University of Southampton

Faculty of Law

University of Southampton

Rethinking Legal Approaches to Electronic Bills of Lading: From Functional Equivalence to a Substantive Approach

by

XU Tengjiao

ORCID ID 0009-0005-5139-7153

Thesis for the degree of Doctor of Philosophy

6th January 2026

University of Southampton

Abstract

Faculty of Law

University of Southampton

Doctor of Philosophy

Rethinking Legal Approaches to Electronic Bills of Lading: From Functional Equivalence to a Substantive Approach

by

XU Tengjiao

The transition from paper-based to electronic bills of lading represents a significant advancement in global trade, promising enhanced efficiency and security. However, this transition also raises complex regulatory challenges. Among the regulatory approaches, functional equivalence has become the cornerstone for legitimizing electronic bills of lading. Scholarship and practice have largely embraced this principle without subjecting it to sustained critical scrutiny, although a few scholars have questioned its limitations in the legal context. In other words, although functional equivalence has been widely accepted, its limitations in the legal context remain underexplored. This research aims to critically evaluate functional equivalence and explore potential alternative approaches to better address the emerging challenges posed by new technologies.

This research will first examine the theoretical underpinnings and historical foundations of functional equivalence. It will trace how this concept entered the field of law and became a regulatory approach for electronic records, including electronic bills of lading. The study will then evaluate how the principle was articulated in UNCITRAL's exploration of e-commerce and assess its adequacy in regulating electronic bills of lading, thereby laying the groundwork for a critical examination of its limitations.

Beyond evaluating functional equivalence, this thesis also draws on the regulatory explorations of other international organisations. The proposed substantive approach on controlled electronic records highlights issues of control, proprietary rights, and custody, offering a distinct perspective. Building on these insights, this thesis proposes a substantive approach as an alternative framework for regulating electronic bills of lading. This approach aims to move beyond functional equivalence by directly addressing the substantive legal requirements of electronic bills of lading.

Table of Contents

Table of Contents

Research Thesis: Declaration of Authorship

Print name: XU Tengjiao

Title of thesis: Rethinking Legal Approaches to Electronic Bills of Lading: From Functional Equivalence to a Substantive Approach

I declare that this thesis and the work presented in it is my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission;

Signature: Date:

Acknowledgements

Since my PhD journey began in October 2021, I have countless times imagined what I would write in this acknowledgement. Now that the time has come to actually write it, I find myself at a loss for where to begin. I tried to make a list, to record the mentors and friends who inspired my research during these three-plus years of my PhD: the faces that lit up my life, the revelations that gave me pause for reflection, allowing me to know and understand myself better. The list is too long, and I can only do my best to recall everyone who has left a mark.

First and foremost, I would like to send my sincere gratitude to my wonderful supervisor, Dr. Johanna HJALMARSSON, who has shouldered the entirety of my supervision from the very first day of my PhD until now. Throughout these almost four years, she has given me immense freedom and respect. Whenever I had any questions, she was always enthusiastic in offering help. Whatever topics I wanted to research, she always provided inspiration. She has been more than just my research supervisor, but has become a mentor for my life. In her, I see the perseverance, courage, and passion of a female scholar for her research; I see the active encouragement a senior academic gives to a young female scholar; I see the love and responsibility of a mother for her family, and even more, I see an independent woman who always maintains independent thought, refusing to be drowned out by the many voices of this world. Recently, while serving as an editor for the Southampton Law Review, I was surprised to find that many of the suggestions I offered were ones Johanna had once given me. I then realized that, in so many things, I have begun to emulate Johanna: learning from her grace, her open-mindedness, her diligence, and her rigor. I am proud to have such a supervisor.

Secondly, I would like to thank my Master's supervisor, Dr. Yu GUO, who is also an exceptional female scholar. It has been over three years since I left Peking University, but during this time, she has always cared for my well-being, applauded every small step of my academic progress, offered advice on my marriage, and urged me to exercise and become stronger.

I am also grateful to UNCITRAL for the internship opportunity. The three months I spent there greatly broadened my research horizons, and the main arguments of my thesis were largely formed in Vienna. I thank the legal officers at UNCITRAL who gave me career advice and encouragement: Anna Jobin BRET, Judith KNIEPER, Anita BRUNADER, Yanying LI, Karen NGAI, Semira MUSAYEVA, Hana DOUMAL, Monica CANAFOGLIA, Thomas TRASCHLER, Alexander

KUNZELMANN, Yaochen GONG and my wonderful office mates: Yvonne ELUMOGO, Khalid ABUDULAZIZ and Fawad AZIZI.

I want to express my gratitude to Professor Stephen D. GIRVIN for my opportunity to be a visiting researcher at the Centre for Maritime Law (CML) at National University of Singapore. My time at CML honed my research perspective on maritime law. Thanks to Professor Paul MYBURGH for the valuable questions he raised during my presentation. And thanks to Rowena GOH, Mustafa YILMAZ, Navid HATAMIPOUR, Bulat KARIMOV, Liwen LEUNG for their excellent questions and inspirations, especially Mustafa YILMAZ for his valuable suggestions on my career and help he offered.

