www.r3datarecovery.com/data-encryption-contribution-data-protection/> (accessed 01/06/2019).

27 Hong Kong Government, Whitepaper 2.0 on Distributed Ledger Technology: [http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) (accessed 11/2/2017); <https://digitalguardian.com/blog/what-data-encryption>.

28 Hong Kong Government, Whitepaper 2.0 on Distributed Ledger Technology: [http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) (accessed 11/2/2017).

29 In a survey conducted by opensea.pro for charters the reputation of counterparties such as carriers is essential: "Ethics and reputation in ship chartering - how important are they nowadays?" <https://opensea.pro/blog/ship-chartering-ethics> (accessed 11/05/2019).

30 S Kim, E Maslowska & E Malthouse, "Understanding the effects of different review features on purchase probability" [2017], International Journal of Advertising, DOI: 10.1080/02650487.2017.1340928 (2) (PDF) *The Effect of Online Customer Reviews' Characteristics on Sales*. Available from: [https://www.researchgate.net/publication/306526906\\_The\\_Effect\\_of\\_Online\\_Customer\\_Reviews'\\_Characteristics\\_on\\_Sales](https://www.researchgate.net/publication/306526906_The_Effect_of_Online_Customer_Reviews'_Characteristics_on_Sales) [accessed 09/05/2019];

It should be permissioned in relation to both functions the issuing of the bill and the recording delivering of goods to the holder of the bill, since these functions are only performed by carriers in the conventional bill of lading. Thus, a central admission entity (a group of carriers) is needed to check who the carrier is as required in the relevant jurisdiction of the carrier and to only permit carriers who are able to fulfil the above two functions.

Ideally that the DLT would be open (unpermissioned), just like the availability of the paper format for bills of lading, so anyone who asserts itself as a carrier can issue bills and deliver goods to the holder. There is however a technical reason for having a permissioned DLT for the functions of issuing and executing the bill. It is to do with the process of validating the transaction of the bill of lading (i.e. authenticity of the issuer of the bill, the authenticity of sending the bill to the consignee, and the authenticity of the transfer). Participants in a DLT who are involved in validating the networks of databases (validating nodes) need an incentive to do the mining which consumes a significant amount of computation power. According to the mechanism of proof-of-work this can be done by rewarding the validating node that succeeds in validating the transaction before other validating nodes do so.<sup>31</sup> The commission will of course be paid by one of the bill of lading parties (carrier, shipper or consignee). But, allowing anyone to do the mining may lead to an unnecessary increase in the number of competing validating nodes. This will subsequently slow down the networks of databases in the platform, and in a worst-case scenario stopping the networks in the platform for hours or days.<sup>32</sup> More validating nodes competing in mining means higher cost and electricity consumption. The high cost and energy consumption may be reduced by applying the mechanism of proof-of-stake as the number of nodes which can validate will be limited by a random selection.<sup>33</sup> Permissioned DLT further reduces the cost and energy consumption. Under permissioned DLT only carriers, will be allowed to validate bills of lading and by deploying proof-of-stake techniques the number of carriers who can validate will be limited by random selection process. In any case, the incentive should be found to encourage carriers to do the mining such as receiving commission. Alternatively, the validation could be done by a trusted service provider, such as Bolero and eesDOCS, who is paid by carriers who are permitted to participate as a carrier in the DLT.

The DLT must be unpermissioned in relation to the function of transferability in order for the bill of lading to be freely available for negotiation among traders. Therefore, any trader who wants to transfer the bill of lading should be allowed to do so by merely creating an account in the platform of DLT. Hence the transferor and the transferee need to create an account in the DLT which should be free from charge and permitted to the public online.

**5- Enabling security of the circulation of goods, finance, and insurance.** DLT must allow the holder of bills through their private and public keys to send the bill to any bank and insurer, who should be able to open an online account in the DLT to check the bill. A single transaction of an international sale of goods involves various actors (buyers, sellers, carriers, banks, insurers and regulatory bodies) with distinctive interests and thus multiple networks regarding the same goods and the same representative documents (e.g. bill of lading, certificate of insurance, bill of exchange, invoice and inspection certificate). All of these parties need to have access to all documents (e.g. bill of lading, invoice and insurance documents). This is known as digital islands problem.<sup>34</sup> For instance, the bill of lading is usually used in letters of credit and the bank as payer, who

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31 Hong Kong Government, Whitepaper 1.0 on Distributed Ledger Technology: [https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) page 9.

32 <https://www.independent.co.uk/voices/bitcoin-news-cryptocurrency-crushed-authorities-tax-haven-regulate-money-price-value-a8164196.html> (accessed 01/03/2018).

33 <https://lisk.io/academy/blockchain-basics/how-does-blockchain-work/proof-of-stake> (accessed 02/06/2019).

