

Chip Off the Old Block:
Acknowledging the Obstacles to Widespread Adoption of
Blockchain Bills of Lading

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ABSTRACT

The bill of lading has been a staple of the maritime shipping industry for centuries. Its evolution to facilitate three core functions was slow and arduous, with little change in the bill of lading's form and function ever since. The advances in electronic communication brought the prospect of electronic alternatives; however, the concept never succeeded, plagued with issues of excessive costs, trust and privacy concerns from industry participants and a lack of global legal recognition of the extension of the bill of lading to an electronic equivalent. However, the advent of blockchain technology has brought with it the prospect of blockchain bills of lading overcoming the problems of the past. This article argues that despite the promise of the technology, the global adoption of blockchain bills of lading is not guaranteed. It first addresses the lack of a universal legal framework, be it via uniform domestic laws or an international instrument, and evaluates the UNCITRAL Model Law on Electronic Transferable Records as an imperfect but necessary solution. It also highlights that the technology's commercial scalability is dependent on establishing a broad global network of industry participants, which in turn requires overcoming issues of trust in the technology and amongst industry competitors, and improving the accessibility of and interoperability between the current siloed blockchain solutions. These obstacles can arguably be overcome, but it requires addressing both the legal and non-legal issues simultaneously rather than linearly. This would also require unprecedented coordination between key industry stakeholders and public organisations at the domestic, regional and international levels.

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INTRODUCTION

COVID-19 has overtly affected our lives in many direct and indirect ways, including through its impact on international trade. Whilst consumers order more goods from the comfort of their own homes, workers in the maritime trade industry follow strict COVID-safe protocols or stay home if they or a co-worker have been infected at the workplace, placing an extraordinary strain on the global trade network. Amongst other pandemic-induced shipping issues, receivers wait for their paper bill of lading (BoL) to arrive, which must be presented to the carrier to release and deliver the goods to the intended receiver. This has exacerbated the problem of containers remaining stuck at ports, terminals, depots and warehouses, with ships forced to anchor outside of ports for days and weeks.¹ Consequently, shipping liners, ports and other operators of key shipping infrastructure have endured a significant rise in costs, amounting to hundreds of thousands of dollars for shipping liners for every day of delay; each day a ship is stranded waiting to enter a port reportedly costs an average AUD150,000.² Naturally, rising costs have been passed on to consumers and are contributing to unprecedented price inflation for freighting goods; freight rates have risen by up to 900% on some shipping lanes compared to the end of

¹ Hariesh Manaadiar, 'The Beginning of the End for the Paper Bill of Lading' (*Shipping and Freight Resource*, 25 May 2020) <www.shippingandfreightresource.com/the-beginning-of-the-end-for-the-paper-bill-of-lading> accessed 1 November 2021; Sam Chambers, 'Carriers Prepare to Bid Farewell to the Old Bill of Lading' (*Splash247*, 19 May 2020) <<https://splash247.com/carriers-prepare-to-bid-farewell-to-the-old-bill-of-lading>> accessed 1 November 2021.

² David Claughton, Kellie Hollingworth and Kath Sullivan, 'Sea Freight Costs May Have Peaked, but More Ships Are Needed to Bring Them Down' *ABC News* (Sydney, 14 October 2021) <www.abc.net.au/news/rural/2021-10-14/sea-freight-costs-stabilising/100535856> accessed 4 December 2021.

2019.³ The logistical complications behind these consequences ostensibly appear to be unique to the pandemic; the reality is that the pandemic has merely brought to the fore problems with paper BoLs that have existed in the industry for decades.

As explained in Part I of this article, the industry has theorised that the digital revolution would bring with it the opportunity to finally move away from paper BoLs towards more instant and efficient electronic BoLs. Whilst many attempts have been made, all previous efforts have failed to make even a small impact in the industry: only 0.1% of all BoLs are currently issued electronically.⁴ However, the birth of blockchain technology in 2009 has brought with it a newfound excitement and confidence that it could fulfil the legal and practical requirements of an electronic BoL.

Blockchain has the potential to revolutionise not just the BoL but also the carriage of goods by sea more broadly. However, it faces many of the same, and some completely new, obstacles to becoming a global, industry-wide solution. At the core of this article, Part II will outline the mixture of legal, technical, and behavioural obstacles that could inhibit the acceptance and integration of blockchain technology on a global scale. In doing so, two observations will emerge. First, the obstacles to a widespread adoption of electronic BoLs, particularly through a blockchain system, are multifaceted and involve more than just mere legal discrepancies or a lack of unification. Second, current

³ United Nations Conference on Trade and Development, 'Container Shipping in Times of COVID-19: Why Freight Rates have surged, and Implications for Policymakers – Policy Brief No. 84' (19 April 2021) UNCTAD/PRESS/PB/2021/2, 3. See also United Nations Conference on Trade and Development, 'Review of Maritime Transport 2021' (18 November 2021) UNCTAD/RMT/2021, 59–61. There are also concerns and investigations into anti-competitive pricing behaviour by shipping liners and ports during the pandemic, namely price gauging and collusion: see e.g. Brendan Murray, Ann Koh and Richard Weiss, 'Freight-Cost Pain Intensifies as Pandemic Rocks Ocean Shipping' *Bloomberg* (New York, 4 February 2021) <www.bloomberg.com/news/articles/2021-02-04/freight-cost-pain-intensifies-as-pandemic-rocks-ocean-shipping> accessed 4 December 2021; Sue Lannin, 'ACCC Launches Investigations into "Exorbitant" Shipping and Port Charges' *ABC News* (Sydney, 14 September 2021) <www.abc.net.au/news/2021-09-14/prices-ports-transport-shopping-acc-covid-inflation/100458836> accessed 4 December 2021.

⁴ Digital Container Shipping Association, 'Standard for the Bill of Lading: A Roadmap towards eDocumentation' (8 December 2020) 5 <<https://dcsa.org/wp-content/uploads/2020/12/20201208-DCSA-P4-DCSA-Standard-for-Bill-of-Lading-v1.0-FINAL.pdf>> accessed 13 February 2022.

problem-solving efforts tend to be fragmented, consistent with the dynamics of the industry itself, and are detrimental to the success of blockchain BoLs.

There is no easy solution to the obstacles faced. Nevertheless, Part III provides some broad guidance on how best to overcome them. Specifically, this article calls for a global alliance between all industry stakeholders and an approach that deals with the identified prohibitive obstacles simultaneously and dynamically. Given the sheer scale of the project of a global blockchain BoL network and the number and breadth of industry participants globally, such an approach would be unlike anything seen before and would go beyond the initiatives recently introduced by some leading industry participants.

I. EVOLUTION OF THE BILL OF LADING

A) Paper bills of lading

The paper BoL is the essential legal document of international maritime shipping that allows the shipper, carrier and receiver (as well as other satellite parties, such as banks) to verify who and what goods are involved in shipment, thereby establishing trust between all parties despite their often transient relationship and geographical distance.⁵ Without it, a conflict of interests and mistrust would prevail between receivers and shippers trading from a distance: shippers want to be paid before relinquishing control of the goods, given concerns of receiver insolvency, failure to pay or fraud; receivers wish to delay payment for cash flow purposes and to ensure that the goods comply with agreed specifications despite the inability for a personal pre-shipment inspection.⁶

⁵ Časlav Pejović, *Transport Documents in Carriage of Goods by Sea: International Law and Practice* (Informa Law 2020) 25–26; Jake Herd, “‘Blocks of Lading’: Distributed Ledger Technology and the Disruption of Sea Carriage Regulation” (2019) 18 QUT Law Review 306, 307.

⁶ Anders Møllmann, *Delivery of Goods under Bills of Lading* (Routledge 2017) 11; Paul Todd, *Bills of Lading and Bankers’ Documentary Credits* (2nd edn, Lloyd’s of London Press 1993) 6–11; Paul Todd, *Modern Bills of Lading* (Collins 1986) 6–7.

The modern-day BoL developed from centuries of mercantile practice aiming to overcome this conflict,⁷ culminating in its three core functions. First, the BoL is a receipt of cargo, evidencing the quantity, quality and condition of the goods shipped, and the date of loading and shipment, among other details.⁸ Second, the BoL evidences the contract of carriage by reproducing its terms.⁹ The BoL's third and most prized function is as a document of title.¹⁰ The BoL embodies certain rights in the shipped goods. At a minimum, whoever has physical possession of the BoL has symbolic or 'constructive possession' of the goods (whilst inaccessible) mid-shipment.¹¹ The BoL holder has an exclusive right to control the goods through the carrier and accept delivery at the port of dispatch.¹² Transferable or negotiable BoLs,¹³ one of the most common types of BoLs,¹⁴ allow the shipper to pass these rights by indorsing and delivering the BoL to the receiver.¹⁵ This function is necessary given the physical inaccessibility of the goods mid-shipment.

⁷ See generally Chester B McLaughlin Jr, 'The Evolution of the Ocean Bill of Lading' (1926) 35 *Yale Law Journal* 548; Pejović (n 5) 5–19; Andrea Lista, *International Commercial Sales: The Sales of Goods on Shipment Terms* (Routledge 2018) 71–72. See also Daniel E Murray, 'History and Development of the Bill of Lading' (1983) 37 *University of Miami Law Review* 689; George Pattison, 'Observations on the History of the Bill of Lading' (1964) 50 *Mariner's Mirror* 283.

⁸ Pejović (n 5) 43; Anthon Rogers, Jason Chuah and Martin Dockray, *Cases and Materials on the Carriage of Goods by Sea* (5th edn, Routledge 2020) 290.

⁹ Pejović (n 5) 71–72; Rogers, Chuah and Dockray (n 8) 245–46.

¹⁰ Pejović (n 5) 112; Rogers, Chuah and Dockray (n 8) 303–4.

¹¹ *Enichem Anic SpA v Ampelos Shipping Co Ltd (The Delfini)* [1990] 1 *Lloyd's Rep* 252 (CA), 268. See also Torsten Schmitz, 'The Bill of Lading as a Document of Title' (2011) 10 *Journal of International Trade Law and Policy* 255, 262.

¹² Pejović (n 5) 126; Rogers, Chuah and Dockray (n 8) 303. The BoL holder has been famously described to be holding the keys to a floating warehouse: *Sanders Bros v Maclean & Co* (1883) 11 *QB* 327, 341 (Bowen LJ).

¹³ 'Negotiable', a legal term of art that means giving the transferee a better title than the transferor has, is understood by mercantile practice to mean merely 'transferable' in relation to a Bill of lading: *Kum v W'ab Tat Bank* [1971] *AC* 439, 446 (Lord Devlin).

¹⁴ United Nations Conference on Trade and Development, 'The Use of Transport Documents in International Trade' (26 November 2003) UNCTAD/SDTE/TLB/2003/3, 16 [45]–[46].

¹⁵ Pejović (n 5) 117–19; Sir Bernard Eder and others, *Scrutton on Charterparties and Bills of Lading* (23rd edn, Sweet & Maxwell 2015) 218. The BoL must indicate that the specified goods be deliverable to 'the order or assigns' of the shipper: *Lickbarrow v Mason* [1794] 5 *Term Rep* 683, 685.

This third function facilitates four significant advantages.¹⁶ First, it ensures that the receiver, when holding the paper BoL, is the only person that can accept delivery of the shipped goods described on the BoL, giving them confidence and assurance needed to pay the shipper. Secondly, and relatedly, the paper BoL is security for the shipper, who can leverage BoL possession to demand payment or otherwise retain it to collect or resell the goods, albeit to their great inconvenience and expense.¹⁷ Collectively, this ‘cash against documents’ system prompts the concurrent performance of the shipper and receiver’s obligations under the sales contract.¹⁸ Trust is bolstered by the BoL’s third advantage of serving as security for a bank providing documentary credit. Banks act as an intermediary to the transaction, paying the shipper in place of the buyer immediately upon the seller’s endorsement and presentation of the BoL to the bank and then delivering the documents to the receiver in exchange for payment.¹⁹ It is the paper BoL’s role in documentary credit that has solidified its place in maritime commerce. Finally, the paper BoL’s third function allows for the mid-shipment resale of goods, often pursued to reduce price risk and augment the profitability of international trade, especially for bulk commodities cargo like oil.²⁰

Despite the centrality of BoLs in international maritime trade, their paper form is becoming increasingly problematic. For one, the expense, effort and time required to prepare, process and administer a paper BoL are immense. A World Economic Forum report and a 2014 test shipment by IBM and Maersk reveal how processing trade documents can account for up to 20% of physical

¹⁶ See Charles Debattista, *Sale of Goods Carried by Sea* (Butterworths 1990) 9; John F Wilson, *Carriage of Goods by Sea* (7th edn, Longman 2010) 133.

¹⁷ Todd, *Bills of Lading and Bankers’ Documentary Credits* (n 6) 12; Debattista (n 16) 10–11.

¹⁸ Mollmann (n 6) 11.

¹⁹ For a more detailed description and depiction of this relationship, see Todd, *Bills of Lading and Bankers’ Documentary Credits* (n 6) 15–20.

²⁰ See Schmitz (n 11) 262.

transportation costs.²¹ Piles of paper documents need to be generated and distributed to dozens of participants,²² who share data ineffectively, with documents often processed manually.²³ These problems are exacerbated if goods are resold multiple times mid-shipment.²⁴ Errors and lost documents are also common, requiring the reproduction and redistribution of documents: a 2014 IBM–Maersk investigation saw 30 participants process documents with over 200 interactions and communications for just one shipment, resulting in 10 of their 34 days of travel spent waiting for missing documents.²⁵ Time spent idly waiting to enter port costs the international shipping industry billions of dollars

²¹ World Economic Forum, ‘Trade Tech: A New Age for Trade and Supply Chain Finance’ (13 September 2018) 4 <https://www3.weforum.org/docs/White_Paper_Trade_Tech_report_2018.pdf> accessed 13 February 2022; IBM, ‘Maersk and IBM Unveil First Industry-Wide Cross-Border Supply Chain Solution on Blockchain’ (5 March 2017) <<https://newsroom.ibm.com/2017-03-05-Maersk-and-IBM-Unveil-First-Industry-Wide-Cross-Border-Supply-Chain-Solution-on-Blockchain>> accessed 1 November 2021; Tom Groenfeldt, ‘IBM and Maersk Apply Blockchain to Container Shipping’ *Forbes* (New Jersey, 5 March 2017) <www.forbes.com/sites/tomgroenfeldt/2017/03/05/ibm-and-maersk-apply-blockchain-to-container-shipping> accessed 1 November 2021; Finans Leonora Beck, ‘Rivals Fear Maersk Supremacy in New Digital Era’ (*ShippingWatch*, 17 October 2017) <<https://shippingwatch.com/carriers/Container/article9955814.ece>> accessed 1 November 2021.

²² See e.g. Ian Allison, ‘Shipping Giant Maersk Tests Blockchain-Powered Bill of Lading’ *International Business Times* (New York City, 14 October 2016) <www.ibtimes.co.uk/shipping-giant-maersk-tests-blockchain-powered-bills-lading-1585929> accessed 1 November 2021; IBM (n 21).