I also feel greatly honoured for being awarded the research scholarship from UNIDROIT, which gave me the opportunity to work on digital assets, which is related to Chapters 4 and 5 of my thesis. My gratitude goes to Laura TIKANVAARA and Dr. William BRYDIE- WATSON. The seminars and close academic exchanges at UNIDROIT gave me much to reflect upon, and having my photo taken with Sir Roy GOODE inspired my courage to press on in the field of commercial law. In Rome, I met many outstanding Chinese girls: Wenqian YU, Shuyue FENG, Yan WANG, and Zhengqing REN. In the days after I submitted the draft of my thesis in the June 2025, we travelled together, freely enjoying the beaches, gelato, aperol spritz, and the Italian summer.

I have been lucky enough to be surrounded by distinguished senior academics who have helped me during my PhD. Thanks to Professor Robert GRIME for granting me an interview after 20 years retirement and our conversation deepened my passion for maritime law. Thanks to Professor Zhiyong ZHANG for his career advice. Thanks to Yuanmin LIN for stimulating my thesis structure. My thanks also go to Professor Andrea LISTA, Dr. Feng WANG, Dr. Liang ZHAO, Dr. Meixian SONG, Professor Miriam GOLDBY and Professor Ozlem GURSES, all of whom have assisted in my research. I am also grateful to the many editors and reviewers who have provided valuable suggestions for my papers.

I must also thank the senior professionals who agreed to be interviewed for my empirical research during my second year. They came from technology companies, shipping companies, international organisations, and banks. Dr Hanane Becha from UN/CEFACT explicitly agreed to be cited by name. For the other interviewees, due to commercial confidentiality, I will refer to

them by their surnames: Mr. FENG, Mr. GU, Mr. YANG, and Ms. LU. Thank you for your detailed answers and for enriching my interview questions.

Thanks to my friends at the University of Southampton: Wenni ZHANG, Xuerui GUO, Meijun CHEN, Yingxue MOU, and Fanyi JI. Without your companionship, I could not have managed my daily life after injuring my back and fracturing my right hand, and I could not have built the draft of my thesis during my recovery. Thanks to my peers and seniors at the Law School, we shared information and progressed together. A special thanks to Dr. Zicong ZENG for helping me with so many questions.

Thanks to Marcel BROWN in the postgraduate graduate office, who twice arranged for my office change and provided help and answers to my many questions during my injury. Thanks to the staff at Building 37, who are always patient with student inquiries, and to the well-being team, who very proactively arranged counselling for me after I experienced sexual harassment in my first office.

I am so blessed with having Donald TANG, my husband, in my life, without his encouragement and companionship, I would not be as confident, chill, and independent as I am today. Thank you so much for witnessing every one of my tears and smiles, and for always being by my side. I must also thank my parents, my sister, and my grandparents. Their presence and every moment we shared gave me the strength to summon the courage to move forward each time I felt like giving up.

Finally, I would like to express my special gratitude to the functional equivalence approach. It is an important starting point for electronic documents, and the constant object of dialogue and reflection throughout my research journey. It was precisely through the continuous process of engaging with it, understanding and criticizing it, that I gradually clarified my own line of thought and came to appreciate the difficulty and value of the evolution of legal ideas. The functional equivalence approach may no longer be able to fully meet the challenges of the new technological environment, in my view, but the theoretical inspiration it has left behind will always deserve respect.

Chapter 1 Introduction

This thesis examines how electronic bills of lading are regulated in law. It focuses on the principle of functional equivalence, which has long provided the main basis for legal recognition of electronic bills of lading, but whose limitations have not been fully addressed. The thesis argues that these limitations call for a substantive approach, and it sets out to analyse both the shortcomings of functional equivalence and the potential of a substantive framework.

This chapter sets out the objectives of the thesis, explains its significance, and outlines the structure and methods used. It also reviews the literature on electronic bills of lading, showing what has been studied, what remains unresolved, and how this thesis offers an alternative approach to their legal treatment.

1.1 Electronic bills of lading and objective of the thesis

The transition from paper-based to electronic bills of lading represents a significant advancement in global trade, promising enhanced efficiency and security. However, this transition also raises complex regulatory challenges.

This thesis takes as its primary object of study the functional equivalence principle, which has emerged as the dominant regulatory approach to electronic bills of lading. Among the regulatory approaches, functional equivalence has become the cornerstone for legitimizing electronic bills of lading. Scholarship and practice have largely embraced this principle without subjecting it to sustained critical scrutiny, although a few scholars have questioned its limitations in the legal context.[1] In other words, although functional equivalence has been

[1] See e.g. UNCITRAL, Model Law on Electronic Transferable Records (2017) and its Explanatory Note, which adopt functional equivalence as a central regulatory technique for electronic transferable records; see also United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (Rotterdam Rules) (2008), arts 8–10, reflecting the widespread acceptance of functional equivalence in international legislative practice concerning electronic transport documents;
For more reflective or critical accounts, see Chris Reed, 'Online and Offline Equivalence: Aspiration and Achievement' (2010) 18(3) *International Journal of Law and Information Technology* 248; M Schellekens, 'What Holds Off-Line, Also Holds On-Line?' in BJ Koops, M Lips, C Prins and M Schellekens (eds), *Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-Liners* (IT & Law Series vol 9, TMC Asser Press 2006) 51; Mireille Hildebrandt and Laura Tielemans, 'Data Protection by Design and Technology Neutral Law' (2013) 21 *Computer Law & Security Review* 509; Susan Greenberg, 'Against Neutrality' (2018) 14 *Journal of Internet Law* 1.

widely accepted, its limitations in the legal context remain underexplored. This research aims to critically evaluate functional equivalence and explore potential alternative approaches to better address the emerging challenges posed by new technologies.