34 A DiCaprio, A Malaket "Digital Islands in Trade Finance: Can a Decentralized System Solve the Network Problem?" [2018] July [https://www.r3.com/wp-content/uploads/2018/10/Digital\\_Islands\\_R3-1.pdf](https://www.r3.com/wp-content/uploads/2018/10/Digital_Islands_R3-1.pdf).

may not be the consignee nor the buyer, needs to have access to the bill of lading to make payment. Unfortunately, there are no uniform standards enabling this. By having an unpermissioned DLT online, for the transfer and check of bills of lading, the solution of DLT would be accessible to banks in letters of credit, insurers, and regulatory bodies via a password given to them by their customer. Ideally the solution of DLT should be part of a broader solution for the transaction of sale of goods and ancillary transactions that build upon collaboration of international merchants.<sup>35</sup>

**6. A method of detecting fraud.** DLT provides more security of the authenticity of bills of lading than paper format. This is due to the processes of validation and broadcasting for consensus, explained above. Any alteration of the bill of lading is almost impossible.

#### IV. LEGAL DIFFICULTIES

Whether the law gives effects to electronic bills of lading as it does to conventional bills of lading should not be a real problem, although certainty of having clear legislation or case law recognising the effects of electronic bills of lading would enhance the confidence of traders in using such an instrument. The history of bills of lading proves that the law has been generally reactive. Given that the ideology of natural (free) market dominates nations,<sup>36</sup> the doctrine of freedom is an intrinsic part of national laws for civil issues and, in addition to the fundamental institution identified in part 2, therefore the law tends to facilitate the ends of parties by reflecting their reasonable expectations. Though there can be time lags and legislative or judicial incompetence – also some systems have wider areas of public policy or mandatory law than England and Wales.

In principle, the legal status of a bill of lading issued, stored and transferred electronically via DLT platform depends on the applicable law between the parties. International Conventions on carriage of goods by sea, to which almost all National laws are subject to, are flexible in catering for electronic bills of lading. Thus, Hague Rules<sup>37</sup> and Hague-Visby Rules<sup>38</sup> stated that a bill of lading “shall be *prima facie* evidence of the receipt by the carrier of the goods as therein described”.<sup>39</sup> They also refer to a bill of lading as a document of title.<sup>40</sup> They convey the bill of lading’s constituent characteristics of receipt for goods and, loosely, transferability without any requirement for a paper format. Indeed a paper format or an electronic format can be valid evidence before courts.<sup>41</sup> More clearly article 14 of Hamburg Rules states that electronic signature is accepted on bills of lading.<sup>42</sup> Moreover, Rotterdam Rules,<sup>43</sup> although it has not come into force yet, expressly accepts negotiable (transferable) electronic transport documents and implicitly recognises that the element of exclusive possession that is moveable as the essential

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35 A DiCaprio, A Malaket “Digital Islands in Trade Finance: Can a Decentralized System Solve the Network Problem?” [2018] July [https://www.r3.com/wp-content/uploads/2018/10/Digital\\_Islands\\_R3-1.pdf](https://www.r3.com/wp-content/uploads/2018/10/Digital_Islands_R3-1.pdf).

36 F Hayek, *Individualism and Economic Order* (University of Chicago Press, 1948) vii, 271, [1].

37 Articles 1,3 & 4 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (Hague Rules 1924).

38 Articles 1, 2 & 3 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading 12 (Hague-Visby-Rules 1968).

39 Article 4 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (Hague Rules 1924); Article 4 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading 12 (Hague-Visby-Rules 1968).

40 Articles 1 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading 12 (Hague-Visby-Rules 1968); International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (Hague Rules 1924).

41 In EU: Regulation on Electronic Identification and Trust Services for Electronic Transactions in the Internal Market (910/2014/EU); English law: see the note by the Law Society of England and Wales “Execution of a document using an electronic signature” <https://www.lawsociety.org.uk/support-services/advice/practice-notes/execution-of-a-document-using-an-electronic-signature/> (accessed 13/06/2018). USA: *US v. Vela*, 673 F.2d 86, 90 (5th Cir. 1982).

42 United Nations Convention on the Carriage of Goods by Sea (The Hamburg Rules, 1978).

43 Article 10 United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (Rotterdam Rules 2008).

test to fulfil the functional equivalent of negotiable bills of lading. Hence, there is a realisation in the international legal discourse that the legal status of the electronic bill of lading (particularly transferability) depends on whether the electronic format enables an exclusive possession of a bill that can be movable from one person to another. As long as the electronic bill of lading enables such a function, there should be no real concern as to its legal status.

On the presumption justified above that a hybrid DLT (i.e. for issuing bills of lading the DLT is permissioned ,and for receiving and transferring bills of lading the DLT is open or unpermissioned) is the most suitable DLT for electronic bills of lading, the potential actual legal difficulties encountering such a hybrid DLT are: (1) systemic risk; (2) transparency and data protection; (3) electronic signature and (4) compliance with money laundering regulation.