²³ Mark B Solomon, ‘Maersk, IBM Launch First Blockchain Joint Venture for Trade, Transportation’ *DC Velocity* (North Attleborough, 16 January 2018) <www.dvelocity.com/articles/29429-maersk-ibm-launch-first-blockchain-joint-venture-for-trade-transportation> accessed 1 November 2021; Shailaja A Lakshmi, ‘PIL, IBM to Implement Electronic Bill of Lading’ (*MarineLink*, 3 October 2018) <www.marinelink.com/news/pil-ibm-implement-electronic-bill-lading-442198> accessed 1 November 2021.

²⁴ Todd, *Bills of Lading and Bankers’ Documentary Credits* (n 6) 87–88.

²⁵ ‘Maersk and IBM Unveil First Industry-Wide Cross-Border Supply Chain Solution on Blockchain’ (n 21); ‘Blockchain is About to Revolutionise the Shipping Industry’ *The Business Times* (Singapore, 24 April 2018) <www.businesstimes.com.sg/transport/blockchain-is-about-to-revolutionise-the-shipping-industry> accessed 1 November 2021. See also Sanne Wass, ‘Tech Startup Automates Bill of Lading and Invoice Auditing’ *Global Trade Review* (London, 15 March 2018) <<https://www.gtreview.com/news/fintech/tech-startup-automates-bill-of-lading-and-invoice-auditing>> accessed 1 November 2021.

each year in wasted fuel alone,²⁶ not to mention the opportunity cost of delayed or missed future freights and lost arbitrage opportunities for the final receivers.

Paper BoLs are also prone to fraud, such as parties duplicating documents to claim the goods or to sell them,²⁷ or alternatively using fraudulent trade documents to seek finance.²⁸ This is exacerbated by the outdated practice of sending multiple BoLs in case one does not complete the journey to the buyer.²⁹ For example, an Australian case found that a freight forwarder had engaged in misleading and deceptive conduct for representing that the issued house BoLs were the original negotiable bills; the original bills had already been issued and used to release the shipment of sheep skins in China. This prevented the financing company in possession of the second set of bills (issued by the freight forwarder on behalf of the shipper) from claiming the goods when the shipper defaulted on their loan.³⁰ Such a case is not unusual, with non-vessel owning common carriers (NVOCCs) accounting for over 95% of all improperly issued BoLs,³¹ sometimes through neglectful error but often with the intention of defrauding the commercial financial system to seek multiple financing or to launder money, among other reasons.³² Anecdotal reports indicate that fraudulent uses of BoLs are not uncommon and notably have been of increasing

²⁶ Simon Valeur, 'Waiting Time in Ports Costs Shipping Billions of Dollars Annually' (*ShippingWatch*, 14 August 2019) <<https://shippingwatch.com/Ports/article11550328.ece>> accessed 1 November 2021.

²⁷ Law Commission (UK), 'Digital Assets: Electronic Trade Documents' (Law Commission Consultation Paper No 254, 2021) para 7.50.

²⁸ See e.g. John Basquill, 'Singapore Oil Trader Hontop Faces Fraud Claims: What Went Wrong?' *Global Trade Review* (London, 22 July 2020) <<https://www.gtreview.com/news/asia/singapore-oil-trader-hontop-faces-fraud-claims-what-went-wrong>> accessed 18 December 2021.

²⁹ Pejović (n 5) 35. See also Drew Nicol, 'IBM and PIL Complete Blockchain Pilot for Instant Bill of Lading Transfer' *Global Trade Review* (London, 6 February 2019) <<https://www.gtreview.com/news/fintech/ibm-and-pil-complete-blockchain-pilot-for-instant-bill-of-lading-transfer>> accessed 1 November 2021.

³⁰ *Australian Capital Financial Management Pty Ltd v Freight Solutions (Vic) Pty Ltd* [2017] NSWDC 279.

³¹ ICC Academy, 'Misuse of NVOCC Bills of Lading Brings New Certificate to Raise Industry Awareness' (15 January 2019) <<https://icc.academy/misuse-of-nvocc-bills-of-lading-brings-new-certificate-to-raise-industry-awareness>> accessed 18 December 2021.

³² Alsum, 'What is an NVOCC and What Is Its Role in Container Transport?' (16 February 2021) <<https://alsum.co/en/noticias/que-es-un-nvocc-y-cual-su-papel-en-el-transporte-de-contenedores>> accessed 26 January 2022; International Chamber of Commerce Commercial Crime Services, 'IMB Warns Against Misuse of NVOCC Bills of Lading' <<https://www.icc-ccs.org/index.php/317-imb-warns-against-misuse-of-nvocc-bills-of-lading>> accessed 26 January 2022.

concern in Asia,³³ prompting industry participants to reconsider the use of electronic BoLs.

Lastly, the assumption that the paper BoL arrives before the cargo no longer holds true, especially for shorter routes. Engineering advancements mean that ships travel increasingly faster on their routes whilst documentation transporting and processing speeds have remained unchanged,³⁴ if not slower given more extensive paper trails: an average trade finance deal for a single commodities cargo by sea can require processing up to 36 original documents and 240 copies by as many as 27 different pairs of hands.³⁵ This timing reversal is especially true if goods are subject to multiple resales mid-shipment that involve multiple financing banks.³⁶ Consequently, carriers are left with the unsavoury choice of paying for storage at the port of destination; keeping the goods on ship at the port, incurring demurrage costs and potentially missing their next scheduled shipment; or suffering penalties and forgoing insurance for releasing the goods without an original paper BoL.³⁷ Meanwhile, buyers bear the risk of their goods perishing or market prices falling whilst waiting for delivery of the paper BoL.

B) Electronic bills of lading

Many industry players envisaged that computing innovations would allow electronic BoLs to resolve the problems of paper BoLs. An electronic system allows for the instantaneous transfer of BoLs, cutting costs and reducing delays, whilst potentially increasing security and reducing human error and fraud, as

³³ Eleanor Wragg, 'Trade-Based Fraud in Asia — A Many-Headed Beast?' *Global Trade Review* (London, 23 July 2019) <<https://www.gtreview.com/magazine/volume-17-issue-3/trade-based-fraud-asia-many-headed-beast>> accessed 18 December 2021.

³⁴ Todd, *Bills of Lading and Bankers' Documentary Credits* (n 6) 86; Todd, *Modern Bills of Lading* (n 6) 17, 134.

³⁵ Jonathan Saul, 'Commodities Trade Finance Goes Electronic After Centuries of Paper' *Reuters* (London, 1 June 2015) <<https://cn.reuters.com/article/trade-finance-electronic/commodities-trade-finance-goes-electronic-after-centuries-of-paper-idUKL5N0YK35320150601>> accessed 1 November 2021.

³⁶ Todd, *Bills of Lading and Bankers' Documentary Credits* (n 6) 86.

³⁷ Wilson (n 16) 157; Todd, *Bills of Lading and Bankers' Documentary Credits* (n 6) 87–88.

well as facilitating innovative features like shipment tracing.³⁸ Indeed, the United Nations estimates a 44% reduction in export times, a 31% lowering of export costs and a USD257 billion boost to global exports if the Asia-Pacific region alone moves all trade-related paperwork online.³⁹

In pursuit of these advantages, several electronic platforms have been set up over the past three decades, most notably SeaDocs, BOLERO and essDOCS.⁴⁰ Nonetheless, despite everything that electronic BoL systems have promised, they have all failed to promote the use of electronic BoLs: as highlighted, only 0.1% of all BoLs today are issued electronically.⁴¹ Whilst each system had their own idiosyncratic design and flaws, several similar issues were evident. For one, platforms were typically designed as a central registry, operated by a third party that recorded and stored all transactions and administered the transfer of control over electronic documents. However, a central registry created a single point of failure, leaving platforms prone to cyberattacks and system failures.⁴² Furthermore, participants did not trust a central intermediary perceived to be serving their own interests.⁴³ Traders were also unwilling to record information in a central registry viewable by their competitors or government agencies.⁴⁴

Platforms generally operated as private ‘clubs’: participants had to meet set criteria to register and use them, and electronic BoLs could only be exchanged

³⁸ Mollmann (n 6) 156; Stephen Mills, *Bills of Lading: A Guide to Good Practice* (3rd edn, The North of England P&I Association 2014) para 306. See also Miriam Goldby, ‘Electronic Bills of Lading and Central Registries: What is Holding Back Progress?’ (2008) 17 Information and Communications Technology Law 125, 134–35; World Economic Forum, ‘Paperless Trading: How Does It Impact the Trade System?’ (2 November 2017) 5–6 <https://www3.weforum.org/docs/WEF_36073_Paperless_Trading_How_Does_It_Impact_the_Trade_System.pdf> accessed 13 February 2022.

³⁹ ‘Thinking Outside the Box’ *The Economist* (London, 26 April 2018) 18–19.

⁴⁰ For an overview of such systems, see Miriam Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (2nd edn, Oxford University Press 2019) paras 11.26–11.34; Emmanuel T Laryea, *Paperless Trade: Opportunities, Challenges, and Solutions* (Kluwer Law International 2002) 83–90.

⁴¹ Digital Container Shipping Association (n 4) 5.

⁴² Chambers (n 1). For example, the case of *MSC Mediterranean Shipping Company v Glencore International*, whilst not strictly regarding a central registry system, involved the hacking of a computer system containing pin codes that were sent to the receiver to accept shipment: *MSC Mediterranean Shipping Company SA v Glencore International AG* [2017] EWCA 365 (Civ) [72]–[77].

⁴³ See Laryea (n 40) 79–83.

⁴⁴ See David A Bury, ‘Electronic Bills of Lading: A Never-Ending Story?’ (2016) 41 *Tulane Maritime Law Journal* 197, 214; *ibid* 79–80.

between parties on the same platform. Confinement to one platform proved detrimental to most systems, as the benefits could only be realised if a significant portion of the industry was on the *same* network.⁴⁵ Registration was an obstacle and deterrent for industry participants.⁴⁶ Transacting with non-registered parties was difficult, generally requiring conversion of the electronic BoL to a paper BoL, which eradicated the benefits of digitalisation whilst still risking non-recognition from courts.⁴⁷

Most importantly, electronic BoLs were not seen in law or practice as ‘functionally equivalent’ to paper BoLs.⁴⁸ It has been notoriously difficult to digitalise the three core functions of a paper BoL, especially the document of title function, which was developed on the premise of transporting and holding a physical document. Most domestic law jurisdictions and the body of international law are yet to recognise electronic BoLs as functionally equivalent to paper BoLs. Former electronic BoL platforms attempted to overcome this through the use of contract law, requiring all participants to sign a multi-party contract (subject to an established legal system, typically English law) that included clauses affirming party recognition of the electronic BoL’s functional equivalence.⁴⁹ Such contracts relied on the common law concepts of novation⁵⁰ and attornment⁵¹ to facilitate electronic BoL transferability and constructive possession of the cargo.⁵² Nevertheless, the platform designs and contractual system imperfectly replicated the paper BoL’s three functions, with the contractual system notably abstracting the relationship between the shipper,

⁴⁵ Wilson (n 16) 170–71.

⁴⁶ See e.g. United Nations Conference on Trade and Development, ‘The Use of Transport Documents in International Trade’ (n 14) 27 [79].

⁴⁷ Pejović (n 5) 220.

⁴⁸ *ibid* 219–20.

⁴⁹ Rogers, Chuah and Dockray (n 8) 343. See e.g. Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) paras 6.03–6.04.

⁵⁰ This involves the replacement of one party to the contract of carriage with another, effectively transferring the contractual relationship.

⁵¹ This involves the transfer of the possessory rights to the cargo that underlie the BoL.

⁵² For a detailed description of how these concepts operate in an electronic BoL context, see Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) paras 6.07–6.32; Christian Albrecht, ‘Blockchain Bills of Lading: The End of History? Overcoming Paper-Based Transport Documents in Sea Carriage Through New Technologies’ (2019) 43 *Tulane Maritime Law Journal* 251, 261. See Goldby, ‘Electronic Bills of Lading and Central Registries’ (n 38) 130.

carrier and receiver.⁵³ As a result, there was a general lack of trust and confidence in these platforms and their ability to uphold the rights of both shipping industry participants and third parties interacting with the BoL, such as banks.⁵⁴

C) Blockchain bills of lading

Whilst Satoshi Nakamoto's groundbreaking white paper⁵⁵ first materialised as Bitcoin and spurred the creation of other cryptocurrencies, blockchain's reliance on cryptographic proofs, removing the need for 'trusted' third parties,⁵⁶ has inspired application to a wide range of industries. Notably, international shipping participants and non-industry innovators saw the potential for blockchain BoLs to resolve the problems of the former electronic platforms and make blockchain BoLs a viable alternative to paper BoLs.

There are several carriers and third-party developers that have released their own blockchain BoL platforms, including TradeLens,⁵⁷ Global Shipping Business Network,⁵⁸ CargoX⁵⁹ and Wave BL.⁶⁰ More platforms continue to be developed, including most recently the International Port Community System Association's Blockchain Bill of Lading project.⁶¹ Whilst details of the underlying blockchain technology for each platform are scant, they all appear to be built as proof-of-work blockchains; it is nonetheless possible that future

⁵³ Elena Orrù, 'The Challenges of ICTs in the Shipping Sector Among International Uniform Law, Codification and Lex Mercatoria: The Electronic Bill of Lading' in Justyna Nawrot and Zuzanna Peplowska-Dąbrowska (eds), *Codification of Maritime Law: Challenges, Possibilities and Experience* (Informa Law 2019) 134, 138.

⁵⁴ See Bury (n 44) 233; Marek Dubovec, 'The Problems and Possibilities for Using Electronic Bills of Lading as Collateral' (2006) 23 *Arizona Journal of International and Comparative Law* 438, 457; Laryea (n 40) 80. See also Todd, *Bills of Lading and Bankers' Documentary Credits* (n 6) 131; Stephen Girvin, *Carriage of Goods by Sea* (2nd edn, Oxford University Press 2011) para 13.15.

⁵⁵ Satoshi Nakamoto, 'Bitcoin: A Peer-to-Peer Electronic Cash System' (Report, 2009) <<https://bitcoin.org/bitcoin.pdf>> accessed 1 November 2021.

⁵⁶ *ibid* 1.

⁵⁷ TradeLens (Website) <www.tradelens.com> accessed 1 November 2021.

⁵⁸ GSBN (Website) <www.gsbntrade.com> accessed 1 November 2021.

⁵⁹ CargoX (Website) <<https://cargox.io>> accessed 1 November 2021.

⁶⁰ Wave BL (Website) <<https://waveelectronicbol.com>> accessed 1 November 2021. For an overview on these platforms, see Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) paras 11.42–11.59.