Against this background, this research will first examine the theoretical underpinnings and historical foundations of functional equivalence. It will trace how this concept entered the field of law and became a regulatory approach for electronic records, including electronic bills of lading. The study will then evaluate how the principle was articulated in UNCITRAL's exploration of e-commerce and assess its adequacy in regulating electronic bills of lading, thereby laying the groundwork for a critical examination of its limitations.

Beyond evaluating functional equivalence, this thesis also draws on the regulatory explorations of other international organisations. The proposed substantive approach on controlled electronic records highlights issues of control, proprietary rights, and custody, offering a distinct perspective. Building on these insights, this thesis proposes a substantive approach as an alternative framework for regulating electronic bills of lading. This approach aims to move beyond functional equivalence by directly addressing the substantive legal requirements of electronic bills of lading.

1.2 Significance of the research and audience

With advancements in technology, electronic documents have emerged as practical alternatives to their paper-based counterparts. They are capable of saving time and costs in commerce, but they also generate complex legal issues. These issues arise not only from the electronic nature of such documents but also from the simultaneous operation of electronic and paper versions, sometimes even within the same transaction. In such circumstances, the two formats may or may not carry the same legal implications, leading to uncertainty. As the most pivotal electronic document in maritime and international trade law, electronic bills of lading represent both the opportunities and the challenges of this transformation.

As early as in 1989, Chandler II predicted electronic bills of lading: "it does seem certain that within the next several years, electronic bills of lading will be generated."[2] Chandler wrote that

[2] George F. Chandler II., 'The Electronic Transmission of Bills of Lading' (1989) 20 J Mar L & Com 571, 573.

the question of whether the usage of electronic systems would be successful was up in the air.[3] Decades later, electronic bills of lading are slowly on the path to gaining wider acceptance.[4] Usage of platforms, fraud, shipping regulations, transaction security, acknowledgment, and privacy are all concerns that may have been predicted at the time yet continue to pose problems. Functional equivalence has provided the primary regulatory foundation for electronic bills of lading, but its capacity to resolve these substantive issues remains doubtful.

Legal and regulatory approaches to electronic bills of lading reveal a significant gap when faced with these challenges. Some international instruments like the UNCITRAL Model Law on Electronic Transferable Records (hereafter referred to as MLETR)[5] and Rotterdam Rules[6] offer partial solutions.[7] Some countries are revising their legislation – notably the UK.[8] Other countries have their own domestic initiatives.[9] The self-regulatory associations of the maritime

---

[3] Ibid., 575-579.

[4] See Aikens R and others, *Bills of Lading* (3rd ed, Informa Law from Routledge 2020); Paul Todd, 'Electronic Bills of Lading, Blockchains and Smart Contracts' (2019) 27 International Journal of Law and Information Technology 339; Miriam Goldby, 'Electronic Bills of Lading and Central Registries: What Is Holding Back Progress' (2008) 17 Info & Comm Tech L 125; Susan Beecher, 'Can the Electronic Bill of Lading Go Paperless' (2006) 40 Int'l Law 627; Rouhshi Low, 'Replacing the Paper Bill of Lading with an Electronic Bill of Lading: Problems and Possible Solutions' (2000) 5 Int'l Trade & Bus L Ann 159; John Livermore & Krailerk Euarjai, 'Electronic Bills of Lading: A Progress Report' (1997) 28 J Mar L & Com 55; the website link of the conference recording is https://bimco.cloud.panopto.eu/Panopto/Pages/Viewer.aspx?id=666282da-5a00-4669-afc5-af9600ae7f38, accessed 28 Feb. 2023; DCSA's Digital Trade Initiative, https://dcsa.org/100-percent-ebl/, accessed 28 Feb. 2023; BIMCO publishes Electronic Bill of Lading Standard for Bulk Shipping, https://www.bimco.org/insights-and-information/contracts/20220714-ebl#:~:text=To%20help%20increase%20adoption%20of%20digital%20trade%20documents,more%20information%20and%20documentation%20for%20the%20new%20standard, accessed 28 Feb. 2023; The FIT Alliance, Uniting behind the mission to standardise the digitalisation of international trade, DCSA BIMCO, FIATA ICC and SWIFT have formed the FIT Alliance, https://dcsa.org/newsroom/resources/future-international-trade-alliance/, accessed 28 Feb. 2023.

[5] See the contribution of the MLETR for the regulation to electronic bills of lading in Section 3.3.3 of Chapter 3.

[6] See the contribution of the Rotterdam Rules for electronic bills of lading in Section 3.3.2 of Chapter 3.

[7] UNCITRAL Model Law on Electronic Transferable Records 2017 (MLETR); United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea 2008 (the "Rotterdam Rules").