### A. Systemic Risk

In the suggested hybrid DLT there is an admission entity of the technology which has the sole role of admitting who is permitted to issue bills of lading. The admission entity neither maintains or controls the function of issuing and transferring bills of lading, nor does it undertake to validate the transaction. The validity process (mining) in relation to the issuing and transferring of bills of lading is undertaken and maintained by many computers of many various carriers. This makes it extremely difficult for attackers to break down the system as they will need computing power higher than the collective computing powers of participants. However, the admission entity is an identified party, which is ideally a group of carriers or a group of banks and a group of insurers<sup>44</sup> who solely control the procedures of admitting carriers to issue bills of lading in the designated DLT network. Unlike shippers, those groups tend to be big cooperations who can sustain an operation as a service provider. It follows that the admission entity is a service provider and will be liable for the service that it particularly provides.

The main risk here is that if the system breaks down because of a cyber-attack, for instance, the content of electronic bills of lading that belong to thousands of carriers, shippers, consignees and transferees may simultaneously be lost. If that happened, parties would lose the prima facie evidence in which their rights and liabilities are embodied. The advantage of a paper bill of lading is that if the paper format or ink was faulty then eventually few bills of lading would be affected. The issue is then whether the admission entity would be liable for such tremendous potential losses.

To avoid liability for the tort of negligence, the admission entity must act with reasonable care<sup>45</sup> in order to prevent losses by for instance, updating security measures against cyber-attacks. Also, depending on the availability of insurance, an admission entity may be obliged (in contract with customers who use the service for value<sup>46</sup> or in tort on the basis of duty of reasonable care<sup>47</sup>) to arrange for insurance against cyber risks and other types of internet risk threatening the system. The responsibility of the admission entity towards carriers who are admitted to participating in the hybrid DLT to issue bills of lading and to undertake mining may be based on contract.<sup>48</sup> Here the solution would be by inserting a standard contractual term on the website excluding or limiting the liability of the admission entity, but such a contractual term may need to pass the test of

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44 These are the main influential actors in international trade and this requires a collaboration between them for being the admitting entity in order to avoid the digital islands problem: A DiCaprio, A Malaket "Digital Islands in Trade Finance: Can a Decentralized System Solve the Network Problem?" [2018] July [https://www.r3.com/wp-content/uploads/2018/10/Digital\\_Islands\\_R3-1.pdf](https://www.r3.com/wp-content/uploads/2018/10/Digital_Islands_R3-1.pdf).

45 E.g. Under common law: *Donoghue v Stevenson* [1932] AC 562; *Home Office v Dorset Yacht Co* [1970] AC 1004; *Anns v Merton LBC* [1978] AC 728; *Caparo PLC v Dickman* [1990] 1 All ER 568.

46 E.g. for supply of service contract under English law: s.13 Supply of Goods and Services Act 1982.

47 *Donoghue v Stevenson* [1932] AC 562; *Home Office v Dorset Yacht Co* [1970] AC 1004; *Anns v Merton LBC* [1978] AC 728; *Caparo PLC v Dickman* [1990] 1 All ER 568.

48 For contract formation: Beale and others (eds), *Chitty on Contracts* (32 edn, Sweet and Maxwell 2017) and for service contract see Vol.II, paras [38-527–38-547](#).

reasonableness under the applicable national law.<sup>49</sup> Also the liability of the admission entity towards carriers may be based on tort on the basis that it comes within the duty of reasonable care to insure against risk such as a cyber-attack if the insurance is reasonably available and here it would be very difficult to exclude or even limit such a liability.<sup>50</sup> Given the significance of the potential losses for many stakeholders, the duty to insure could become a matter of policy under national laws to avoid a disastrous event such as a cyber-attack. The duty to insure would add cost to transactions and may render the service of electronic bills of lading uneconomic.

We suggest that the ideal solution is that the above suggested system of hybrid DLT must allow the parties to obtain a paper format as a copy of the electronic format of bill of lading. In this way, if the system of DLT breaks down carriers, shippers and transferees could produce evidence to assert their rights. The suggested solution serves the same purpose of the idea of issuing couple of original copies of a paper bill of lading, so if a copy of the original format is lost the parties will be able to assert their rights by a written document. By implementing the solution of paper copies the admission entity shifts the responsibility to the participants for preserving the content of bills of lading if the system of the hybrid DLT breaks down. Here the system is hybrid in terms that it is based on an electronic format and it is only based on a paper format once the service of the electronic format collapses. Such a solution would jettison the demand for imposing the costly duty to insure against the risk of cyber-attacks, as the disastrous event could be avoided by alternative solutions.

### *B. Private Data Protection*

Although transparency is one of the advantages that DLT offers it encounters the legal difficulty of personal data protection, because the information in DLT regarding bills of lading are personal, stored permanently and meant to be transparent to all miners in the network which seem to be repugnant to some of the principles behind the private data protection conventions.<sup>51</sup> Data protection laws are considered as overriding mandatory law to the extent that the breach of their provision may lead to a criminal prosecution.<sup>52</sup> Personal data means (in EU General Data Protection Regulation (GDPR))<sup>53</sup>: “any information relating to an identified or identifiable living individual (subject to subsection (14)(c))”.<sup>54</sup> Although the new definition of personal data in the GDPR includes almost any information relating to an individual who is located in EU area, the individual must be a living being. This means that the information in relation to companies are not personal data and in the majority of bills of lading it is companies who transact so the information about them is not personal data subject to the data protection law.