⁶¹ International Port Community System Association, 'IPCSA Bill of Lading' <<https://ipcsa.international/initiatives/ipcsa-bill-of-lading>> accessed 18 December 2021.

developed blockchain BoL platforms will use proof-of-stake consensus mechanisms.⁶²

An electronic BoL transfer between a shipper and receiver is recorded as a 'block'. This transaction is not processed until verified by computer 'nodes', creating a unique 'hash' digit that corresponds to the transaction, which is also timestamped. Transaction records are then added to each node's ledger, establishing multiple verifiable copies of the transaction record. As these proofs are distributed among many nodes, the data recording the transaction can only be appended, and cannot be deleted or amended.⁶³ The carrier is paid according to the carriage contract, and the shipper receives a unique token representing the electronic BoL, granting them exclusive control; the shipper can transfer the token to receivers, banks or other parties as required. Each new transaction is recorded as a new block 'chained' to all previous blocks, producing a complete, immutable record of transactions.⁶⁴ Private and public keys are used by both transacting parties to sign the unique identifying hash of the new block and authenticate each transferrer's identification.⁶⁵ Collectively, this ensures that no one token is accidentally or fraudulently 'double-spent' by multiple persons. The carrier delivers the goods to the receiver with a public key matching that of the last block.⁶⁶ It is this decentralised verification infrastructure, unique to blockchain technology, that finally achieves functional equivalence and, most importantly, digitalises the document of title function.

The benefits of blockchain BoLs mirror the promised benefits of electronic BoLs. Most prominently, because documents can be sent to the receiver in minutes rather than days or weeks, blockchain BoL trials have

⁶² For example, proof-of-stake is used by ShipChain in their tracking and tracing public blockchain system Mainnet: Shipping and Freight Resource, 'Blockchain Transaction Capacity and Speed Boost for Shippers as Shipchain's "MAINNNET" Goes Live' (1 September 2000) <www.shippingandfreightresource.com/blockchain-transaction-capacity-and-speed-boost-for-shippers-as-shipchains-mainnet-goes-live> accessed 4 December 2021. Ethereum, which several currently available blockchain BoL platforms are built upon, including CargoX, is currently transitioning its consensus mechanism from proof-of-work to proof-of-stake: Ethereum, 'Proof-of-Stake (POS)' (10 December 2021) <<https://ethereum.org/en/developers/docs/consensus-mechanisms/pos>> accessed 18 December 2021.

⁶³ Herd (n 5) 309.

⁶⁴ *ibid.*

⁶⁵ Nakamoto (n 55) 2.

⁶⁶ Herd (n 5) 309–10.

already seen significant cost and time savings.⁶⁷ The transaction verification completed by the blockchain nodes and the immutable nature of the recorded transactions ensures the authenticity and integrity of recorded transactions whilst making accidental or malicious tampering almost impossible.⁶⁸ The technology also has the potential to revolutionise other aspects of maritime shipping complementary to the BoL, such as tracking shipments, monitoring the condition and environment of the shipped goods and executing smart contracts.⁶⁹

II. OBSTACLES TO UNIVERSAL ADOPTION OF BLOCKCHAIN BILLS OF LADING

Despite the promise of blockchain BoLs, the technology and its application to international shipping logistics are still in their infancy, with many platforms still in the process of, or just concluding, the proof-of-concept and trial stages. Whilst the benefits are clear, blockchain is yet another technology attempting to resolve the problems with paper BoLs. Several significant

⁶⁷ See e.g. Ben Meyer, 'CargoX "Smart" Bill of Lading Aces Test' *American Shipper* (Chattanooga, 24 August 2018) <www.freightwaves.com/news/cargo-x-smart-bill-of-lading-aces-test> accessed 1 November 2021; Sanne Wass, 'TradeLens Develops App Marketplace, Explores Link with we.trade Blockchain Platform' *Global Trade Review* (London, 9 July 2019) <www.gtreview.com/news/fintech/tradelens-develops-app-marketplace-explores-link-with-we-trade> accessed 1 November 2021; The Maritime Executive, 'PIL and IBM Trial Delivery Using Blockchain Platform' (2 February 2019) <www.maritime-executive.com/article/pil-and-ibm-trial-delivery-using-ibm-blockchain-platform> accessed 1 November 2021.

⁶⁸ Edwin Lopez and Jennifer McKeivitt, 'Maersk, IBM Partner to Boost Supply Chain Transparency with Blockchain' *Supply Chain Dive* (Washington, DC, 6 March 2017) <www.supplychaindive.com/news/blockchain-maersk-ibm-digitization-challenge-wal-Mart-real-time/437412> accessed 1 November 2021.

⁶⁹ Alysia Xirinachs, 'Blockchain Technology: Friend or Foe?' *More Than Shipping* (New York, 12 May 2017) <www.morethanshipping.com/blockchain-technology-friend-foe> accessed 1 November 2021; Sara Hadim, 'Tradelens Will Improve Operations in the Shipping Industry' *More Than Shipping* (New York, 25 April 2019) <www.morethanshipping.com/tradelens-will-improve-operations-in-shipping> accessed 1 November 2021; Hariesh Manaadiar, 'Is Blockchain the Panacea for the Shipping Industry? Hype vs Reality' *Shipping and Freight Resource* (Johannesburg, 30 January 2019) www.shippingandfreightresource.com/is-blockchain-the-panacea-for-the-shipping-industry accessed 1 November 2021; Brian Aoach, 'Commentary: Three Observations about the Adoption of Distributed Ledger Technology in Supply Chain' *Freight Waves* (Chattanooga, 13 August 2019) <www.freightwaves.com/news/three-observations-adoption-distributed-ledger-tech-in-supply-chain> accessed 1 November 2021.

obstacles are forced to use of the technology by the majority of the industry as a substitute for paper BoLs. These need to be acknowledged and addressed as soon as possible if the goal of an electronic BoL is to become a reality; otherwise, blockchain BoLs face the same fate as its predecessors. This article examines what are considered to be the most prohibitive obstacles: the lack of an international legal framework, the lack of interoperability between platforms and other technical issues, and issues with trust and perceptions of commercial viability.

A) Lack of a universal legal framework

From a technological standpoint, blockchain satisfactorily replicates the three BoL functions. However, industry participants also need reassurance that the law will recognise and enforce blockchain BoLs and the underlying rights and obligations associated with its functional equivalence. Whilst there is greater confidence that legal systems can and will recognise the functions of receipt of goods and evidence of contract,⁷⁰ legal recognition of the document of title and negotiability function remains in significant doubt. This is particularly because the document of title function, as encoded around the world, is based on the notion of physically possessing and sending a tangible paper document. An electronic 'document' naturally cannot be physically 'possessed' as a tangible paper BoL can; it can merely be 'exclusively controlled' through some electronic system, running counter to centuries of law and mercantile practice.⁷¹

Historically, legal systems around the world, especially in key maritime jurisdictions such as the United Kingdom, have not recognised electronic BoLs as equivalent to paper BoLs. In addition, reliance on contract law as a workaround has proven problematic. For one, parties remain uncertain that courts globally will universally uphold the contractual terms that declare functional equivalence.⁷² Relatedly, the legal standing of third parties involved, such as banks using the blockchain BoL as collateral, is unknown, contributing to their reluctance to engage with blockchain BoLs.⁷³ Contracts also constitute another form of the private 'club' problem: non-members of an electronic BoL

⁷⁰ See e.g. Laryea (n 40) 61–63, 72–73; Wilson (n 16) 166. See also Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) para 2.08. But see Pejović (n 5) 239.

⁷¹ Pejović (n 5) 221–22.

⁷² Bury (n 44) 221–22.

⁷³ *ibid* 223; Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) para 6.128.

platform ‘club’ may disagree with the agreed terms used within the club’s contracts, leading to disputes or a refusal by non-members to trade altogether with members.⁷⁴ This has been a major obstacle to the growth of electronic BoLs of the past.⁷⁵

Multi-party contracts are therefore impractical, legally uncertain and are overall a poor substitute for a globally uniform legal framework. However, blockchain BoL solutions continue to rely on multi-party contracts given the stagnant state of the law.⁷⁶ Legal systems around the world will need to collectively change to accommodate blockchain BoLs if they are to become a viable solution. The origins of such change could be rooted at either the domestic level or the international level. The pros and cons of each are explored below.

Domestic law solutions

Focusing on changing domestic laws seems an ideal starting point: whilst the legal principles of BoLs are, at their simplest, universal, they are formalised via the domestic laws of key shipping jurisdictions. Several possibilities have been envisaged. Some have argued that common law courts can leverage the *lex mercatoria* foundations of BoLs⁷⁷ to recognise the blockchain BoL’s digital form and the expected rights and obligations of the shipping industry. This recognition could happen either by courts extending the law and trade usage for paper BoLs *mutatis mutandis* by broadening relevant concepts, such as ‘possession’, to allow for a digital materialisation of paper BoLs or, alternatively, by recognising a new *lex mercatoria* for blockchain BoLs.⁷⁸ Both scenarios seem improbable: despite almost 30 years of electronic BoLs, usage of any form of platform remains minimal today, with restrained optimism for exponential growth given the comfort and certainty of paper BoLs.⁷⁹ Since the common law test for establishing custom is based on the number of transactions, not the

⁷⁴ Eleanor Wragg, ‘Governments Urged to Lift Legal Barriers to Digital Trade to Mitigate COVID-19 Impact’ *Global Trade Review* (London, 22 April 2020) <www.gtreview.com/news/global/governments-urged-to-lift-legal-barriers-to-digital-trade-to-mitigate-covid-19-impact> accessed 1 November 2021.

⁷⁵ Pejović (n 5) 220–21.

⁷⁶ Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) para 6.46.

⁷⁷ See above (n 9) and accompanying text.

⁷⁸ See e.g. Albrecht (n 52) 268–71; Orrù (n 53) 134.

⁷⁹ Albrecht (n 52) 274.

length of time of the ‘custom’,⁸⁰ there is no current merchant custom that could be relied upon by the courts. Furthermore, the little case law on electronic BoLs globally thus far reveals a general reluctance by courts to view them as functionally equivalent.⁸¹ Whilst the view of courts may change when confronted with blockchain BoLs, given that they better achieve functional equivalence than previous electronic BoLs,⁸² there is no guarantee of that outcome. Overall, there is little value for industry participants in bringing an expensive and likely unsuccessful case.

It has also been argued that the trade document laws of some jurisdictions are already sufficiently broad to support the recognition of electronic BoLs, including blockchain BoLs, and the transfer of rights through those mediums. For example, Jake Herd has argued that the definitions of ‘document’ and ‘document of title’ under Australian federal and state legislation have sufficient interpretative scope to encompass blockchain BoLs, particularly as blockchain BoLs come the closest to achieving functional equivalence.⁸³ However, the broadening of the interpretative scope of pre-existing legislation remains legally uncertain in each jurisdiction until there is an unlikely favourable ruling from an authoritative court.

The more certain and immediate alternative is for legislated change. Some jurisdictions, including the US, Germany, South Korea and Italy, have introduced legislation recognising electronic BoLs and their functional equivalence.⁸⁴ In a less extreme alternative, a similar result could arguably be achieved with simple tweaks to the language or interpretation of pre-existing legislation to expand their scope to electronic documents.⁸⁵ Broadly, this involves expanding the definition of negotiable ‘bills of lading’ (or other equivalent definitions, such as ‘trade document’) and recognising that the

⁸⁰ *Edelstein v Schuler & Co* [1902] 2 KB 144, 154 (J Bingham).

⁸¹ Bury (n 44) 227–28, discussing *Glencore International AG v MSC Mediterranean Shipping Co* [2015] EWHC 1989 (Comm). On the lack of case law, see, for example, the responses to question 3 in Clyde & Co, ‘The Legal Status of the Electronic Bills of Lading: A Report for the ICC Banking Commission’ (International Chamber of Commerce, 17 October 2018).

⁸² Albrecht (n 52) 268, 270.

⁸³ Herd (n 5) 311–14. Regarding Danish law, see Mollmann (n 6) 159–68, 176.

⁸⁴ For an overview of the legislated changes, see Pejović (n 5) 239–40; Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) paras 6.57–6.64; Albrecht (n 52) 271–72. See also Orrù (n 53) 143. For an overview of the legal status of electronic BoLs in 10 key jurisdictions, see generally Clyde & Co (n 82).

⁸⁵ Goldby, ‘Electronic Bills of Lading and Central Registries’ (n 38) 129.

‘document of title’ function can be executed not just through possession of a paper BoL but also through exclusive control of an electronic BoL. For example, section 1(5) of the Carriage of Goods by Sea Act 1992 (UK), which explicitly recognises the three functions of a paper BoL,⁸⁶ allows for regulations to be made that apply the Act to ‘an electronic communications network’ such as a blockchain or other electronic BoL network.⁸⁷ However, no such regulations have been implemented since its inception. Nevertheless, it presents an apt example of one way that legislative texts that recognise paper BoLs and the document of title function can be modified or expanded to include electronic BoL equivalents.

Despite the advantages of clarity and certainty, legislative reform has been slow. The speckled legislative amendments alone have been insufficient to support any form of electronic BoL so far.⁸⁸ Legislated changes must be far-reaching given the cross-border nature of shipping logistics. Furthermore, without a coordinated effort, there is significant risk that the rights and obligations recognised will vary in each jurisdiction, creating a fractured global legal framework that is difficult and expensive for industry participants to navigate. A more global, uniform development is therefore required.

International law solutions

Global consistency in law is often best achieved through widespread adoption of an international legal instrument. The different types of instruments available differ in the mechanisms relied upon and the types of goals pursued to achieve consistency across multiple domestic jurisdictions.⁸⁹ Whereas international conventions impose uniform binding obligations on a state to be implemented in their jurisdiction, other soft law instruments merely nudge and

⁸⁶ Carriage of Goods by Sea Act 1992 (UK) s 2.

⁸⁷ *ibid* art 1(5).

⁸⁸ Goldby, ‘Electronic Bills of Lading and Central Registries’ (n 38) 129.

⁸⁹ For an overview of the range of instruments available to establish a global legal framework and how they do so, see Roy Goode, ‘Reflections on the Harmonisation of Commercial Law’ (1991) *os-19(1) Uniform Law Review* 54, 57; Hannu Honka, ‘Harmonization of Contract Law through International Trade: A Nordic Perspective’ (1991) 11 *Tulane European and Civil Law Forum* 111, 127; Olena Bokareva, *Uniformity of Transport Law through International Regimes* (Edward Elgar 2019) 92–112. See also Kristoffer Koch, ‘Quest for Harmonization to Implement Electronic Bills of Lading: An International Perspective’ (Master’s thesis, University of Gothenburg 2021) 24–31.

guide the rules and practices of state and industry to a point of harmony. It is therefore essential to use the right instrument and mechanism for the context.⁹⁰

In the case of electronic transferable records such as blockchain BoLs, that context is extending or adapting existing legal principles developed for the paper BoL to new and evolving technology. They also require greater consistency and certainty in the legal principles as applied to electronic BoLs, such that there is significant uptake from states with little variability across jurisdictions and that industry participants are confident that those principles will be enforced. It is suggested that there are only two international legal instruments that fit these parameters: international conventions and model laws.

a) Unification, International Conventions and the Rotterdam Rules

The most extreme form of cross-jurisdictional consistency via international law is ‘uniformity’. Whilst uniformity’s definition is ambiguous and wide-ranging,⁹¹ this article takes it to mean the imposition of an inflexible international obligation to adopt uniform rules.⁹² This is almost always pursued via an international convention. It should be noted that uniformity via international convention is somewhat of a misnomer: even the most widely adopted conventions are not universally adopted, and adopting states often lodge reservations or declarations regarding their interpretation or application.⁹³ Furthermore, even with interpretation principles and resources, jurisdictional differences in interpretation and application are inevitable. Nevertheless, international conventions provide certainty and predictability in the law for all

⁹⁰ Bokareva (n 89) 84, discussing Mario Matteucci, ‘The Unification of Commercial Law’ (1960) *Journal of Business Law* 137, 137–39.