[8] Law Commission, 'Electronic trade documents' <https://www.lawcom.gov.uk/project/electronic-trade-documents/> accessed 25 May 2022; Law Commission, 'Electronic trade documents: Report and Bill' <https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2022/03/Electronic-Trade-Documents-final-report-ACCESSIblE-1.pdf> accessed 25 May 2022.

[9] Including but not limited to: China: China's E-Commerce Law took into effect in 2019; Germany: German Commercial Code; Japan: Electronically Recorded Monetary Claims Act; South Korea: Regulation on Implementation of the Provisions of the Commercial Act Regarding Electronic Bills of Lading.

sector have also made some explorations.[10] However, most of these efforts ultimately rely on the functional equivalence principle as their underlying logic. Published research on electronic bills of lading has likewise concentrated on formal aspects, paying relatively little attention to the role of functional equivalence itself. This thesis addresses that gap by critically analyzing the principle, thereby offering insights relevant to both scholars and policymakers concerned with the legal infrastructure of international trade.[11]

1.3 Structure and methodology

Chapter 1 introduces the research objectives, significance, audience, as well as the thesis structure and methodology. Chapter 2 examines the theoretical and historical foundations of functional equivalence, tracing its origins from sociological functionalism to its adoption in electronic commerce law. Chapter 3 critically assesses the limitations of the principle in regulating electronic bills of lading, drawing on both doctrinal analysis and interview evidence to identify its intrinsic, practical, and external shortcomings. Chapter 4 proposes a substantive approach as an alternative regulatory model. Building on insights from substantive framework for controlled electronic records, this chapter develops the elements of the substantive approach: definition, control, proprietary rights, and custody. Chapter 5 evaluates the extent to which the substantive approach can be applied to electronic bills of lading through detailed case analysis, testing its effectiveness across the core legal issues of definition, control, proprietary rights, and custody. Chapter 6 concludes by summarising the findings, highlighting the thesis's contributions, limitations, and assessing the future prospects of combining functional equivalence with substantive approaches.

---

[10] DCSA's Digital Trade Initiative, https://dcsa.org/100-percent-ebl/, accessed 28 Feb. 2023; BIMCO publishes Electronic Bill of Lading Standard for Bulk Shipping, https://www.bimco.org/insights-and-information/contracts/20220714-ebl#:~:text=To%20help%20increase%20adoption%20of%20digital%20trade%20documents,more%20information%20and%20documentation%20for%20the%20new%20standard, accessed 28 Feb. 2023; The FIT Alliance, Uniting behind the mission to standardise the digitalisation of international trade, DCSA BIMCO, FIATA ICC and SWIFT have formed the FIT Alliance, https://dcsa.org/newsroom/resources/future-international-trade-alliance/, accessed 28 Feb. 2023.

[11] See prominently the comprehensive works of Miriam Goldby, Paul Todd, Stephen D. Girven, and other authors cited in Chapter 2.

The methodology adopted in this thesis combines doctrinal analysis with empirical methods. The doctrinal component examines primary and secondary legal sources, including statutes, international instruments, case law, and scholarly commentary.[12]

Case studies are used to analyse legal issues arising under both paper and electronic bills of lading, providing a comparative foundation for evaluating the substantive approach.

In addition, qualitative interviews were conducted with stakeholders directly involved in the practice of electronic bills of lading, including carriers, banks, technology providers, industry standard-setting bodies, and representatives of international organisations.[13]

In particular, qualitative interviews and related communications were conducted as follows:

(1) An interview was conducted with a representative from COSCO Shipping who held a dual role as both a project leader and a ship master, offering insights into the specific considerations of a large shipping company in adopting electronic bills of lading, including requirements and strategic considerations when a carrier operates its own electronic bill of lading platform (17 October 2022).
(2) Interviews were then conducted with three interviewees from a third-party electronic bills of lading technology provider, including project leader responsible for platform implementation (21 October 2022).
(3) Perspectives from the regulatory and standard-setting sphere were obtained through an interview with Dr Hanane Becha, digital trade expert and Vice Chair of UN/CEFACT, which addressed international efforts to harmonise electronic trade documentation (21 November 2022).
(4) Further insights were drawn from email correspondence with a product manager from essDOCS regarding the technical architecture and operational features of electronic bill of lading systems (24 November 2022).
(5) In addition, a bank officer from the Bank of China was interviewed to examine the implications of electronic bills of lading for trade finance and banking practice (22 November 2022).

[12] See Chapter 1 and 3.
[13] ERGO II Submission ID: 75827 - Legal and Regulatory Approaches to Electronic Bills of Lading.

Research interviews can be conducted based on a subjective or an objective approach. Given that my research is in a social sciences discipline and that the cultural differences among interviewees are inseparable, the subjective approach is adopted, considering the views and culture of the interviewees. Interviewees were drawn from multiple jurisdictions and institutional settings, including the United Kingdom, China, and the United Nations. The interviews were semi-structured, allowing for both consistency across key themes and flexibility to capture emerging insights.