In rare cases it is a sole trader who may be a shipper or a consignee in bills of lading, and in such cases data protection law applies which may cause a legal difficulty for electronic bills of lading in DLT. As an illustration of such a legal difficulty and for an insight to potential solutions, we would briefly analyse the six principles upon which the recent EU General Data Protection Regulation (GDPR) is based.<sup>55</sup> Individuals or entities are not allowed to store personal data unless the following principles in GDPR are adhered:

First, lawfulness, fairness and transparency in that the information must be used for legitimate interests (i.e. if it is necessary for the performance of a task for the declared

49 E.g. Under English law the Unfair Contract Terms Act (1977) dictates a test for reasonableness under section 11, although it does not apply to international sale of goods (s.26) it applies to international supply of services: *Trident Turboprop (Dublin) Ltd -v- First Flight Couriers* [2008] 2 Lloyd's Rep 581.

50 E.g. English law is hostile to exclude and limit liability on tort even for negligence: s.2 Unfair Contract Terms Act (1977).

51 Hong Kong government, Whitepaper 2.0 on Distributed Ledger Technology: [http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper\\_On\\_Distributed\\_Ledger\\_Technology.pdf](http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper_On_Distributed_Ledger_Technology.pdf) (accessed 11/2/2017).

52 E.g. s.10 of Data Protection Act (2018).

53 Regulation (EU) 2016/679.

54 S.2 Data Protection Act (2018).

55 Regulation (EU) 2016/679.

purpose) or with the consent of the relevant individual.<sup>56</sup> Also the process of using the information should not be in breach of other laws and should not cause undue detriment.<sup>57</sup> Consent should be required by the electronic system via SCT to all uses of the data necessary for the functioning of the DLT bill of lading. This can be achieved by making receipt of the bill conditional upon consent, of a declaration that the recipient is not a living being (i.e. a company).

Second, the information should only be collected for a clear purpose<sup>58</sup>. Hence, the suggested DLT should clearly state that it is merely designed for bills of lading and, for instance, the documentary sales.

Third, the information collected should only be adequate and relevant (the minimum data) for the functioning of the purpose.<sup>59</sup> The information collected will be used for the relevant purpose, namely, the bill of lading between the parties and for a common purpose that is the maintaining of the DLT system as data in the DLT cannot be deleted or changed so it will be permanently maintained.

Fourth, the admission entity should take all reasonable steps to ensure that the information is not incorrect as well as to take due diligence steps to remove incorrect information.<sup>60</sup> The task of the admission entity in the suggested hybrid DLT is merely to allow who is admitted to issue bills of lading who will also be able to validate the network. Therefore, the admission entity is under a duty of reasonable care to ensure that the information relevant to carriers is not incorrect and to amend incorrect information. However, the admission entity should not be held responsible for the accuracy of the information relevant to the parties of bills of lading, as it does not have a role in that aspect of the service. Here we argue that the duty is on the carriers who insert information, as their position is similar to a volunteer or a contractor who chooses to write information about others in an open site.

Fifth, storage limitation in that the keeper of the information<sup>61</sup> (e.g. admission entity in electronic bills of lading) is not allowed to keep the information for longer than is needed and that depends on the purpose for which the information is kept. In the context of electronic bills of lading based on DLT the question is whether the purpose for collecting the information is for a particular bill of lading or it involves both a bill of lading and keeping the information permanently for the purpose of the function of the technology of DLT. Also, the admission entity must set a standard retention period and in electronic bills of lading, as we suggest, the admission entity should clarify that information is kept permanently but will be encrypted automatically after a reasonable period of time from all participants including the carriers and the transferees once the electronic bill is submitted to the carrier for the delivery of goods.

Sixth, integrity and confidentiality in that the information keeper must ensure that appropriate security measures are taken to protect the information.<sup>62</sup> The admission entity should apply the encryption technology and any updates in order to avoid liability.

In conclusion, the suggested DLT can be compliant with data protection laws if the law takes into account that the permanent storage of encrypted information is a legitimate interest for the function of applications using DLT. The law may however require the subject's explicit consent. DLT can be a virtually open site for the public and therefore the liability should rather be focused on an identified individual who has a reasonable control over the process of inserting personal data.

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56 S.35 of Data Protection Act (2018).