⁹¹ See e.g. Bokareva (n 89) 73–77; Ajendra Srivastava, *Modern Law of International Trade: Comparative Export Trade and International Harmonization* (Springer 2020) 27; Camilla Baasch Andersen, ‘Defining Uniformity in Law’ (2007) 12 *Uniform Law Review* 5.

⁹² Srivastava (n 91) 27–28; Koch (n 89) 18–19.

⁹³ As permitted and regulated by the Vienna Convention on the Law of Treaties (adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTS 331, pt 1 s 2. Given the undermining of the goal of uniformity of a trade-based treaty, the United Nations Commission on International Trade Law generally prohibits reservations or declarations in its drafted international conventions: United Nations Commission on International Trade Law, ‘A Guide to UNCITRAL: Basic Facts about the United Nations Commission on International Trade Law’ (United Nations, January 2013) para 36 <<https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/12-57491-guide-to-uncitral-e.pdf>> accessed 14 February 2022. See also Bokareva (n 89) 95–97.

relevant stakeholders, which facilitate global trade and reduce dispute costs.⁹⁴ Unsurprisingly, they were the predominant means of securing global legal uniformity in the 20th century, including in international maritime and transport law.⁹⁵

It would at first seem that an international convention would be the preferred instrument for establishing a global legal framework for blockchain (and other electronic) BoLs. Shipping industry participants remain wary of the technology, in part due to the lack of certainty of their legal rights (as will be discussed later), which a widely adopted international convention could easily remedy. Furthermore, international conventions are a familiar tool given the several monolithic international conventions that already regulate the space of international maritime law and trade law, including the United Nations Convention on Contracts for the International Sale of Goods⁹⁶ and the Hague/Hague–Visby Rules.⁹⁷

Taking this approach, the best available option is to encourage adoption of the 2008 United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (Rotterdam Rules),⁹⁸ which was developed in light of concerns that the legal regime regulating the international carriage of goods lacked uniformity and ‘fail[ed] to adequately take into account ... the use of electronic transport documents’.⁹⁹ With a technologically neutral

⁹⁴ Srivastava (n 91) 24–26; Bokareva (n 89) 77, 80–81. See also Koch (n 89) 19–20, discussing William Tetley, ‘Uniformity of International Private Maritime Law: The Pros, Cons, and Alternatives to International Conventions; How to Adopt an International Convention’ (2000) 24 *Tulane Maritime Law Journal* 775, 797–800.

⁹⁵ Bokareva (n 89) 94, 116; Srivastava (n 89) 36.

⁹⁶ United Nations Convention on Contracts for the International Sale of Goods (adopted 11 April 1980, entered into force 1 January 1988) 1489 UNTS 3.

⁹⁷ International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading (adopted 25 August 1924, entered into force 2 June 1931) 120 LNTS 155 (Hague Rules); Protocol to Amend the International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading (adopted 23 February 1968, entered into force 23 June 1977) 1412 UNTS 121 (Hague–Visby Rules); Protocol to Amend the International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading (adopted 21 December 1979, entered into force 14 February 1984) 1412 UNTS 121.

⁹⁸ United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (adopted 11 December 2008, not entered into force) (Rotterdam Rules).

⁹⁹ United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea, UNGA Res 63/122 (2 February 2009) UN Doc A/RES/63/122, Preamble para 2.

definition of ‘negotiable electronic transport record’,¹⁰⁰ the Convention’s broad scope encompasses blockchain BoLs. Most importantly, it provides that mandated requirements for paper BoLs apply to electronic transport records¹⁰¹ and guarantees the functional equivalence of the issuance, exclusive control, and transfer of an electronic transport record to its paper BoL counterparts.¹⁰² Based on its content, the Rotterdam Rules are therefore an ideal candidate to establish the necessary global legal framework for blockchain BoLs.

The burgeoning problem with the Rotterdam Rules is that it is yet to enter into force 13 years after it was drafted, requiring 15 more ratifications or accessions to reach the required 20.¹⁰³ It has likewise attracted little support from major shipping nations.¹⁰⁴ The reasons behind this resistance are varied and specific to the interests of each state (and their locally operating industry participants). Many of the issues are also associated with provisions completely unrelated to the electronic transport document provisions; the Rotterdam Rules were designed to be a comprehensive multimodal transport treaty that would replace the current international convention framework: a framework fragmented by several international conventions, non-uniformly adopted protocols and many reservations and declarations. This seems to be revealing in and of itself: it could be adduced that there is no global appetite to replace the likes of the Hague/Hague–Visby Rules that form part of the current framework. States appear to prefer to give precedence to their own modified implementation of the current rules for the carriage of goods by sea and their sovereignty rather than pursuing a new and totally uniform legal framework.¹⁰⁵

Despite their best efforts to achieve uniformity, the Rotterdam Rules are unlikely to ever enter into force. To scrap it and begin the lengthy and costly process of drafting a new international convention seems wasteful given the observed preferences of states. Ultimately, the use of an international

¹⁰⁰ Rotterdam Rules (n 98) arts 1(18)–(19).

¹⁰¹ *ibid* arts 8(a) and 9.

¹⁰² *ibid* art 8(b).

¹⁰³ United Nations Treaties Collection, ‘United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea’ (United Nations Treaty Collection: Status of Treaties) <https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XI-D-8&chapter=11&clang=_en> accessed 1 November 2021.

¹⁰⁴ See e.g. ‘Positions of Belgium, France, Germany and the United Kingdom’ (*Rotterdam Rules*, 30 May 2013) <www.rotterdamrules.com/content/positions-belgium-france-germany-and-united-kingdom-0> accessed 1 November 2021.

¹⁰⁵ This is not unique to the Rotterdam Rules: Alan D Rose, ‘The Challenges for Uniform Law in the Twenty-First Century’ (1996) 1 *Uniform Law Review* 9, 13.

convention to establish a uniform legal framework for blockchain BoLs (and electronic BoLs generally) is not viable. A different instrument is needed that is sensitive to the different legal systems and preferences of each state but that nevertheless leads to a harmonious global legal framework.

b) Harmonisation, Model Laws and the MLETR

If uniformity is too high and rigid a standard to be achieved for a global legal framework, harmonisation provides a more flexible alternative. Whilst the distinction between unification and harmonisation is not clear-cut,¹⁰⁶ this article views harmonisation as the pursuit of a common baseline of laws in a particular legal field across multiple jurisdictions and/or reconciling differences in an area of law between different legal systems.¹⁰⁷ This consistency standard can be achieved through a multitude of instrument types including model laws, standards and legislative guides.¹⁰⁸ Such instruments are generally not legally binding on any one state and, as such, can be modified as desired or necessary to accommodate the legal system and the political and economic pressures of each adopting jurisdiction.¹⁰⁹ Given this, greater input from non-state or non-government actors is possible, and the instruments can be drafted and adopted much quicker than a legislative instrument or treaty.¹¹⁰ Thus, harmonisation is ideal when total uniformity in law is not desired or feasible, as is the case for establishing a legal framework for electronic BoLs. Indeed, it is the flexibility of harmonisation instruments that attracts states to participate and implement the instrument in their own jurisdictions,¹¹¹ and thus its pursuit has somewhat supplanted the pursuit of unification in the era of modern international law.¹¹²

Of all the instruments of harmonisation, model laws most closely approximate the uniformity of international conventions. Model laws are drafted legislative texts, typically by an international body, that are either recommended to states as ready templates to legislate or as guides to drafting a modified

¹⁰⁶ Bokareva (n 89) 73–77.

¹⁰⁷ Srivastava (n 91) 29–30. See also Koch (n 89) 18–19.

¹⁰⁸ See above n 90.

¹⁰⁹ Gerold Hermann, 'The Uncitral Arbitration Law: A Good Model of a Model Law' (1998) 3 *Uniform Law Review* 283, 484–85.

¹¹⁰ Bokareva (n 89) 102–5.

¹¹¹ Bokareva (n 89) 100; United Nations Commission on International Trade Law (n 93) para 38. cf Rose (n 105) 13.

¹¹² Srivastava (n 91) 23–25; Andersen (n 91) 18–31.

version.¹¹³ When enacted, they are enforced like any other domestic law. However, as these laws will be based on a model law, enactment by multiple states should nevertheless approximate unification and thus realise the aforementioned benefits of unification. Indeed, whilst model laws are designed with the knowledge that they will be adapted and changed in many jurisdictions, the model law drafters may encourage states to make as few changes as possible to maximise unification.¹¹⁴ Model laws are therefore the ideal legal instrument for the establishment of an electronic BoL framework to provide the legal certainty for blockchain BoL platforms worldwide, particularly given the argued need to balance harmony in law with state sovereignty.

An ideal model law that has sufficient breadth to encompass blockchain BoLs is the 2017 United Nations Commission on International Trade Law (UNCITRAL) Model Law on Electronic Transferable Records (MLETR).¹¹⁵ It was created as previous conventions and model laws on electronic commerce did not focus on electronic transferable records,¹¹⁶ leading to ‘uncertainties as to the legal value of electronic transferable records’ that present an ‘obstacle to international trade’.¹¹⁷ As a technologically neutral legal instrument, its scope also covers blockchain BoLs.

The MLETR addresses the issue of legal recognition of electronic BoLs by declaring that ‘[an] electronic transferable record shall not be denied legal effect, validity or enforceability on the sole ground that it is in electronic form’.¹¹⁸ Reinforcing this, the model law rejects any denial of legal effect, validity or enforceability in one jurisdiction if the electronic transferable record was issued or used in another jurisdiction.¹¹⁹ These provisions provide industry participants with the global recognition of electronic BoLs that they have been requesting for over 20 years.

¹¹³ United Nations Commission on International Trade Law (n 93) para 37; Koch (n 89) 28–29.

¹¹⁴ See e.g. United Nations Commission on International Trade Law (n 93) para 38.

¹¹⁵ UNCITRAL Model Law on Electronic Transferable Records (United Nations, 2018) (MLETR).

¹¹⁶ *ibid* Preamble para 3.

¹¹⁷ Model Law on Electronic Transferable Records of the United Nations Commission on International Trade Law, GA Res 72/114 (18 December 2017) UN Doc A/RES/72/114, Preamble paras 2–5. See also Explanatory Note to the UNCITRAL Model Law on Electronic Transferable Records (United Nations, 2018) paras 3–9.

¹¹⁸ MLETR (n 115) art 7(1).

¹¹⁹ *ibid* art 19(1).

Outside of the general provisions, the MLETR lays out the technological and practical requirements of electronic transferable record systems to achieve legal recognition of their functional equivalence,¹²⁰ all of which blockchain BoLs should satisfy. It first declares that domestic legal requirements of writing and signature are met by an electronic transferable record if the information contained therein is accessible and usable in electronic format¹²¹ and if a ‘reliable method’ to identify a person and their intention is used.¹²² These requirements must also be met in order to ensure the endorsement of an electronic record.¹²³ Blockchain BoLs are designed to contain all the necessary information of a paper BoL, and their system of public and private ‘keys’ used to verify and record persons involved in each transfer of control over a BoL satisfies the signature requirement.

As a technologically neutral legal instrument, the MLETR extends the domestic legal recognition of ‘transferable document or instrument’ to any form of electronic transferable record if they contain the information legally required of the relevant domestic jurisdiction and a reliable method is used:

- (1) To identify that electronic record as the electronic transferable record;
- (2) To render that electronic record capable of being subject to control from its creation until it ceases to have any effect or validity; and
- (3) To retain the integrity of that electronic record.¹²⁴

Blockchain BoLs should easily satisfy these three conditions. Starting with the second condition, the MLETR equates the possession and transfer of a paper BoL to ‘exclusive control’ and transfer of that control, but only if a reliable method is used to achieve that and identify the person in control.¹²⁵ As outlined, blockchain BoLs are only accessible by those with the correct public and private keys, of which the latter also identifies the person accessing the BoL, thereby allowing for ‘exclusive control’ throughout the lifespan of each individual blockchain BoL. Identification and integrity can be addressed

¹²⁰ *ibid* ch 2.

¹²¹ *ibid* art 8.

¹²² *ibid* art 9.

¹²³ *ibid* art 15.

¹²⁴ *ibid* art 10(1).

¹²⁵ *ibid* art 11.

collectively. The MLETR stipulates that the criterion for assessing integrity is that all information contained in the electronic transferable record remains complete and unaltered apart from typical or expected changes caused by communication, storage and display.¹²⁶ What is essential to a blockchain is its immutable ledger system, which allows not only for the identification of each token and all of its transactions but also precludes the tinkering of information; it merely allows for the addition of information regarding each new transaction.

The most challenging obstacle to any blockchain BoL platform is whether it meets the MLETR's general reliability standard laid out in Article 12. This inexhaustive list of requirements includes the assurance of data integrity, the prevention of unauthorised access to and use of the system, the application of industry standards and the existence of a declaration by an appropriate body as to the reliability of the method, among others. Some of these are technical and administrative requirements that depend on the underlying technology and design of each system. However, other requirements depend on domestic, regional and/or international industry standards. Many such standards are being developed for the first time, creating a shifting ground for blockchain BoL providers. Any uncertainty can be somewhat mitigated if providers actively engage with the drafters of these standards, although uncertainty may remain without an authoritative ruling as to whether a blockchain BoL platform satisfies these standards. This would ideally be addressed with the introduction of a registration, licensing and/or accreditation system.¹²⁷

For the MLETR to become the legal backbone for blockchain BoLs worldwide, it is imperative that there is a widespread, diverse, and speedy implementation of the model law globally given the cross-border and multi-jurisdictional nature of the international shipping of goods. At the time of writing, six jurisdictions have enacted legislation based on the MLETR: Bahrain,

¹²⁶ *ibid* art 10(2).

¹²⁷ Singapore, which is one of the first jurisdictions to implement legislation based on the MLETR, legislated for such a system: Electronic Transactions (Amendment) Act 2021 (Singapore) s 16O(2).