Ethical approval was obtained through ERGO II, and all interviews were recorded, transcribed, and analysed to identify recurring themes relevant to the research questions.[14]

In addition to the formal interviews outlined above, the author also engaged in informal exchanges with representatives from entities during an internship at UNCITRAL. These exchanges took place in the course of sessions of Working Group IV and Working Group VI, and involved participants from governments, international organisations, industry bodies, and private sector stakeholders. While these interactions did not form part of the structured interview process, they provided valuable contextual understanding of the practical and policy considerations of electronic trade law.

1.4 Literature review

Technology has always been central in the debate over electronic bills of lading. Tajti has highlighted the growing influence of 'legal tech,' noting that technological change increasingly shapes legal institutions.[15] He also suggests that blockchain may reduce fraud and speed up transactions, offering new opportunities in trade. Mandel, however, takes a more cautious approach, emphasising that law should neither react too quickly nor too slowly to technological

[14] Ibid.

[15] There is no universally accepted definition of legal tech in academia, and there is much discussion in the industry. See Maria Correa, 'What Is Legal Technology and How Is It Changing Our Industry?' (The Lawyer Portal, 29 Jan 2019). <https://www.thelawyerportal.com/blog/what-is-legal-tech-and-how-is-it-changing-industry/> accessed 18 May 2022; Patrick Szakiel, 'What Is Legal Tech? (+How It's Changing the Legal Industry)' (G2, 11 Jun 2019). < https://www.g2.com/articles/legal-tech> accessed 18 May 2022; Lisa Dimyadi, 'What is Legal Technology?' (Clio, 9 May 2022). <https://www.clio.com/resources/legal-technology/what-is-legal-technology/#:~:text=Legal%20technology%20is%20a%20type%20of%20technology%20which,these%20are%20not%20specific%20to%20the%20legal%20industry.> accessed 18 May 2022.

change.[16] Instead, it should adapt in a gradual and flexible manner. Brownsword, Scotford, and Yeung further explore the issue from a regulatory angle, pointing to the blurred boundaries between law and regulation,[17] while Ganne stresses that technology alone cannot drive digitalisation and that legal recognition of instruments such as e-signatures, together with coordinated global action, is necessary.[18] These discussions underline the importance of the technology–law relationship, but they remain at a general level and rarely examine the regulatory principle of functional equivalence directly.

Further debates explore how electronic transferable records should be defined and regulated. Safranko distinguishes between functional and substantive approaches, arguing that the definition of electronic transferable records shapes the regulatory method itself.[19] Rogers questions the continuing relevance of negotiable instruments altogether, noting that their traditional functions may no longer reflect modern commercial practices.[20] This raises fundamental questions about whether functional equivalence remains an adequate framework when the very concept of negotiability is being challenged. Although these analyses provide important insights, they tend to address discrete issues and stop short of offering a systematic critique of functional equivalence as a regulatory principle.

Several authors have also examined practical issues, such as uniqueness and transferability. Bons, Lee, and Wagenaar propose three possible solutions to the problem of uniqueness: reliance on a specific technology that guarantees only one record exists at a time, the use of a trusted third-party registry, or the replacement of negotiable with non-negotiable instruments. Each of these options has limitations.[21] Technological solutions risk obsolescence, centralised

---

[16] Gregory N. Mandel, 'Legal Evolution in Response to Technological Change' in Brownsword R, Scotford E, and Yeung K, *The Oxford Handbook of Law*, Regulation and Technology (Oxford University Press 2017).
[17] Roger Brownsword, Eloise Scotford, and Karen Yeung, 'Law, Regulation, and Technology: The Field, Frame, and Focal Questions' in Brownsword R, Scotford E, and Yeung K, *The Oxford Handbook of Law, Regulation and Technology* (Oxford University Press 2017) 3.
[18] Emmanuelle Ganne, 'Blockchain for Trade: When Code Needs Law' (2021) 115 AJIL Unbound 419, 421.
[19] The Uniform Electronic Transactions Act (UETA) is one of the several United States Uniform Acts proposed by the National Conference of Commissioners on Uniform State Laws (NCCUSL). Its purpose is to harmonize state laws concerning retention of paper records (especially checks) and the validity of electronic signatures; also see 'Glossary: Uniform Electronic Transactions Act (UETA)' (*Practical Law*) <https://uk.practicallaw.thomsonreuters.com/3-578-4607?contextData=(sc.Default)&transitionType=Default&firstPage=true> accessed 24 May 2022.
[20] James Steven Rogers, 'Introduction', *The End of Negotiable Instruments: Bringing Payment Systems Law Out of The Past* (1st edn, Oxford University Press 2011), XXI.
[21] Bons and others, 'Obstacles for the development of open electronic commerce' in Martijn Hoogeweegen and Bas Vermeer (eds), *Academic Research on Electronic Commerce* (Erasmus

registries raise governance questions, and non-negotiable substitutes do not preserve the essential functions of bills of lading.[22] Proposals to replace negotiable bills with seaway bills face similar criticisms, since the legal basis and commercial functions of the two instruments are fundamentally different.[23] These discussions show that the uniqueness and transferability problems cannot be resolved simply through functional equivalence, but they do not provide a coherent alternative framework.