57 S.35 of Data Protection Act (2018).

58 S.36 of Data Protection Act (2018).

59 S.37 of Data Protection Act (2018).

60 S.38 of Data Protection Act (2018).

61 S.39 of Data Protection Act (2018).

62 S.40 of Data Protection Act (2018).

### C. Electronic Signature

Signature can be defined as information, uniquely linked to the signatory, intended to authenticate the relevant document.<sup>63</sup> Electronic signature is a signature executed in an electronic form. When one signs electronically using Microsoft word or PDF, for instance, the electronic signature, unlike handwritten, may not be uniquely connected to the signatory and may be easily copied by others. That is why there are various models of law whereby some laws having a minimalist approach accepting electronic signature as long as a consent of the signatory to use it is given,<sup>64</sup> and other laws, though they are very few, adopt a strict approach by only accepting a very secure complex type of electronic signature.<sup>65</sup> Electronic signature has various types.<sup>66</sup> The simple type is typing a name or an initial at the end of an electronic document as a method to authenticate the relevant document.<sup>67</sup> The most complex type of electronic signature is a digital signature by which a service provider issues a certificate identifying the signatory or the holder of a particular public key cryptography (known in EU as a qualified signature); laws require such a service provider to be accredited by the government in order to prevent the real risk of fraudsters issuing certificates of identity.<sup>68</sup> While these signatures might not be based on a certificate issued by a government-licensed certification authority, they are not “a simple type” of signature, but cryptographic ones.<sup>69</sup> The issue is that through the processes of encryption and validation by algorithmic tasks, DLT can provide a very secure electronic signature. DLT can fulfil the ‘reliability’ standard underlying the recognition of electronic signature (the simple and complex types) issued by the UNCITRAL Model Law on Electronic Signatures (2001) and adapted by many national laws,<sup>70</sup> in the context of electronic bills of lading, namely: (1) the method of authentication adequately identifies the person to whom the signature belongs (i.e. this can be done by implementing the technology of handwritten electronic signature such as in electronic PDF); (2) it adequately indicates the person’s intention in respect to the information contained in the electronic communication (i.e. this can be done by having an electronic format that looks like paper format requiring signature at the bottom of bill of lading) and; (3) the electronic signature is adequately under the control of the signatory in terms that it can be stored with that person for a long time to the extent that any unauthorised alteration or deletion is detectable (i.e. this is highly achieved in DLT as the account holder has a private key or password that no one can have an access to except him).<sup>71</sup> In addition, DLT can certainly fulfil the ‘reliability’ standard of UNCITRAL Model Law on Electronic Transferable Records (2017) as DLT provides the holder of the key (password) an exclusive control and the data are preserved with integrity by being reasonably secure from unauthorised amendments, and the electronic bill can easily contain that it is to order or transferable.<sup>72</sup> Even a digital signature can be securely executed in DLT without the need to accredit the service provider because in DLT the certificate can be validated automatically in the network without the need to a

63 English law and EU Law: The Law Commission, “Consultation Paper: Electronic Execution of Documents” (2018, The Law Commission UK), paras 3.83- 3.87. An electronic signature may also be used instead of a handwritten signature even where there is no statutory requirement for a signature <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2018/08/Electronic-execution-of-documents-consultation-paper.pdf>; USA Law: s.2(8) Uniform Electronic Transactions Act (UETA) (1999); the definition can be inferred from the requirements of a valid electronic signature in Article 9 United Nations Convention on the Use of Electronic Communications in International Contracts (2007).

64 E.g. Canada: Personal Information Protection and Electronic Documents Act (PIPEDA) (2000).

65 E.g. Brazil: Provisional Measure Law 2.200-2 (2001).

66 The Law Commission UK, “Consultation Paper: Electronic Execution of Documents” (2018, The Law Commission UK), paras 2.9 - 2.36 <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2018/08/Electronic-execution-of-documents-consultation-paper.pdf>.

67 The Law Commission advised that such an electronic signature is legally valid: The Law Commission, “Electronic Commerce: Formal Requirements in Commercial Transactions” (2001, The Law Commission UK) para 3.33 [https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2015/09/electronic\\_commerce\\_advice.pdf](https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2015/09/electronic_commerce_advice.pdf).

68 Article 3(12) eIDAS (electronic IDentification, Authentication and trust Services) EU Regulation 910/2014.

69 <https://lisk.io/academy/blockchain-basics/how-does-blockchain-work/digital-signatures>.

70 Article 6 UNCITRAL Model Law on Electronic Signatures (2001).

71 Article 6 UNCITRAL Model Law on Electronic Signatures (2001).

72 Article 10 UNCITRAL Model Law on Electronic Transferable Records (2017).

trustworthy third party. Accordingly, electronic signature in DLT should be legally recognised and enforced under national laws as a handwritten signature. We will now evaluate the current status of laws.