Belize, Kiribati, Paraguay, Singapore and the Abu Dhabi Global Market.¹²⁸ Several other jurisdictions are also considering adopting or are in the process of passing drafted legislation, including Papua New Guinea and Trinidad and Tobago.¹²⁹ In its short time since its conception, the MLETR is set to become a more successful harmonisation instrument than the Rotterdam Rules. Although the list of adopting states is geographically diverse, the only two prominent shipping states are Singapore, which has one of the busiest ports in the world, and Paraguay, with its Colón port listed as a top 50 shipping container port by volume by the World Shipping Council.¹³⁰ Establishing the MLETR as a global framework will require the most prominent shipping jurisdictions to adopt MLETR-aligned legislation. This would not only make a legal framework supporting blockchain BoLs applicable to the shipment of goods, but would also provide political and economic incentive for other jurisdictions to adopt the MLETR.

Recent actions by developed economies and key shipping nations to digitalise the BoL, whilst greater than anything seen before, are nevertheless slow and somewhat non-committal. The strongest commitments have come from binding digital economy agreements between Australia and Singapore,¹³¹ and between Chile, New Zealand and Singapore.¹³² The latter agreement

¹²⁸ United Nations Commission on International Trade Law, 'UNCITRAL Model Law on Electronic Transferable Records (2017) — Status' <https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_transferable_records/status> accessed 27 January 2022. To see the enacting legislation, see Electronic Transferable Records Law 2018 (Bahrain); Electronic Transactions Act 2021 (Belize) pt VII; Electronics Transactions Act 2021 (Kiribati) pt 5; De los servicios de confianza para las transacciones electrónicas, del document electrónico y los documentos transmisibles electrónicos (Paraguay) ley n° 6822; Electronic Transactions (Amendment) Act 2021 (Singapore); Electronic Transactions Regulations 2021 (ADGM) pt 5.

¹²⁹ International Chamber of Commerce, 'UNCITRAL Model Law on Electronic Transferable Records: The Case for Adoption' (August 2021) 8 <https://7703b98d-a40e-40b5-9a19-2340c0e85ea4.filesusr.com/ugd/0b6be5_31e4afc71bda42738b69e73f6cb67d5d.pdf> accessed 1 November 2021.

¹³⁰ World Shipping Council, 'The Top 50 Container Ports' <<https://www.worldshipping.org/top-50-ports>> accessed 1 November 2021.

¹³¹ Australian Government Department of Foreign Affairs and Trade, 'Australia-Singapore Digital Economy Agreement' <<https://www.dfat.gov.au/trade/services-and-digital-trade/australia-and-singapore-digital-economy-agreement>> accessed 1 November 2021.

¹³² New Zealand Foreign Affairs & Trade, 'Digital Economy Partnership Agreement (DEPA)' <<https://www.mfat.govt.nz/cn/trade/free-trade-agreements/free-trade-agreements-in-force/digital-economy-partnership-agreement-depa>> accessed 1 November 2021.

explicitly commits all three states to ‘endeavour to adopt’ the MLETR.¹³³ The former merely commits to maintain legal frameworks consistent with the MLETR’s principles and consider the model law when developing new ‘mechanisms’ for electronic transferable records.¹³⁴ Whilst the internationally binding treaties are a strong indication of an intention to implement the MLETR, the non-committal language of the provisions and reference to mere compliance with MLETR principles provides scope for those states to adopt legislation that is significantly different in substance to the MLETR or to not pass such legislation at all.

This language is not unique to these treaties. The most prominent actions have been that of the G7+ Digital and Technology Ministers,¹³⁵ made up of several of the largest shipping nations by volume, who in 2021 agreed via a non-binding ‘framework’ to adopt legislation ‘compatible with the principles of the [MLETR]’ and to ‘promote international efforts that facilitate the use of electronic transferable records within the private sector’.¹³⁶ They eventually released their ‘roadmap to reform for electronic transferable records’ in December 2021, which outlines broad pathways to resolve issues, such as addressing domestic legal barriers, developing legal solutions, as well as promoting and supporting legal reform internationally. The roadmap is not legally binding and provides only broad goals for addressing these issues,

¹³³ Digital Economy Partnership Agreement (Chile—New Zealand—Singapore) (adopted 11 June 2020, entered into force 1 January 2021) art 2.3(2).

¹³⁴ Australia—Singapore Digital Economy Agreement (adopted 6 August 2020, entered into force 8 December 2020) ATS 2020 13, arts 8(2) and (4).

¹³⁵ South Korea and Australia participated in these meetings and the agreed ‘framework’.

¹³⁶ UK Department for Digital, Culture, Media and Sport, ‘Ministerial Declaration: G7 Digital and Technology Ministers’ Meeting’ (*gov.uk*, 28 April 2021) 5–6 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/981567/G7_Digital_and_Technology_Ministerial_Declaration.pdf> accessed 1 November 2021; UK Department for Digital, Culture, Media and Sport, ‘G7 Digital and Technology Track: Annex 4: Framework for G7 Collaboration on Electronic Transferable Records’ (*gov.uk*, 28 April 2021) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/986162/Annex_4_Framework_for_G7_collaboration_on_Electronic_Transferable_Records.pdf> accessed 1 November 2021. See also Law Commission (UK), ‘Electronic Trade Documents’ <www.lawcom.gov.uk/project/electronic-trade-documents> accessed 1 November 2021.

without any set timelines or details.¹³⁷ It therefore remains to be seen if the G7+ states will implement MLETR-based legislation in a timely fashion, if at all. Currently, only the UK Law Commission is completing a review of legislative reform for electronic transferable records, including the viability of implementing the MLETR.¹³⁸

Meanwhile, other prominent shipping nations are yet to take any significant action towards adopting the MLETR, and some have even expressed some hesitation. The most notable example is China, the reluctance of which appears to stem from a preference for a different legal instrument that would extend the document of title function to other transport and multimodal documents, rather than resistance to the principles underlying the MLETR.¹³⁹ Nevertheless, any hesitation or staggered adoption of the MLETR by these states and other key shipping jurisdictions will create, at least initially, a fragmented legal framework that only legally supports electronic BoLs for portions of a multi-leg shipment. This would likely dissuade other states from adopting the MLETR and could undermine what is the best available means of establishing a global framework for the blockchain BoL. It is pivotal that international organisations and other states that have adopted or are considering adopting the MLETR should further encourage key shipping jurisdictions to be leaders in the electronic transferable records space.

With or without the guidance and assistance of G7+ countries, all jurisdictions will face political and/or economic challenges in drafting and implementing MLETR-based legislation. The more influential politicians will need to be convinced that not only the economic benefits to the nation would surmount any obstacles and costs associated with a bill supporting electronic transferable records, but also that these benefits are amplified if the MLETR forms the foundation of the national legal instrument. Then begins the process of engaging with industry stakeholders to receive and adapt their input in

¹³⁷ UK Department for Digital, Culture, Media and Sport, 'UK G7 Presidency: Roadmap to Reform for Electronic Transferable Records' (*gov.uk*, 17 December 2021) <<https://www.gov.uk/government/publications/uk-g7-presidency-roadmap-to-reform-for-electronic-transferable-records/uk-g7-presidency-roadmap-to-reform-for-electronic-transferable-records>> accessed 18 December 2021.

¹³⁸ See Law Commission (UK) (n 136).

¹³⁹ United Nations Commission on International Trade Law, 'Day 1: Electronic Transferable Records and Dematerialization of Trade Documents' (*YouTube*, 16 April 2021) 42:40:00–56:43:00 <<https://www.youtube.com/watch?v=LOTFaGCpC3E>> accessed 18 December 2021.

drafting the legal instrument. At the same time, the drafted instrument must not significantly stray from the MLETR so as not to undermine the goal of achieving consistency between national laws.¹⁴⁰ This is a lengthy, costly, and complex process, particularly for smaller nations where the economic case for providing legal support for electronic transferable records is not clear-cut. Especially for such countries, this process necessitates the continued support of the model law drafters, UNCITRAL and other interested international and regional organisations already advocating for MLETR adoption, most notably the International Chamber of Commerce (ICC). Indeed, such support has already proven successful, with Belize and Kiribati recently implementing MLETR-based legislation with support from such organisations.¹⁴¹

There are also implementing costs for both the public and private sector to contend with. Key infrastructure and industry participants such as ports and customs are often owned or run by the state and necessarily require state investment to ensure those facilities are compatible with a blockchain BoL system. This will be particularly challenging for some smaller and developing economies whose infrastructure would require significant expansion or update in order to accommodate the transmitting and processing of blockchain BoLs.¹⁴² These costs will need to be considered when engaging in the process of implementing the MLETR. Consideration of the extent of private investment post-MLETR implementation is also important; time and resources spent adopting the MLETR will be wasted if the private sector is either unwilling or unable to invest to make their infrastructure and practice blockchain-compatible. For example, there are reports that BoL-interacting foreign organisations that service a significant portion of a market in smaller nations, like some foreign banks, are hesitant to invest in infrastructure and business practices in those nations necessary to process blockchain BoLs until there are sufficient commercial opportunities that make such an investment commercially

¹⁴⁰ Harold C. Gutteridge, *Comparative Law: An Introduction to the Comparative Legal Method of Legal Studies* (Cambridge University Press 1946) 157.

¹⁴¹ For an explanation of this process with regards to Kiribati's implementation of MLETR-based legislation, see Luca Castellani, 'MLETR in Developing Countries: Lessons from the Pacific' (*LinkedIn*, 11 October 2021) <<https://www.linkedin.com/pulse/mletr-developing-countries-lessons-from-pacific-luca-castellani>> accessed 1 November 2021.

¹⁴² See Henry D. Gabriel, 'The UNCITRAL Model Law on Electronic Transferable Records' (2019) 24 *Uniform Law Review* 261, 279.

viable.¹⁴³ Even if there is a willingness by businesses to adapt, small and medium enterprises may be initially shut out given the sheer expenses of updating their entire infrastructure and business practices.

The obstacles that countries face when adopting the MLETR are not insurmountable, although they will be more challenging for some than others. Nevertheless, at this early stage, there will need to be leadership from some states for the adoption and promotion of the MLETR, particularly states that process a large volume of goods shipments in order to reduce the obstacles and increase the commercial justification for other states to adopt the MLETR.

B) Technological, practical and behavioural obstacles

The failure of past electronic BoLs was in part due to their inability to physically scale the technology and establish a sufficiently vast network of users on any one platform. These same obstacles can impede the success of blockchain BoLs, regardless of their technological superiority. Without achieving the necessary scale, the benefits of blockchain BoLs will not be realised.

To some extent, the reasons for these obstacles relate to the current limitations of the technology. This includes low transaction capacity and insufficient storage capacity. There are also environmental issues: the immense amount of computing power required to operate electronic BoLs and the current proof-of-work blockchain BoLs demands significant energy consumption and partially offsets the environmental gains from moving

¹⁴³ Castellani (n 141). This has been corroborated by Raoul Renard from the International Chamber of Commerce.

transport documents to an electronic medium.¹⁴⁴ This is not just a negative externality but also an issue of public image for the already pollutant-heavy shipping industry, which accounts for almost 3% of all greenhouse gas emissions.¹⁴⁵

Whilst all these are significant issues that need to be addressed, they are not prohibitive to the establishment of a global blockchain BoL network, particularly given the significant investment and development in this space over the past few years. Rather, the two biggest non-legal obstacles to achieving industry-wide usage of blockchain BoLs are the onboarding of all relevant industry participants and the inability to rectify fragmentation of blockchain platforms without interoperability solutions and standardisation.

Onboarding

Achieving the necessary user scale requires in part onboarding a large number and broad range of industry participants: not just shippers, carriers and buyers but also third-party intermediaries, customs brokers, and port and terminal operators, as well as parties from other industries interacting with BoLs, including financial institutions, customs and government agencies and

¹⁴⁴ See e.g. Son Nguyen, 'Using Blockchain to Mitigate Risk in Container Operations: A Researcher's Perspective' (*Shipping and Freight Resource*, 8 September 2020) <www.shippingandfreightresource.com/using-blockchain-to-mitigate-risk-in-container-operations> accessed 1 November 2021; Marcus Hand, 'Where the Digital and Physical World's Meet the Biggest Risk for Blockchain' *Seatrade Maritime News* (Colchester, 5 March 2018) <www.seatrade-maritime.com/europe/where-digital-and-physical-worlds-meet-biggest-risk-blockchain> accessed 1 November 2021; Hadim (n 69). It should be acknowledged that there is continued research in an academic and commercial setting to make proof-of-work blockchains more energy efficient (see e.g. Nouredine Lasala and others, 'Green-PoW: An Energy-Efficient Blockchain Proof-of-Work Consensus Algorithm' (*Cornell University*, 8 July 2020) <<https://arxiv.org/abs/2007.04086>> accessed 13 February 2022) and that proof-of-stake blockchains are generally more energy-efficient than proof-of-work blockchains: see e.g. Rong Zhang and Wai Kin (Victor) Chan, 'Evaluation of Energy Consumption in Block-Chains with Proof of Work and Proof of Stake' (2020) 1584 *Journal of Physics: Conference Series* 012023 <<https://iopscience.iop.org/article/10.1088/1742-6596/1584/1/012023/pdf>> accessed 18 December 2021). Both technological advancements could be implemented in current and/or future blockchain BoL platforms.

¹⁴⁵ See generally International Maritime Organization, 'Fourth IMO Greenhouse Gas Study 2020' (July 2020) <<https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fourth%20IMO%20GHG%20Study%202020%20-%20Full%20report%20and%20annexes.pdf>> accessed 26 January 2022.

inland transportation providers.¹⁴⁶ All such parties have their own pre-existing systems in place and their unique interests that they wish to protect. For example, shippers will want to keep commercially sensitive information secret, and banks providing documentary credit will want the freedom to control and scrutinise the BoL. The fragmented nature of the industry, combined with its technological hesitancy, means that blockchain BoL providers face a difficult task of onboarding industry participants.

a) Trust in the technology

As a nascent technology, faith in blockchain BoL systems from all industry participants is essential to their onboarding. However, the industry has generally been reluctant to embrace significant technological changes given the assurance and certainty of the status quo.¹⁴⁷ General reluctance is likely to be exacerbated by the decentralised, untrustworthy nature of blockchain technology, which requires a complete shift in the thinking and management of industry players from a competitive to a collaborative mindset.¹⁴⁸ For example, industry participants will be inputting commercially sensitive information into a platform shared by their competitors; even if that information remains private and secure on the blockchain network, the perceived threat of exposure lingers. Onboarding industry participants therefore requires not just overcoming hesitancy but also providing transitional assistance, including assurances as to information security and the willing of a cooperative mindset.

Similarly, many industry players are concerned about system malfunctions and security breaches of blockchain BoL platforms. Blockchain cannot verify the veracity of the inputted data. Thus, any tampering or human error at the data entry stage can undermine the integrity of a BoL blockchain system. Even without input errors, moving BoLs to an electronic medium naturally makes the system prone to outages, corrupted data and related malfunctions. An additional

¹⁴⁶ For an overview of the fragmented nature of the maritime goods transport industry, see generally Bruce Farthing, *International Shipping: An Introduction to the Policies Politics and Institutions of the Maritime World* (2nd edn, Lloyd's of London Press 1993).