International efforts further illustrate these tensions. UNCITRAL has played a leading role in shaping the legal framework for electronic commerce. Its Model Laws on Electronic Commerce (1996), Electronic Signatures (2001), and Electronic Transferable Records (2017) all adopt the principle of functional equivalence, adapting paper-based legal concepts to electronic form.[24] The MLETR promotes media neutrality, treating electronic communications as equivalent to paper-based methods by 'stretching' existing concepts.[25] However, questions remain about its adequacy, especially in relation to exclusive control as the functional substitute for possession. The Rotterdam Rules, by contrast, offer an autonomous set of rules and recognise electronic records without requiring a paper equivalent.[26] Scholars have described this divergence as a 'parallel' versus 'separate' approach.[27] Gabriel notes that having one set of rules for paper transactions and another for electronic ones risks creating conflicting legal

University, Faculty of Business Administration 1996) 128. The performative nature means: "In international trade the purpose of sending documents is not only to exchange information (informative) but may also be to change the commitments among parties. The latter type of communication is referred to as performative, introduced by Austin (1962) and extended by Searle (1969)." Austin, J.L. "How to DO things with words", Harvard University Press, Cambridge, MA, 1962; Searle, J. "Speech Acts: An Essay in the Philosophy of Language", Cambridge University Press, London, 1969.

[22] Bons and others, 'Obstacles for the development of open electronic commerce' in Martijn Hoogeweegen and Bas Vermeer (eds), *Academic Research on Electronic Commerce* (Erasmus University, Faculty of Business Administration 1996) 132.

[23] Ibid.

[24] Zvonimir Safranko, 'The Notion of Electronic Transferable Records' (2016) 3 InterEULawEast: J Int'l & Eur L, Econ & Market Integrations 1, 5.

[25] Henry D. Gabriel, 'The UNCITRAL Model Law on Electronic Transferable Records' (2019) 24 Unif. L. Rev 261, 262.

[26] See Manuel Alba, 'The Use of Electronic Records as Collateral in the Rotterdam Rules: Future Solutions for Present Needs' (2009) 14 Unif L Rev 801, 803, footnote 5.

[27] See Manuel Alba, 'Electronic Commerce Provisions in the UNCITRAL Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea' (2009) 44 Tex Int'l L J 387; Yu Guo, *Legislation on* Electronic Transferable Record: Problem and Solution (1st edn, Peking University Press 2019) 2; David A. Bury, 'Electronic Bills of Lading: A Never-Ending Story' (2016) 41 Tul Mar LJ 197, 223.

outcomes.[28] Alba highlights the specific difficulty of ensuring equivalence for the possession function of bills of lading, a challenge that functional equivalence alone may not resolve.[29] These contributions point to the fragility of the principle when confronted with the unique role of bills of lading in international trade.

National laws add further diversity. The UETA in the United States established early recognition of electronic records and signatures, but its functional equivalence model has proven difficult to adapt to blockchain and smart contracts.[30] Bosco examines how the UETA embodies functional equivalence but struggles to deal with blockchain, suggesting that rapid technological developments undermine the stability of the equivalence model.[31] Other scholars have examined how domestic reforms, such as those in the United Kingdom, engage with functional equivalence when revising laws on electronic trade documents.[32] While these initiatives provide useful perspectives, they largely continue to rely on equivalence-based reasoning, and few attempt to develop a substantive framework for electronic bills of lading.

In summary, the literature on electronic bills of lading and related electronic records is rich and diverse. Scholars have examined the role of technology, the challenges of regulation, and the development of international instruments. They have debated the merits of functional and substantive approaches, and they have explored issues such as uniqueness, transferability, and negotiability. However, the existing literature remains fragmented, with many discussions either too abstract, focusing on law and technology in general, or too narrow, concentrating on technical provisions of particular instruments. What is missing is a systematic and critical evaluation of functional equivalence itself, especially its limitations when applied to electronic bills of lading. This thesis addresses that gap by analysing functional equivalence both

---

[28] Henry D. Gabriel, 'The UNCITRAL Model Law on Electronic Transferable Records' (2019) 24 Unif. L. Rev 261, 262.
[29] Manuel Alba, 'The Use of Electronic Records as Collateral in the Rotterdam Rules: Future Solutions for Present Needs' (2009) 14 Unif L Rev 801, 804-806.
[30] 'Electronic Transactions Act' (*Uniform Law Commission*) <https://www.uniformlaws.org/committees/community-home?CommunityKey=2c04b76c-2b7d-4399-977e
d5876ba7e034#:~:text=The%20Uniform%20Electronic%20Transactions%20Act,removing%20barriers%20to%20electronic%20commerce> accessed 25 May 2022.
[31] A.J. Bosco, 'Blockchain and the Uniform Electronic Transactions Act' (2018) 74 Bus Law 243, 245, 248, 250.
[32] Andrew Dickinson, 'Electronic Trade Documents and the Conflict of Laws in the United Kingdom' (2024) 55 *Law Quarterly Review* 65; Liang Zhao, 'UK Electronic Trade Documents Act: problems of reliable system and exclusive control' (2025) 25(3) *International Trade Law & Regulation* 159.

doctrinally and empirically, and by proposing a substantive approach as an alternative framework.