Electronic signature is legally valid and recognised under national laws.<sup>73</sup> Under common law,<sup>74</sup> EU law,<sup>75</sup> USA law,<sup>76</sup> Chinese law,<sup>77</sup> Arabic laws,<sup>78</sup> African laws<sup>79</sup> and other National laws<sup>80</sup> the simple type of electronic signature can be legally valid as the traditional handwritten signature. Therefore, a simple type of electronic signature in bills of lading is usually legally valid and recognised as a handwritten signature under most laws, mainly because the formality of authenticating bills of lading does not require witnessing and attesting as required in deeds.<sup>81</sup>

However, some national laws, although they are very few, such as Brazilian law, only recognise digital signature as the valid electronic signature.<sup>82</sup> Under some national laws a simple type of electronic signature is not legally valid if one of the parties is or represents a governmental body, and in such a situation only the digital signature (using public key cryptography) can be legally valid as it is perceived here as the only reliable method of authentication.<sup>83</sup> South African law only recognises digital signature for documents, such as bills of lading, where the law requires a signature on them.<sup>84</sup> Digital signatures do not usually have legal validity unless the service provider is permitted by governments to provide digital certificates of identity,<sup>85</sup> and therefore digital identification is not legally valid under most national laws if it is produced automatically through DLT even though such a technology provides a high level of authenticity due to the process of mathematical validation. We advise that the electronic signature of the carrier and transferor in bills of lading should be based on a simple type and not on a digital

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73 The Law Commission, "Consultation Paper: Electronic Execution of Documents" (2018, The Law Commission UK), paras 3.83-3.87. An electronic signature may also be used instead of a handwritten signature even where there is no statutory requirement for a signature <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2018/08/Electronic-execution-of-documents-consultation-paper.pdf>; Article 9 United Nations Convention on the Use of Electronic Communications in International Contracts (2007); Global Guide to Electronic Signature Law: <https://acrobat.adobe.com/content/dam/doc-cloud/en/pdfs/document-cloud-global-guide-electronic-signature-law-ue.pdf>

74 Under English law: The Law Commission, "Consultation Paper: Electronic Execution of Documents" (2018, The Law Commission UK), paras 3.83-3.87 <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2018/08/Electronic-execution-of-documents-consultation-paper.pdf>.

75 Under EU Law: The Law Commission, "Consultation Paper: Electronic Execution of Documents" (2018, The Law Commission UK), paras 3.83-3.87 <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2018/08/Electronic-execution-of-documents-consultation-paper.pdf>.

76 Electronic Signatures in Global and National Commerce (ESIGN) Act (2000); the Uniform Electronic Transactions Act (UETA) (1999).

77 Article 13 Electronic Signature Law of the People's Republic of China (2004); C Cao, "A note to China's new law on electronic signatures By Chris Cao" [2016] Eiger Law <<http://journals.sas.ac.uk/deeslr/article/viewFile/2307/2260>>.

78 Egypt: The Electronic Signature Law 15/2004; Jordan: articles 1 & 8 Electronic Transactions Law 85/2001 and for transferable documents such as bills of lading see article 19 which accommodates simple electronic signatures in instruments transfer rights; Kuwait: article 3 Electronic Transactions Law 20/2014; UAE: Article 8 Federal Law On Electronic Commerce and Transactions 1/2006 but article 2 (c) states that this law on electronic signature does not apply to negotiable documents and this may mean transferable bills of lading (it is doubtful though), so an electronic signature may not be accepted on transferable bills of lading.

79 Tanzania: articles 4, 6 & 7 [Electronic Transactions Act \(2015\)](#); South Africa: Electronic Communications and Transactions Act (ECTA), (2002) but pursuant to article s.13 (1) only digital signature is accepted if the law requires a signature and the law requires a signature in bills of lading; Nigeria: The Electronic-Transactions Bill (2010) but s.2 excludes bills of lading.

80 Canada: Personal Information Protection and Electronic Documents Act (PIPEDA) (2000); Chile: Article 3 of Law 19.799; Malaysia: Laws Of Malaysia Act 658 Electronic Commerce Act (2006).

81 For the legal problems encountering electronic signature in deeds: The City of London Law Society, Electronic Execution of Documents Law Commission Consultation Paper (dated 21 August 2018) Joint response of the Financial and Company Law Committees of the City of London Law Society.

82 Provisional Measure 2.200-2 (2001).

83 E.G. Hong Kong: S.6 Electronic Transactions Ordinance (2000).

84 S.13 South Africa: Electronic Communications and Transactions Act (ECTA), (2002)

85 E.G. Hong Kong: Electronic Transactions Ordinance (2000); South Africa: Electronic Communications and Transactions Act (ECTA), (2002); Egypt: The Electronic Signature Law 15/2004.

signature, since the latter requires the involvement of another party as a service provider permitted by governments to authenticate signatures in bills of lading which will add a layer of complexity (e.g. legal liability and international private law issues) to what is already a complex transaction. Consequently, the laws that require a digital signature (via a service provider accredited by the government) for bills of lading, obstruct the circulation of electronic bills of lading through DLT. We advise that such laws should be updated to accommodate the new technology of DLT.