¹⁴⁷ Vishnu Rajamanickam, 'CargoX's Blockchain-Based Smart Bill of Lading Solution is Now on dexFreight's Platform' *American Shipper* (Chattanooga, 8 March 2019) <www.freightwaves.com/news/blockchain/cargoxs-blockchain-based-smart-bill-of-lading-solution-is-now-on-dexfreights-platform> accessed 1 November 2021.

¹⁴⁸ Allison McCauley, 'Is Collaboration the New Competition? Blockchains Flip Conventional MBA Wisdom' *Forbes* (New Jersey, 23 May 2019) <www.forbes.com/sites/alisonmccauley/2019/05/23/is-collaboration-the-new-competition-blockchains-flip-conventional-mba-wisdom> accessed 1 November 2021.

and more nefarious concern is that, even with its decentralised nature and encryption features, blockchain is not impervious to hacking; a hacker needs to only successfully attack 51% of the nodes to gain control of the network.¹⁴⁹ There is typically a greater possibility of private blockchains being hacked, given the generally smaller number and higher concentration of the computation power of nodes.¹⁵⁰ Whilst some public blockchain networks have thousands of nodes,¹⁵¹ others are much smaller. Some public blockchains even limit who can become a mining node,¹⁵² which naturally limits the node count. Furthermore, blockchain node counts can fluctuate widely, making platforms more vulnerable to such attacks when node counts dip.¹⁵³ Unfortunately, some of the finer details of currently available blockchain BoL platforms, including their node count, are not public knowledge; however, particularly in the first few years of any platform's life span, it would be expected that platforms have lower node

¹⁴⁹ Feng Wang, 'Blockchain Bills of Lading and Their Future Regulation' (2021) NUS Law Working Paper 2021/008, 13–14 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3817112> accessed 1 November 2021.

¹⁵⁰ Private, or 'permissioned', blockchains require approval for a user to join the blockchain network from the managing body. As private blockchains, the systems are generally more efficient, private and tailored. The current blockchain BoL platforms developed by industry participants, such as TradeLens and Global Shipping Business Network, are private blockchains.

¹⁵¹ Public, or 'permissionless', blockchains are publicly accessible (typically via an easy-to-use interface), often developed on the Ethereum public blockchain. Given this, such blockchains allow for user anonymity. Current blockchain BoL platforms developed by third-party providers, such as CargoX and Wave BL, are public blockchains.

¹⁵² See, for example, the response to the question 'Can anyone be a miner for WAVE BL blockchain transactions?' at Wave BL, 'FAQ' <<https://waveelectronicBoL.com/faq>> accessed 1 November 2021.

¹⁵³ See e.g. Bitnodes, 'Charts' <<https://bitnodes.io/dashboard/?days=730>> accessed 1 November 2021; Ethernodes, 'History' <<https://ethernodes.org/history>> accessed 1 November 2021. See also Luke Conway, 'Ethereum Has Lost Over 6,500 Nodes in the Last Two Weeks' (*TheStreet*, 9 September 2021) <<https://www.thestreet.com/crypto/ethereum/ethereum-is-still-missing-huge-amount-of-nodes-after-unintentional-hard-fork>> accessed 1 November 2021. 51% attacks have been successfully conducted on big and small public blockchains: see e.g. Jamie Redman, 'Small Ethereum Clones Getting Attacked by Mysterious "51 Crew"' (*Bitcoin.com*, 4 September 2016) <<https://news.bitcoin.com/ethereum-clones-susceptible-51-attacks>> accessed 1 November 2021; Billy Bambrough, 'Bitcoin Fork Suffers "Massive" 51% Attack in Attempt to "Destroy" the Cryptocurrency, Sending Its Price Sharply Lower' *Forbes* (London, 4 August 2021) <<https://www.forbes.com/sites/billybambrough/2021/08/04/bitcoin-fork-suffers-massive-51-attack-in-attempt-to-destroy-the-cryptocurrency-sending-its-price-sharply-lower/?sh=1b6180c5248f>> accessed 1 November 2021. This list of theoretical costs of 51% attacks on proof-of-work cryptocurrencies puts into perspective how vulnerable smaller public (and private) blockchain platforms are: Crypto51 (Website) <<https://www.crypto51.app>> accessed 1 November 2021.

counts. It should nonetheless be noted that a successful 51% attack is no small feat, particularly on larger public blockchains but even so for smaller node-count networks. Industry participants are privy to all these issues, as they present not only practical concerns but also questions of liability of blockchain BoL platforms.¹⁵⁴ Even if these concerns are exaggerated by some industry participants, there will be great difficulty for blockchain BoL platforms to overcome these perceptions to onboard them.

Outside of general mistrust, there are three notable industry participants whose treatment of blockchain BoLs are important in and of themselves and for their effect on the attitudes of others.

First, intermediaries such as freight forwarders and NVOCCs have expressed some concern that blockchain will make their roles redundant.¹⁵⁵ These organisations complete much of the heavy lifting for merchants who do not know how to ship their goods. Much like what travel websites did to travel agents, intermediary shipping organisations are concerned that shippers will become reasonably comfortable with using blockchain platforms, particularly those with a simple and accessible web interface, and therefore no longer require intermediary services.¹⁵⁶ However, whilst some intermediaries may be pushed out, their concerns fail to account for the incredible difficulty and expense faced by small and medium-sized enterprises and other entities in developing nations, even using web interfaced blockchain BoL platforms, as will be discussed below.¹⁵⁷ Blockchain providers must work with intermediaries to convince them and ensure that only the substance of their former business model changes. That is, for those enterprises without the funds or technical capabilities to directly access blockchain BoL platforms and integrate it into their own operations, intermediaries can provide that access at a relatively low cost point. Shipping intermediaries have an opportunity to pivot from being a purely logistical intermediary to becoming (also or exclusively) a technology intermediary. This would not only allow intermediaries to remain relevant in the digitalisation of BoLs but would also make blockchain BoLs more accessible, thereby expanding the technology's reach and contributing to its success.

¹⁵⁴ Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (n 40) para 11.09.

¹⁵⁵ See Beck (n 21); Xirinachs (n 69).

¹⁵⁶ Xirinachs (n 69).

¹⁵⁷ See below Part III(B)(2)(c).

Second, banks' hesitancy could impact the flow of trade-related finance. For one, banks remain comfortable with their traditional processes, and several have publicly expressed that they are not persuaded by thoughts of smart contracts automatically triggering payments upon transferring exclusive control of the blockchain BoL.¹⁵⁸ Indeed, banks in the past have been critical of platforms that prevented them from scrutinising electronic BoLs.¹⁵⁹ However, banks are increasingly willing to embrace blockchain, as is evidenced by their development of proprietary private blockchain systems for letters of credit.¹⁶⁰ Nevertheless, banks remain critical of the lack of multi-factor security provisions on blockchain BoL platforms,¹⁶¹ although their attitude may soften as the security of blockchain BoL platforms improve and banks become more comfortable and familiar with the offerings. Given the essential role that banks play in providing documentary credit upon presentation and review of the BoL, it is imperative that banks are comfortable in investing in and adopting the blockchain BoL technology.

Third, ports, customs and other government bodies have their own BoL processing methods with little incentive to change.¹⁶² Given the necessity for the industry to engage those parties, persistent resistance by these parties to the accommodation of blockchain technology will likely stop any chance of it becoming mainstream in the maritime trade industry.¹⁶³ State intervention may be necessary in the form of regulatory changes and funding to facilitate the

¹⁵⁸ Melodie Michel, 'First Live Blockchain Trade Transaction Conducted' *Global Trade Review* (London, 7 September 2016) <www.gtreview.com/news/global/first-live-blockchain-trade-transaction-conducted> accessed 1 November 2021.

¹⁵⁹ Todd, *Bills of Lading and Bankers' Documentary Credits* (n 6) 130–31.

¹⁶⁰ Beck (n 21).

¹⁶¹ See Eleanor Wrang, 'Exclusive: Contour Goes Live, Making Blockchain-Based Trade Finance a Reality' *Global Trade Review* (London, 5 October 2020) <www.gtreview.com/news/fintech/exclusive-contour-goes-live-making-blockchain-based-trade-finance-a-reality> accessed 1 November 2021.

¹⁶² Lili Nguyen, 'Goodbye Paper, Hello Blockchain?' *Seatrade Maritime News* (Colchester, 29 October 2019) <www.seatrade-maritime.com/block-chain/goodbye-paper-hello-blockchain> accessed 1 November 2021; Alan Amling and others, 'When Is(n't) Blockchain Right? A Decision Guide for Supply Chain Professionals' (*The University of Tennessee Knoxville Global Supply Chain Institute*, April 2021) 31 <<https://supplychainmanagement.utk.edu/research/2021-04-When-Isnt-Blockchain-Right.pdf>> accessed 13 February 2022.

¹⁶³ Søren Pico, 'Two Major Obstacles Hold Digitization Back in Shipping' (*ShippingWatch*, 19 July 2019) <<https://shippingwatch.com/carriers/Container/article11455728.ec>> accessed 1 November 2021.

internal processing of blockchain BoLs by those parties.¹⁶⁴ In addition, blockchain BoL developers should create additional platform features that are of utility to those entities as a means of persuading them to onboard. This may include unifying various data from several sources, providing real-time tracking of shipments and establishing more efficient BoL information communication channels between these entities. Nevertheless, it may be impossible to onboard all such gatekeeping parties. For example, they may lack the resources to not only upgrade or install new infrastructure but also to change internal processes, train employees and educate all users of their services. They too would need sufficient commercial interest to justify the transition to processing blockchain BoLs. For such parties, finding ways for blockchain BoL technology to become interoperable with their technology may be more suitable. Indeed, this may be a suitable intermediate step to encourage them to eventually onboard onto blockchain BoL networks via infrastructure upgrades.

b) The 'cooperation paradox': Trusting competitors and central bodies

Blockchain is designed to gear participants to move away from a need to trust and coordinate with each other to instead have trust in the system. However, the highly competitive and information-sensitive nature of the shipping industry has prompted wariness from some industry participants that other participants could use blockchain BoL platforms nefariously rather than collaboratively. This is known as the 'cooperation paradox', and it is considered by the industry as a major barrier to the success of blockchain BoL systems.¹⁶⁵ The cooperation paradox plays out in two ways.

One concern is that commercially sensitive data will be visible to or easily accessible by competitors, particularly on a public blockchain network, and used to lure away customers.¹⁶⁶ Similarly, a buyer could cut out a middleman if they

¹⁶⁴ Goldby, 'Electronic Bills of Lading and Central Registries' (n 38) 134–36.

¹⁶⁵ Simon Valeur, 'Everyone Believes in Blockchain — But No One Trusts Each Other' *ShippingWatch* (Copenhagen, 19 January 2019) <<https://shippingwatch.com/Services/article11156208.ece>> accessed 1 November 2021, discussing Andrew Schmahl and others, 'Resolving the Blockchain Paradox in Transportation and Logistics' (*Boston Consulting Group*, 29 January 2019) 8–9 <https://image-src.bcg.com/Images/BCG-Resolving-the-Blockchain-Paradox-in-Transportation-and-Logistic-Jan-2019_tcm9-212394.pdf> accessed 13 February 2022.

¹⁶⁶ Costas Paris, 'Shipping Blockchain Initiative Gathers Steam' *The Wall Street Journal* (New York, 2 July 2019) <www.wsj.com/articles/shipping-blockchain-initiative-gathers-steam-11562061601> accessed 1 November 2021.

determine, for example, who is the selling vendor.¹⁶⁷ Such concerns were prevalent in previous electronic BoL systems.¹⁶⁸ However, it has been argued that this behaviour is also prevalent with paper BoLs, at least by those handling or processing the BoL, as they can provide the BoL or pass on the information contained to competitors.¹⁶⁹ Blockchain systems have the capability to hide information from others without the relevant key.¹⁷⁰ Indeed, who has accessed a blockchain BoL record and when they did so would likely be recorded and thus far more easily determinable, particularly on private blockchain platforms, relative to paper BoLs, which can be photocopied or shared by one of the many (unknown) hands who touch it. Blockchain's superior security measures relative to paper BoL solutions need to be better emphasised and communicated to the shipping industry to overcome their concerns.

Industry participants are also concerned by the self-interested nature of central bodies on private blockchain networks. The most notable example of a central body is TradeLens, designed and operated by IBM and Maersk. The company was originally structured as a joint venture, with Maersk owning 51% of the company and all of TradeLens' intellectual property, sparking concerns that the economic benefits would not be shared equally and that Maersk could manipulate the blockchain framework to benefit themselves over other participating liners.¹⁷¹ After two years of struggling to onboard industry participants, Maersk and IBM responded to feedback that only a neutral platform would be trusted¹⁷² and moved to a collaboration model, whereby business operations are managed separately and the intellectual property is co-

¹⁶⁷ Allison (n 22).

¹⁶⁸ See Laryea (n 40) 173–74. But see Albrecht (n 52) 267, discussing United Nations Conference on Trade and Development, 'The Use of Transport Documents in International Trade' (n 14) 27 [79].

¹⁶⁹ Stefan Kukman, 'Why the Shipping Industry Should Not Fear Transparency' (*Splash247*, 27 January 2020) <<https://splash247.com/why-the-shipping-industry-should-not-fear-transparency>> accessed 1 November 2021.

¹⁷⁰ *ibid.*

¹⁷¹ Andrea Tinianow, 'How Maersk's Bad Business Model is Breaking Its Blockchain' *Forbes* (New Jersey, 30 October 2018) <www.forbes.com/sites/andreatinianow/2018/10/30/how-maersks-bad-business-model-is-breaking-its-blockchain> accessed 1 November 2021.

¹⁷² Sanne Wass, 'Maersk and IBM Go Live with Global Blockchain Trade Platform TradeLens' *Global Trade Review* (London, 9 August 2018) <www.gtreview.com/news/fintech/maersk-and-ibm-go-live-with-blockchain-supply-chain-platform-tradelens> accessed 1 November 2021.

owned and jointly developed by the two organisations.¹⁷³ This put Maersk on the same terms and conditions as any other network participant. As this shows, any perception of bias from the controlling body of a private blockchain network will be viewed unfavourably by industry participants. Attention to industry sentiment and careful business structure design is required when setting up blockchain BoL in order to reduce onboarding resistance from potential users.

c) Trust in the legal framework

Putting aside concerns with the technology itself and its users, a core trust problem is that all parties dealing with a BoL remain hesitant due to the uncertainty of the legal validity of a blockchain BoL.¹⁷⁴ This has been a constant problem for all electronic BoLs.¹⁷⁵ It threatens forming a vicious cycle that can prevent blockchain BoLs becoming anything more than a trial concept: legislators only legislate when there is sufficient evidence of interest from potential users, whilst maritime industry participants remain hesitant to significantly engage with blockchain BoLs without a clear legal framework.¹⁷⁶ The lack of confidence is further exacerbated as legal standards regarding electronic BoLs differ across jurisdictions.¹⁷⁷ Industry participants will never feel confident in using the system without clear, uniform legal standards that replicate their rights and obligations when using paper BoLs. This hesitation cycle therefore needs to be broken, potentially by finding some preliminary middle ground that both governments and industry participants feel comfortable to engage.

d) Accessibility

¹⁷³ Michael Del Castillo, 'IBM–Maersk Blockchain Platform Adds 92 Clients as Part of Global Launch' *Forbes* (New Jersey, 9 August 2018) <www.forbes.com/sites/michaeldelcastillo/2018/08/09/ibm-maersk-blockchain-platform-adds-92-clients-as-part-of-global-launch-1> accessed 1 November 2021.