Chapter 2 Functional Equivalence: Theoretical Foundations and Historical Evolution

2.1 Introduction

This chapter investigates the theoretical underpinnings and historical development of the principle of functional equivalence. It first situates the concept within broader traditions of functionalism and equivalence functionalism, highlighting both their contributions and limitations. It then turns to the field of electronic commerce law, where functional equivalence has evolved from an abstract idea into a guiding legislative technique. Finally, the chapter examines how international instruments have operationalised the principle by fixing it to specific functions, thereby laying the groundwork for understanding both its utility and its inherent constraints. By clarifying the original theoretical assumptions and the historical path through which functional equivalence has been incorporated into legal regulation, this chapter provides the conceptual foundation for the analysis in Chapter 3. It shows that the practical and doctrinal issues discussed in the following chapter are not simply matters of implementation, but are closely linked to the way the principle itself has been designed and applied.

2.2 Historical and theoretical foundations: from the initial thoughts to the legal doctrine

Functional equivalence is a regulatory method requiring functionally similar services to be regulated alike.[33] Its historical roots can be traced back to functionalism in the social sciences. Functionalism gradually entered the legal domain through comparative law, where scholars such as Ernst Rabel transformed it into a methodological tool for understanding how legal systems respond to similar societal needs.

[33] Andrej Savin, 'Rule Making in the Digital Economy: Overcoming Functional Equivalence as a Regulatory Principle in the EU' (2019) 22 Journal of Internet Law 3, 4.

This section builds on this background by first introducing functionalism as a sociological and legal concept, before turning to equivalence functionalism, which builds on the functionalist insight that similar problems across societies tend to produce similar solutions. This doctrinal development provides the theoretical foundation for applying functional equivalence in modern legal contexts, including the regulation of electronic bills of lading.

2.2.1 Functionalism in sociology and law

Functionalism, in its sociological sense, refers to an approach that views society as an integrated system in which each part contributes to the stability of the whole.[34] In the social sciences, functionalism has no uniform definition but broadly refers to a theory and method closely linked to structuralism.[35] By the nineteenth century, functionalism had secured a position in sociology by conceptualizing society as an organism.[36] Thinkers such as Herbert Spencer and Emile Durkheim advanced this 'organic' metaphor, which later provided legal scholars with a systemic model for comparing institutions.[37] Sociologist Parsons' AGIL model (adaptation, goal attainment, integration, latency) epitomized functionalism's concern with systemic stability: societies survive by performing indispensable functions.[38] This made Parsons the most prominent functionalist of the twentieth century.[39] The functionalist mindset also spread beyond sociology, influencing political science in Easton's systems analysis, though these details are peripheral here.[40] As Husa observes, functionalism is theoretically loaded, explanation-oriented, and reliant on the 'organic system' metaphor, which are all features that would shape its later legal application.[41]

---

[34] It is well known that Ernst Rabel (1874-1955) was the first comparatist who clearly stated and formulated functionalism as a methodological principle in the comparative study of law. See Lando, Ole. "Ernst Rabel (1874–1955)" In *Festschrift 200 Jahre Juristische Fakultät der Humboldt-Universität zu Berlin: Geschichte, Gegenwart und Zukunft* edited by Stefan Grundmann, Michael Kloepfer, Christoph G. Paulus, Rainer Schröder and Gerhard Werle, 605-626. Berlin, New York: De Gruyter, 2010. https://doi.org/10.1515/9783899496307.605.

[35] Jaakko Husa, 'Functional Method in Comparative Law - Much Ado about Nothing?' (2013), 2 EPLJ 4, 6.

[36] Ibid.

[37] Mark A. Schneider, 'Structuralism', in *Blackwell Encyclopedia of Sociology*, (ed.) George Ritzer (2007) pp 4856-4857 (<http://www.sociologyencyclopedia.com/public/>).

[38] Talcott Parsons, *The Social System* (Routledge 1951).

[39] Larry Brownstein, *Talcott Parson's General Action Scheme* (Schenkman, Massachusetts, 1982).

[40] See footnote 17 in Jaakko Husa, 'Functional Method in Comparative Law - Much Ado about Nothing?' (2013), 2 EPLJ 4, David Easton, *A Systems Analysis of Political Life* (Wiley: New York 1965).

[41] Jaakko Husa, 'Functional Method in Comparative Law - Much Ado about Nothing?' (2013), 2 EPLJ 4, 9. p.s. there is no "e)" in the original sentences of the cited article.

Although functionalism originated in sociology, its conceptual vocabulary proved attractive to comparative lawyers. By treating law as a functional response to social needs, scholars such as Ernst Rabel adapted the sociological method into a legal one: legal rules could be compared not as abstract doctrines but as practical solutions to similar societal problems.[42] This transposition laid the groundwork for later variants of functionalism in comparative law, among which equivalence functionalism is most relevant to functional equivalence.

As we can see, functionalism entered the field of law through comparative scholarship. By focusing on how legal rules solve similar social problems, comparatists could transcend doctrinal differences.[43] Ernst Rabel was the first to formalize functionalism as a legal method.[44] His focus was practical: showing how different legal systems responded to similar social problems, particularly in trade. As a drafter of the CISG, his approach left a lasting imprint on international commercial law.[45] Rabel's functionalism was criticized as narrow and unsystematic, yet its pragmatism was also praised.[46] This tension, between practical utility and theoretical thinness, arguably foreshadowed the strengths and weaknesses of functional equivalence in electronic commerce. Like Rabel's method, functional equivalence arguably provides a workable solution to cross-border commercial problems but does so at the cost of theoretical depth, leaving unresolved questions of legal justification and normative coherence.