Another problem encountering electronic signature in electronic bills of lading is that in countries such as the UAE,<sup>86</sup> Hong Kong,<sup>87</sup> USA (New York Law)<sup>88</sup> and Singapore<sup>89</sup> the law of electronic signature excludes negotiable instruments. Under Common law a bill of lading is considered as a semi-negotiable document since the rights in bills of lading are transferred subject to prior defects,<sup>90</sup> so fortunately bills of lading are not excluded from the law of electronic signature under Common law jurisdictions unless they are clearly excluded as, regrettably, in Singapore<sup>91</sup> and potentially in Nigeria.<sup>92</sup> A bill of lading may be regarded as a negotiable instrument under Civil law jurisdictions as the rights in bills of lading are transferred free from prior defects (e.g. UAE law)<sup>93</sup> just like bills of exchange. Hence an electronic signature in bills of lading may unfortunately not be legally recognised under an applicable law similar to the UAE law. Given the need for the international circulation of bills of lading whereby the goods are transported across various national borders and customs, these laws should be updated to accommodate the use of electronic bills of lading. As a pragmatic solution the parties are advised to apply the law that clearly recognises a simple type of electronic signature for electronic bills of lading, such as Jordanian law,<sup>94</sup> but this would not overcome the problem that an electronic bill of lading may not be accepted by custom authorities – if it is (whereby goods are transported across borders) in a jurisdiction that does not recognise electronic signature on bills of lading. Furthermore, the laws that do not recognise an electronic signature on negotiable instruments (e.g. bills of exchange) making it difficult to circulate electronic bills of lading. In many international sale contracts, the use of bills of lading accompanies the use of bills of exchange for payment (i.e. documentary collection and acceptance documentary credits) and finance purposes, so it would be more complex for banks to check or exchange one document electronically whilst progressing the other document in a paper format. The identified legal difficulties in electronic signature illustrate how some laws can be an aspect of an incompetent international infrastructure hindering the advance of a potentially disruptive technology.

Consequently, the laws that require a digital signature (via a service provider accredited by the government) for bills of lading, obstruct the circulation of electronic bills of lading, and other trade documents such as bills of exchange, through DLT. We advise that, ideally as a multi-state harmonization of the law, such laws should be updated to accommodate the new technology of DLT. Alternatively, and as a more pragmatic solution for the time being, we advise that a digital signature should be adopted in the DLT suggested in our paper. This can be done by fulfilling the requirements of the digital signature only under the law of the few countries, identified above, that reject simple electronic signature. So, under those countries the admission entity of the DLT suggested in this paper needs to apply for an accreditation to provide an electronic certificate of identity. This of course triggers another complexity. That is the issue of the reasonability of the service provider for the authenticity of signature, which is not an issue in the handwritten signature.

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86 Article 2(c) Federal Law on Electronic Commerce and Transactions 1/2006.

87 Schedule 1 Electronic Transactions Ordinance (2000).

88 Electronic Signatures and Records Act, §307(1).

89 Article 4 & Schedule 1 Electronic Transactions Act (2010).

90 B Harris, *Ridley's Law of the Carriage of Goods by Land Sea and Air*, (8<sup>th</sup> edn, Sweet & Maxwell 2010).

91 Article 4 & Schedule 1 Electronic Transactions Act (2010).

92 S.2 The Electronic-Transactions Bill (2010).

93 As it can be inferred from article 264 Marine Commercial Law 26/1981; Federal Supreme Court (Civil) Decision 140/2009.

94 Article 19 Electronic Transactions Act 85/2001.

#### *D. Compliance with Regulations of Anti Money Laundering and Anti-Terrorism*

Since DLT is often associated with cryptocurrencies such as Bitcoin by which many money laundering crimes were committed, some make the error of perceiving the technology as being designed to launder money or to facilitate terrorist activities.<sup>95</sup> The anonymity of participants in Bitcoin and other cryptocurrencies using DLT makes it very difficult to enforce the requirement of Know Your Customer with due diligence imposed by Regulations of Anti Money Laundering and Anti-Terrorism (AMLT).<sup>96</sup> DLT has many various applications, but cryptocurrency is one of the applications that attracts money laundering and AMLT regulation because it offers a financial service. Other applications of DLT may not be subject to AMLT when they do not process the exchange money for money or money for high value goods. In the UK for instance, AMLT applies to financial service businesses, accountants, estate agents, solicitors and businesses that exchange high value goods for money;<sup>97</sup> therefore shipping companies are not required to register under the Financial Conduct Authority for AMLT regulations. Accordingly, in our suggested hybrid DLT platform for electronic bills of lading the rule of Know Your Customer in AMLT is not required, since the subject-matter of the application is the digitisation of documents for the service of transportation and not for financial service (but if it is also used for bills of exchange the platform may attract AMLT). In any case it should be the responsibility of the carrier to check the identity of the shipper, consignee and transferee (traders), since the contract of carriage between the shipper and the carrier is created before issuing the bill of lading through DLT. The role of the admission entity in the suggested DLT is merely to permit carriers to join as issuers of bills of lading. Such an admission entity is under a legal duty to check the identity of carriers with due diligence check, if AMLT regulations apply and to check whether the carrier is subject to trade sanctions by UN or the government of the jurisdiction under which the admission entity operates.<sup>98</sup>

However, in future service providers may become obliged to implement procedures anti trade-based money laundering.<sup>99</sup> Currently, if banks were to be part of the admission entity in our suggested DLT for bills of lading, which is advisable to avoid digital islands problem explained above,<sup>100</sup> they would need to implement the guidance of national authorities in taking protective measures against trade-based money laundering such as Know Your Customer (carriers and traders who deal with bills of lading).<sup>101</sup> Here the design of DLT may be affected, and although it will lead to a safer legal environment it will dishearten traders to use DLT for electronic bill of lading as such a platform will not provide the level of confidentiality that paper bills will otherwise do.