¹⁷⁴ See Pejović (n 5) 233; Bury (n 44) 237; *ibid* 128–29, discussing United Nations Conference on Trade and Development, 'The Use of Transport Documents in International Trade' (n 14) 27 [79].

¹⁷⁵ See United Nations Conference on Trade and Development, 'The Use of Transport Documents in International Trade' (n 14) 27 [79].

¹⁷⁶ Goldby, 'Electronic Bills of Lading and Central Registries' (n 38) 129–30. See also Pejović (n 5) 238.

¹⁷⁷ Goldby, 'Electronic Bills of Lading and Central Registries' (n 38) 129.

Even if trust issues are resolved, there remains the issue of platform accessibility. Particularly for private blockchains, industry participants will need to integrate and become familiar with yet another technology. Whilst larger companies have the necessary economies of scale to achieve this, small to medium shipping enterprises may not see sufficient value to make that investment.¹⁷⁸ This could be circumvented if an intermediary with blockchain capabilities acts either on instruction or as an agent. Furthermore, some public blockchain BoL systems provide a simple web interface, thereby reducing this problem.¹⁷⁹ However, there remains the need for education, training and consumer support, and potentially a need to change company management, structure or processes to conform to the technology.¹⁸⁰ These again take time, effort and investment that may be intimidating or prohibitive for small and medium-sized shipping enterprises. Such factors have been obstacles in the past to the shipping industry adopting technological change.¹⁸¹

Similarly, developing countries may not have the infrastructure and support necessary for their industry participants to integrate blockchain BoL systems. In some instances, these enterprises may entirely manually process and transport shipping documentation.¹⁸² This is problematic not only when such countries are the starting or final destinations but also, and especially, when they are intermediate destinations; line shippers in particular make tens, if not hundreds, of stops at different ports, interacting with a myriad of industry participants and documents, including the BoL, as evidenced in the IBM–Maersk study.¹⁸³ A significant amount of investment, education and training

¹⁷⁸ Shannon Manders, 'Asia's Trade Finance Industry Leaders Debate Digitisation, Blockchain and Fintech' *Global Trade Review* (London, 21 November 2018) <www.gtreview.com/news/asia/asias-trade-finance-industry-leaders-debate-digitisation-blockchain-and-fintech> accessed 1 November 2021.

¹⁷⁹ Pejović (n 5) 231; 'How to Handle Blockchain Going Mainstream' (*Splash247*, 28 August 2018) <<https://splash247.com/how-to-handle-blockchain-going-mainstream>> accessed 1 November 2021.

¹⁸⁰ See Amling and others (n 164) 32.

¹⁸¹ Goldby, 'Electronic Bills of Lading and Central Registries' (n 38) 132, discussing United Nations Conference on Trade and Development, 'The Use of Transport Documents in International Trade' (n 14) 27 [79]; Solomon (n 23).

¹⁸² See e.g. Jacob Gronholt-Pederson, 'Shipping Industry Goes Digital in Lockdown' *MarineLink* (New York, 28 May 2020) <www.marinelink.com/news/shipping-industry-goes-digital-lockdown-478899> accessed 1 November 2021.

¹⁸³ See above n 25 and accompanying text.

would be required, perhaps by foreign entities, to ensure that any blockchain network can reach all corners of the globe.¹⁸⁴

Interoperability and standardisation

Successful onboarding efforts will mean little if the present fragmented nature of the industry is mirrored in blockchain networks. There are currently several blockchain BoL platforms at the development or early commercialisation stage, each built on their own underlying technology. This threatens a modern version of an old problem: different blockchain platforms cannot communicate with each other without additional tools, and thus parties on two different platforms cannot transfer a BoL. Each blockchain system becomes a digital silo that requires its own vast internal network to be of any value.¹⁸⁵ Whilst larger enterprises will likely have the economies of scale and resources to justify joining multiple networks as a way of circumventing this issue, many smaller industry participants will naturally be unable to enjoy that same luxury. In any case, industry participants needing to access multiple networks defeats the purpose of blockchain BoLs becoming an industry-wide infrastructure for, and a digital replication of, paper BoLs. A multi-network blockchain infrastructure merely recreates the ‘club’ problem and would likely see the technology suffer the same fate as its electronic BoL predecessors.

However, a solution does exist in the form of interoperability tools such as application programming interfaces (APIs), which allow different platforms to communicate with each other.¹⁸⁶ Creating and utilising such tools establishes a network of networks: blockchain (and non-blockchain) platforms can exchange data, allowing BoLs to be transferred regardless of the different digital platforms utilised by each party.¹⁸⁷

¹⁸⁴ See generally Laryea (n 40) 179–87.

¹⁸⁵ Philippe Salles, ‘Tech Connections: Cut Ties to Paper Bills of Lading’ *American Shipper* (Chattanooga, 7 March 2019) <www.freightwaves.com/news/tech-connections-cut-ties-to-paper-bills-of-lading> accessed 1 November 2021; Lee Bailey, ‘Shepherding the Blockchain Ecosystem with Industry Chains’ (*Loom Network Journal*, 3 December 2018) <<https://medium.com/loom-network/shepherding-the-blockchain-ecosystem-with-industry-chains-24596a2be980>> accessed 1 November 2021.

¹⁸⁶ World Economic Forums, ‘Inclusive Deployment of Blockchain for Supply Chains: Part 6 — A Framework for Blockchain Interoperability’ (9 April 2020) 14 <<https://www.weforum.org/whitepapers/inclusive-deployment-of-blockchain-for-supply-chains-part-6-a-framework-for-blockchain-interoperability>> accessed 13 February 2022.

¹⁸⁷ *ibid* 6–9.

Three forms of interoperability are required for blockchain BoL platforms. First, different blockchain BoL platforms will need to communicate with each other. Second, blockchain BoL platforms will need to communicate with other blockchain platforms used for non-BoL functions, such as banks' own trade finance blockchain systems.¹⁸⁸ Finally, blockchain BoL platforms will need to communicate with non-blockchain digital systems used by some organisations.¹⁸⁹

Achieving interoperability is difficult. For one, APIs can be inefficient. APIs need to be developed for each bilateral platform combination, requiring potentially hundreds of APIs.¹⁹⁰ This multiplies the costs, expense and difficulty of developing and using blockchain BoL systems. Furthermore, the two contrasting blockchain models in the international shipping industry present two conflicting motivations regarding interoperability. Developers of niche blockchain BoLs and shipping monitoring solutions generally endorse interoperability. Offering such a niche tool, their blockchain solutions are both technological and economic complements to other niche blockchain tools. As such, industry participants would likely only use them if the blockchain tool can integrate and communicate with these other tools that they are using. On the other hand, developers of multi-functional, modular blockchain platforms are more resistant to supporting interoperability, as their business model is to offer participants of the shipping industry an all-in-one product package.¹⁹¹

Interoperability is much more achievable with standardisation in API tools, data format and the language and format of the content in blockchain BoLs. Developing a set of industry-wide standards would minimise the number of interoperable tools required and make their development quicker and easier. This should make blockchain BoL platform integration easier, cheaper and more

¹⁸⁸ See Felix Thompson, 'Singapore Amends Law to Give electronic BoLs and Other Electronic Trade Instruments Legal Footing' *Global Trade Review* (London, 10 February 2021) <www.gtreview.com/news/fintech/singapore-amends-law-to-give-electronic-BoLs-and-other-electronic-trade-instruments-legal-footing> accessed 1 November 2021.

¹⁸⁹ Feng (n 149) 19.

¹⁹⁰ Bailey (n 185); Finbarr Bermingham, 'R3 and Hyperledger in a Two Horse Race, but Interoperability Isn't the Priority' *Global Trade Review* (London, 1 November 2018) <www.gtreview.com/news/fintech/r3-and-hyperledger-in-a-two-horse-race-but-interoperability-isnt-the-priority> accessed 1 November 2021.

¹⁹¹ Bermingham (n 190). See e.g. Eleanor Wragg, 'IGP&I Approves TradeLens Electronic Bill of Lading System for Its Members' *Global Trade Review* (London, 7 April 2021) <www.gtreview.com/news/fintech/igpi-approves-a-fifth-electronic-bill-of-lading-system-for-its-members> accessed 1 November 2021.

accessible.¹⁹² Market forces also may pressure voluntary compliance with standards if enough industry participants adopt standards early, allowing others to realise the benefits of standardisation and perhaps even encourage judicial recognition of blockchain BoLs.¹⁹³ This has been evident in the air cargo industry. Electronic air freight waybills (e-AWBs) were standardised by the International Air Transport Association (IATA) in 2010. The adoption rate currently stands at 75%, growing over 6% in the year to May 2021.¹⁹⁴ Such was the uptake that, on 1 January 2019, IATA mandated that e-AWBs become the mandated default contract of carriage for all air cargo shipments on enabled trade lines.¹⁹⁵

Several standardisation initiatives have already been established. The most notable is the Digital Container Shipping Association (DCSA), formed in 2019 by nine ocean carriers representing 70% of the world's containerised trade.¹⁹⁶ DCSA has recently published a suite of open-source electronic BoL format, data and process standards,¹⁹⁷ aligned with the United Nations Centre for Trade Facilitation and Electronic Business multimodal transport reference data model.¹⁹⁸ Other initiatives include the Digital Standards Initiative by the ICC, working collaboratively with the DCSA to create open trade standards to facilitate interoperability among blockchain networks and technology

¹⁹² Chambers (n 1).

¹⁹³ Feng (n 149) 36.

¹⁹⁴ International Air Transport Association, 'e-AWB International Monthly Report' (May 2021) 1 <<https://www.iata.org/contentassets/4bc75639b37641ba88f2e81e5516a020/e-awb-monthly-report-r17.pdf>> accessed 13 February 2022.

¹⁹⁵ International Air Transport Association, 'e-AWB' <<https://www.iata.org/en/programs/cargo/e/eawb>> accessed 1 November 2021.

¹⁹⁶ See also Digital Container Shipping Association, 'About' <<https://dcsa.org/about>> accessed 1 November 2021.

¹⁹⁷ Digital Container Shipping Association, 'eBill of Lading' <<https://dcsa.org/standards/ebill-of-lading>> accessed 1 November 2021. See also Eleanor Wragg, 'Industry Association Takes on e-Bill of Lading Standardisation' *Global Trade Review* (London, 17 June 2020) <www.gtreview.com/news/fintech/industry-association-takes-on-e-bill-of-lading-standardisation> accessed 1 November 2021.

¹⁹⁸ See e.g. International Organization of Standardization, 'ISO/TC 307: Blockchain and Distributed Ledger Technologies' <www.iso.org/committee/6266604.html> accessed 1 November 2021.

platforms,¹⁹⁹ and OpenShipping.org's release of open-sources APIs and standards.²⁰⁰

However, whilst some initiatives are working collaboratively, there remains a threat of fragmentation of standards, particularly as each of these initiatives focuses on niche problems within the broader issue of blockchain BoL and electronic BoL standardisation.²⁰¹ Relatedly, given that there is no legal requirement to adhere to any one standard (outside of any organisational membership requirements to adhere to a particular standard), it is possible that not all industry participants will adopt any one standard, let alone the more widely adopted standard(s), particularly if there is a lack of commercial incentive in these early years of blockchain BoLs. Such fragmentation would be more of a setback than a success, as the industry is unlikely to have the confidence to move to blockchain BoL platforms if there cannot be an agreement on standards.

III. THE NEED FOR UNPRECEDENTED COLLABORATION

The obstacles facing blockchain BoLs are clearly numerous, multifaceted, and intertwined. As a result, it is not expected that blockchain BoLs will experience the meteoric rise that others forecast; industry integration will be gradual in speed and breadth, although the bottlenecking and strain on the industry caused by COVID-19 has increased awareness of and urgency for the need for electronic trading solutions. The concern is that the main obstacles to a global blockchain BoL network are addressed too slowly or otherwise in a patchy and uncoordinated manner such that blockchain BoLs cannot be used globally and throughout the entire journey of transported goods. Therefore,

¹⁹⁹ International Chamber of Commerce, 'Digital Trade Standards Initiative Launches under the Umbrella of ICC' (4 March 2020) <<https://iccwbo.org/media-wall/news-speeches/digital-trade-standards-initiative-launches-under-the-umbrella-of-icc>> accessed 1 November 2021; Digital Standards Initiative (Website) <<https://www.dsi.iccwbo.org>> accessed 1 November 2021. See also Maddy White, 'New Head of ICC's Digital Standards Initiatives Talks Trade Digitalisation Scale Up' *Global Trade Review* (London, 8 October 2020) <www.gtreview.com/news/fintech/new-head-of-iccs-digital-standards-initiative-talks-trade-digitalisation-scale-up> accessed 1 November 2021; Eleanor Wragg, 'DCSA Standardises Electronic Bills of Lading' *Global Trade Review* (London, 9 December 2020) <www.gtreview.com/news/global/dcsa-standardises-electronic-bill-of-lading> accessed 1 November 2021.

²⁰⁰ OpenShipping.org (Website) <www.openshipping.org> accessed 1 November 2021.

²⁰¹ Feng (n 149) 35–36.

there is a need for some plan or coordination between all interested stakeholders to best allocate the time and resources in order to expedite the establishment of blockchain BoL as a viable alternative to the paper BoL.

It has been suggested that a structured step-by-step approach to the development and rollout of blockchain platforms would be the best solution. For example, Dale Huang, Chief Technology Officer of COSCO Shipping Lines, has proposed a four-stage approach based on functions: after forming a panel designed to assist coordination and data sharing, the next three stages involve finding blockchain solutions for tracking-and-tracing, insurance and finally payment processes.²⁰² Similarly, the United Nations Economic Commission for Europe's paper, 'A Roadmap towards Paperless Trade', presents a five-stage strategy rolling out electronic transferable record infrastructure linearly to different stakeholders, expanding to form a global network.²⁰³

Such orderly plans do not accord with the self-interested, fragmented yet inter-reliant nature of the maritime trade industry. Each industry participant has their own BoL handling procedures, yet they are reliant on parties before and after for an effective and efficient transfer of the document; any one participant not appropriately integrated into the chain bottlenecks the movement of the BoL. Nor do such plans accord with the cycle of inaction: legislators and regulators refuse to regulate until there is sufficient interest from the industry, whilst industry players remain hesitant to embrace blockchain technology until there is sufficient legal certainty.²⁰⁴

Taking these matters into account, a more appropriate approach requires an 'all-fronts' effort: legal, technological, commercial, and behavioural issues must be addressed simultaneously given the interrelated and cyclical nature of these obstacles. Furthermore, there should be a dynamic weighting and direction

²⁰² Vishnu Rajamanickam, 'Blockchain is the Technology of Logistics Industry in the Future, Says COSCO e-Logistics CTO' *Freight Waves* (Chattanooga, 11 June 2018) <www.freightwaves.com/news/technology/blockchain-is-the-technology-of-the-logistics-industry-in-the-future-says-cosco-e-logistics-cto> accessed 1 November 2021. See also Marcus Hand, 'After the Hype: Blockchain in Shipping Needs a Change in Mindset: SAP' *Seatrade Maritime News* (Colchester, 20 September 2019) <www.seatrade-maritime.com/asia/after-hype-blockchain-shipping-needs-change-mindset-sap> accessed 1 November 2021.

²⁰³ United Nations Economic Commission for Europe, 'A Roadmap towards Paperless Trade' (2006) ECE/TRADE/371.

²⁰⁴ Goldby, 'Electronic Bills of Lading and Central Registries' (n 38) 129–30.

of efforts and resources, organically shifting them between more and less pressing matters, and targeting development in certain jurisdictions and with certain stakeholders as needed. This approach should ensure an efficient allocation of resources such that progress is faster and spread across geography and industry stakeholder types. As a result, industry participants should grow increasingly confident that the blockchain BoL solution is sound. Taking this approach, and drawing on the previously identified obstacles, efforts to resolve the previously discussed issues can be categorised into four ‘fronts’: (1) introducing industry standards; (2) establishing a global legal framework; (3) building the necessary infrastructure; and (4) onboarding industry participants.

Arguably, at this early stage, more efforts should be directed towards the development of a set of universal standards regarding the design, implementation and use of blockchain BoLs.²⁰⁵ This is not only because these standards are lacking and need to be developed from scratch, but also because such ‘soft law’ instruments can be developed and implemented far quicker than laws, as they do not need to go through a political process. Standards will also establish design and commercial certainty for developers and users alike. Furthermore, they will signal to legislators that there is a clear commercial interest in blockchain BoLs and electronic transferable records, prompting more states to adopt a legal framework to support the technology. Universal standards therefore represent the middle ground that can defeat the hesitancy cycle of governments and industry participants.

There are two areas that standards need to focus on. The first regards issues of interoperability between blockchain BoL platforms as well as with other blockchain and non-blockchain systems for transferring and processing BoLs and other related information. These standards primarily serve a commercial and user-oriented purpose, and therefore development should primarily be led by the private sector. This is already happening, as discussed earlier, with the carrier-backed DCSA and the ICC’s Digital Standards Initiative both working on interoperability solutions. The other standards of importance are those that fall under the general reliability standards required by the MLETR. These will most likely be developed by domestic government agencies of states implementing the MLETR. As argued for the development of technical standards, efforts must be made to ensure that the general reliability standards developed in each state or jurisdiction are as consistent as possible, such that

²⁰⁵ See generally Feng (n 149) 29–37.

there is no additional (possibly prohibitive) expense for blockchain BoL developers and users for ensuring that they satisfy large variations in general reliability standards across the jurisdictions with which they operate. Collaboration and transparency between governments and their relevant agencies is imperative to achieving consistency.

Progress on the legal framework front also has some momentum but may nevertheless lack the impetus needed to encourage other states to adopt MLETR-based legislation. This is particularly so for three reasons. First, with so few states having implemented (or about to implement) the MLETR as domestic law, the incentive for other states to adopt is much lower. The MLETR is only of use if a significant number of states, and particularly the largest shipping states, adopt MLETR-based legislation. Second, the ‘commitments’ made by states regarding the MLETR are somewhat reserved, as discussed earlier, and do not guarantee that those states will implement the MLETR, or at least do so with pace. Finally, as the world hopefully overcomes the COVID-19 pandemic in the coming years, the additional pressures that it has placed on the international cargo industry will ease, at least to some extent, reducing the urgency and incentive to adopt electronic trading solutions and the MLETR.

To overcome these challenges, international organisations and global industry bodies need to put pressure on those states who have expressed any interest or made any commitment to implement the MLETR to ensure that they act. They must also engage with other states and assist them throughout the implementation process, as the ICC has done for Kiribati. Furthermore, local and regional industry participants and representative bodies need to actively express their desire for implementation of a legal framework in their respective jurisdiction.²⁰⁶ Nevertheless, addressing each state one by one is a daunting, slow and resource-intensive approach. Greater attention should therefore be put towards working with regional organisations and unions to establish regional harmonisation. This could be achieved through multilateral treaties, some other non-binding agreement or even general roadmaps, such as the measure to adopt the MLETR in the Pacific Island Forum’s Pacific Regional E-commerce Strategy and Roadmap.²⁰⁷ A regional commitment would allow for a more

²⁰⁶ See International Chamber of Commerce (n 130) 10.

²⁰⁷ Pacific Island Forum Secretariat, ‘Pacific Regional E-commerce Strategy and Roadmap’ (August 2021) 40 <<https://www.forumsec.org/wp-content/uploads/2021/02/Regional-Ecommerce-Strategy-Roadmap.pdf>> accessed 13 February 2022.

localised blockchain BoL economy to form, providing the necessary commercial incentive for those regional states to adopt the MLETR. Establishing several such regional economies would further incentivise other states to adopt the MLETR and provide several pillars to grow into a global legal network.

The infrastructure front is one that will require attention from both the public and private sector. Key infrastructure and industry participants such as ports and customs are often owned or run by the state and necessarily require state investments to transition to a blockchain BoL system. This will particularly be a challenge for some smaller and developing economies, who may need to expand or update their infrastructure in order to accommodate the investment in and maintenance of blockchain-specific infrastructure.²⁰⁸ These costs will need to be factored when considering implementation of the MLETR: something that international organisations assisting in adoption should facilitate. There may be scope to seek development loans or otherwise establish public-private partnerships in the establishment of this infrastructure. Consideration of the extent of private investment post-MLETR implementation is also important; time and resources will be wasted if the private sector is either unwilling or unable to invest in adopting their own infrastructure and practices to accommodate blockchain BoLs. For example, there are reports that foreign businesses that serve a significant portion of a market that interacts with a BoL in smaller nations, as some banks do, are hesitant to invest in the infrastructure and business practices necessary to process blockchain BoLs until there are sufficient commercial opportunities to make the investment commercially viable.²⁰⁹ This is where establishment of a regional legal framework is necessary in order to establish a regional blockchain BoL economy that justifies private investment into infrastructure. Although, in any case, small and medium-sized enterprises will also likely need the financial support of the state to adopt the technology²¹⁰ or, alternatively, rely on shipping intermediaries to invest in the technology themselves and provide blockchain BoL services at a lower cost. Support from public international organisations and not-for-profits will be needed for industry stakeholders operating in places where their local government cannot provide the support required.²¹¹

²⁰⁸ See Gabriel (n 142).

²⁰⁹ Castellani (n 141). This has been corroborated by Raoul Renard from the International Chamber of Commerce.

²¹⁰ See Pico (n 143).

²¹¹ See generally Laryea (n 40) 179–87.

The final front entails not only establishing industry participant's trust in the technology and legal framework but also creating a commercially viable environment for industry participants to make the leap to blockchain BoLs. These two elements are interrelated, as commercial viability is, in large, based on having reliable technology and a global framework, whilst both more secure, interoperable technology and growth in the legal framework will only happen as the commercial benefits of blockchain BoL are perceived and realised. Ultimately, confidence in blockchain BoL from private and public sector participants should snowball in light of headway made on the other fronts. Nevertheless, in the meantime, engagement with industry by governments and organisations working on those other fronts must not be neglected. Given the many types of participants that interact with the BoL throughout the whole supply chain, each of their interests must be considered and balanced.

Dealing with each of the four fronts is an overwhelming prospect and, if not executed with sufficient management or coordination, can lead to continued fragmentation of the industry and an imperfect allocation of resources. For example, with several organisations developing interoperability standards, and the possibility that each MLETR-adopting nation will create their own general reliability standards in accordance with Article 12 of the MLETR, there stands the real possibility of competing industry standards and rules that are too difficult for industry participants to decipher and too costly to comply with. There is also the possibility that too many resources and efforts are directed to one of the four fronts to the neglect of others, or that certain geographical areas and stakeholders are paid less attention to than others. Both possibilities would significantly hamper the goal for a harmonised, global blockchain BoL system.

Some form of cooperation, open communication and coordination is needed to address these issues. Given the vast number and breadth of industry participants, industry representative groups, governments, government agencies, regional groups and international organisations that would be involved, the establishment of some sort of organisation that acts on behalf of all such participants is unlikely to be practical. The number and breadth of type of stakeholders means that there is a possibility that no roadmap, pathway or decision could ever be agreed upon. Rather, it is proposed that an alliance is formed between all such stakeholders. The function of such an alliance would be to share updates as to the progress of each of the four fronts and identify how efforts can be best managed to avoid duplication of efforts, conflicts or other issues that would undermine the formation of a global and harmonised blockchain BoL network. The coordination of efforts and uniformity or

consistency in laws, standards and practices would be pursued not through mandates but through forum discussion, roadmaps and publications, and other assistance. This is effectively an extrapolation of the intergovernmental forums or international organisation working groups to involve both public and private participants. Such a project would likely need to be spearheaded by those international organisations already heavily engaged in assisting with the development of blockchain BoLs and electronic transferable records, such as UNCITRAL and the ICC.

To the author's knowledge, nothing like this has been attempted in other areas, and certainly not at this scale,²¹² most likely due to the prodigious logistical difficulties of arranging meetings with hundreds of potential stakeholders, as well as the costs involved. However, the beginnings of such a proposed alliance seem to be forming under the auspices of the ICC. Their Digital Standards Initiative is primarily focused on establishing uniformity in digital standards for electronic transferable instruments that are accessible and usable by all industry players, and advocating the adoption of the MLETR. The initiative is governed by an international Governing Board comprising members from the ICC, Asian Development Bank and the World Trade Organization. In August 2021, it added an Industry Advisory Board with cross-regional and cross-industry representation.²¹³ Finally, the Digital Standards Initiative most recently launched a Legal Reform Advisory Board to support the legal harmonisation efforts of the initiative. It comprises 30 leaders from around the world, including members from the Asian Development Bank, Bankers' Association for Finance and Trade, the Commonwealth, ICC France, ICC Germany, ICC Mexico, the International Trade and Forfeiting Association and UNCITRAL.²¹⁴ The Legal Reform Advisory Board aims to keep the G7+ to their electronic transferable record commitments made in 2021, as well as work with the EU, the Commonwealth, the African Union, individual governments and the World Trade Organization to facilitate domestic laws implemented and

²¹² However, a similar approach has been advocated by Alan D Rose: see generally Rose (n 105).

²¹³ Digital Standards Initiative, 'About' <<https://www.dsi.iccwbo.org/about-icc-digital-standards-initiative>> accessed 18 December 2021.

²¹⁴ International Chamber of Commerce, 'ICC Forms Legal Reform Advisory Board to Support Digital Standards Initiative' (15 December 2021) <<https://iccwbo.org/media-wall/news-speeches/icc-forms-legal-reform-advisory-board-to-support-digital-standards-initiative>> accessed 18 December 2021.

aligned with the MLETR.²¹⁵ These advisory boards are said to work together, as well as with the Governing Board and the wider initiative, to achieve their goals.

The Digital Standards Initiative, along with the individual work of the ICC, covers the first and second fronts (and henceforth will contribute to the achievement of the fourth front). Nevertheless, it falls short of the comprehensive alliance proposed in at least two ways. First, whilst somewhat global in its reach, and impressively so given its short existence, participation in the Digital Standards Initiative is still somewhat limited and concentrated to Asian participants, noting that the Singapore Government and the Asian Development Bank were the founding members of the Digital Standards Initiative. However, the organisation is built with a global mindset and with expectations to increase participation by governments, international organisations and industry participants. For example, the Legal Reform Advisory Board already has 30 members from around the world, with an expectation to have ‘upwards of 100 countries’ join the board by 2023.²¹⁶ Second, and more critically, the Digital Standards Initiative does not appear to have an emphasis on resource allocation and assistance in the development and installation or upgrade of infrastructure, at least formally. That is, the third front regarding having the necessary infrastructure to support the exchange of blockchain BoLs throughout the global supply chain is not formally addressed as a mandate. If the ICC’s Digital Standards Initiative is to evolve into the coordinating body that addresses all such fronts, it will need to find a way to inform all interested parties about how to allocate efforts and resources to ensure that a blockchain BoL network is truly global and connected to all parts of the supply chain. Ideally, it would also assist public and private organisations to seek funds or otherwise provide them with funds to upgrade or install the necessary infrastructure. This would also assist in the achievement of the other fronts: assisted investments should ensure that the standards advocated by the initiative are implemented, prompt governments to adopt MLETR-based legislation as organisations operating in their jurisdiction increasingly engage with blockchain BoLs, and overall make industry participants more comfortable to take the significant step to move away from paper BoLs to blockchain BoLs.

²¹⁵ Eleanor Wragg, ‘Exclusive: ICC Targets Digital Trade Legal Reform in 100 Countries with Industry-Wide Board’ *Global Trade Review* (London, 15 December 2021) <<https://www.gtreview.com/news/global/exclusive-icc-targets-digital-trade-legal-reform-in-100-countries-with-industry-wide-board>> accessed 18 December 2021.

²¹⁶ *ibid.*

CONCLUSION

For all its faults, the paper BoL has remained a central part of maritime trade for centuries. In many respects, this reflects just how highly industry participants value the document and its functions. However, it also reflects the fact that there has never been a viable alternative that overcomes the paper BoL's issues. The electronic BoL solutions developed over the past three decades showed promise, but an inability to adequately reproduce the BoL's function as a negotiable document of title, amongst other issues, ultimately saw their demise. The blockchain BoL represents the first technology to achieve functional equivalence at a practical level.

Nevertheless, blockchain is no perfect technology. To achieve the scale and network necessary to make the technology viable in the maritime shipping industry, blockchain BoL providers must onboard all industry participants types from all corners of the world, no matter how large or small, by assisting them to overcome their anxieties and accessibility issues. Furthermore, fragmentation of blockchain networks, given the lack of interoperability, mirrors the devastating 'club' problem of former electronic BoLs. The industry must ensure that blockchain platforms are interoperable, ideally by developing uniform, global standards.

Efforts have already begun to address these issues. However, those efforts too risk turning into a fragmented mess. Industry participants must overcome their habitual tendencies to act only in their interest and begin working collaboratively to implement a global and dynamic strategy to ensure that a uniform, interconnected network for blockchain BoLs is implemented globally.