#### V. CONCLUSION

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95 For an unclear division between blockchain and cryptocurrency see for example V Arnold, "Completing a blockchain risk assessment", (Lexology) (accessed 01/10/2018) <https://www.lexology.com/library/detail.aspx?g=a9004186-7a62-49f1-a717-b4bc0c90312d>.

96 Policy Department for Economic, Scientific and Quality of Life Policies (edt), R Houben, A Syner: "Cryptocurrencies and blockchain Legal context and implications for financial crime, money laundering and tax evasion", [July 2018] <http://www.europarl.europa.eu/committees/en/supporting-analyses-search.html>.

97 [The Money Laundering, Terrorist Financing and Transfer of Funds Regulations 2017 \(SI 2017 No. 692\)](#); The Money Laundering Regulations 2007 (SI 2007 No. 2157); The [Terrorism Act \(2006\)](#); The [Terrorism Act 2000 and Proceeds of Crime Act 2002 \(Amendment\) Regulations \(2007\)](#); see the UK government website: <https://www.gov.uk/guidance/money-laundering-regulations-who-needs-to-register>.

98 E.G. USA PATRIOT Act (2001); KPMG Company, "Turning Risk Into Advantage", Shipping Insights 5 (accessed 05/09/2018 <https://assets.kpmg.com/content/dam/kpmg/pdf/2013/12/turning-risk-into-advantage.pdf>

99 [http://baft.org/docs/default-source/marketing-documents/baft17\\_tmbl\\_paper.pdf](http://baft.org/docs/default-source/marketing-documents/baft17_tmbl_paper.pdf).

100 Texts of footnote 163.

101 E.g. The Guidance of Banks' Control of Financial Crime Risks in Trade Finance issued by UK's Financial Conduct Authority (FCA) in 2013; for details on various national procedures: [https://www.citibank.com/tts/insights/eSource\\_academy/docs/thought\\_leadership/1461942122-Citi-Trade-Based-Money-Laundering-Whitepaper.pdf](https://www.citibank.com/tts/insights/eSource_academy/docs/thought_leadership/1461942122-Citi-Trade-Based-Money-Laundering-Whitepaper.pdf).

This second part of the article evaluated the type of technology that could accommodate the social structure of the constituent norms of bills of lading. It was proposed that a distributed ledger technology (DLT), as opposed to a centralised ledger technology, is currently the only way to provide the right platform to facilitate electronic bills of lading, like the actual social platform of paper bills of lading. A hybrid (permissioned and unpermissioned) platform based on DLT is the most suitable system. Accordingly, the membership of miners (validators of the system) who are able to issue bills of lading and to check the authenticity of transactions in the platform, should only be permitted to carriers. But for transferring (sending and receiving) the bill of lading, the platform should be open to public so any trader to whom the bill is transferred should be able to transfer it to any other trader, or to send it to a bank or insurer for checking, in the world. However, legal difficulties encountering DLT for electronic bills of lading must be tackled well in advance. The legal recognition of electronic bills of lading is not the real issue. Liability from systematic risks, such as cyber-attacks, can be overcome by requiring carriers to keep a copy of the electronic bill of lading in a paper format. Principles of privacy and personal data may be fulfilled by deploying the technology of encryption, and it is the carrier, rather than the admission entity, in our proposed DLT who will be liable for inserting personal information. The real legal difficulty is that some national laws as surveyed in the article require the most complex type of signature (digitised signature) authenticated by an entity accredited by governments which is not suitable, and necessary, for DLT. Other laws may not recognise, although very few, electronic signature in bills of lading. Also, some laws do not recognise electronic signature in negotiable instruments which make it difficult for the circulation of electronic bills of lading as they accompany negotiable instruments in some payment methods. The law on electronic signature under such national laws must be amended to accommodate the new innovation of DLT as the reliability test for the recognition of electronic signature can be easily fulfilled in DLT. For the time being, we suggested a pragmatic solution of adopting digital signature in the proposed hybrid DLT that is in accordance to the few national laws which only accept digital signature in bills of lading. Surprisingly, it seems that the laws for anti-money laundering and anti-terrorism, as illustrated in the UK's Regulation, do not attract the requirement of Know Your Customer for electronic bills of lading through the platform of DLT as, unlike virtual currency, DLT is used here not for an exchange of money for money. Even if Know Your Customer is required in DLT for bills of lading, in our proposed hybrid DLT that would apply to the carriers who are admitted by the admission entity to issue bills and to validate the network, so it would practically be manageable.