A more scientific vocabulary and perspective, absent from Rabel's early writings, were later emphasized by Zweigert and Kötz. They situated comparative law within an international context and proposed that its purpose was to identify the 'best' legal solution, derived from

---

[42] Ernst Rabel, *The Conflict of Laws: A Comparative Study* (University of Michigan Law School.
[43] Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011. p21; Christopher McCrudden, 'Judicial Comparativism and Human Rights', in Comparative Law - A Handbook, (eds.) Esin Ortct and David Nelken (Hart: Oxford 2007) pp. 371-397, 375.
[44] Lando, Ole. "Ernst Rabel (1874–1955)" In *Festschrift 200 Jahre Juristische Fakultät der Humboldt-Universität zu Berlin: Geschichte, Gegenwart und Zukunft* edited by Stefan Grundmann, Michael Kloepfer, Christoph G. Paulus, Rainer Schröder and Gerhard Werle, 605-626. Berlin, New York: De Gruyter, 2010. https://doi.org/10.1515/9783899496307.605.
[45] Basedow, Jürgen. "Rabel, Ernst". In *Encyclopedia of Private International Law,* (Cheltenham, UK: Edward Elgar Publishing, 2017) accessed Apr 26, 2024, https://doi.org/10.4337/9781782547235.R.1, 1461-1466.
[46] Jan M. Smits, 'Taking Functionalism Seriously: On the Bright Future of a Contested Method' (2011) 18 Maastricht J Eur & Comp L 554, 556.

systematic comparison and evaluation.[47] This framed comparative law not merely as a descriptive exercise but as a normative and methodological enterprise.[48]

Husa has helpfully summarized their paradigm as a staged process: posing a functional question … evaluating which solution is 'best.'[49] This process arguably illustrates functionalism's central ambition: to treat law as a system responding to universal problems, thereby enabling critical cross-jurisdictional evaluation.

Subsequent scholarship has further refined this functional approach. Michaels identifies at least seven distinct conceptions of functionalism, the most significant for present purposes being 'equivalence functionalism.'[50] This variant emphasizes that similar problems across societies often generate similar legal responses, arguably providing a crucial basis for the regulatory alignment of electronic and paper bills of lading.

Despite its influence, functionalism has remained controversial and these controversies are relevant not only at a theoretical level but also for understanding how functional approaches are later translated into legal regulation.[51] For its proponents, it is the most effective, if not the

---

[47] Iain D.C. Ramsay, 'Functionalism and Political Economy in the Comparative Study of Consumer Insolvency: An Unfinished Story from England and Wales' (2006) 7 Theoretical Inq L 625, 628-629; Christopher A. Whytock, 'Legal Origins, Functionalism, and the Future of Comparative Law' (2009) 2009 BYU L Rev 1879, 1882-1883; K. Zweigert and H. Kotz, *An Introduction to Comparative Law* (3rd ed., Oxford University Press, Oxford 1998); Jaakko Husa, 'Functional Method in Comparative Law - Much Ado about Nothing?' (2013) 2 EPLJ 4, 13.

[48] Konrad Zweigert & Hein Kötz, *An Introduction to Comparative Law* 3 edn (Oxford University Press: Oxford 1998), 8.

[49] Jaakko Husa, 'Functional Method in Comparative Law - Much Ado about Nothing?' (2013), 2 EPLJ 4, 15.

[50] Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011, p344-345. The seven concepts are: (1) finalism, a neo-Aristotelian functionalism based on inherent teleology, (2) adaptionism, an evolutionary functionalism in a Darwinian tradition, (3) classical (Durkheimian) functionalism, expanding institutions through their usefulness for society, (4) instrumentalism, a normative theory of using law for social engineering, (5) refined functionalism, a functionalist method that replaces certain postulates of classical functionalism with empirically testable hypotheses, (6) epistemological functionalism, an epistemology that focuses on functional relations rather than on the ontology of things, and (7) equivalence functionalism, building on these concepts but emphasizing the non-teleological, non-causal aspect of functional relations. Largely oblivious of incompatibilities, functionalist comparative law (8) uses all of these.

[51] See, for example, Ralf Michaels, The Functional Method of Comparative Law, in *Matthias Reimann and Reinhard Zimmermann (Eds.)*, *The Oxford Handbook of Comparative Law* (Oxford: Oxford University Press, 2006), p. 340; Ginter Frankenberg, Critical Comparisons: Re-thinking Comparative Law, 26 HARv. INT'L L.J. 411, 428-29 (1985); Jaakko Husa, 'Farewell to Functionalism or Methodological Tolerance?', Rabels Z (2003) 419; Esin Ortct, 'Methodology of Comparative Law', in Elgar Encyclopedia of Comparative Law (ed.); Mathias Reimann, 'The Progress and Failure of Comparative Law in the Second Half of the Twentieth Century', 50 AM. J. COMP. L. 671, 679 (2002); Jan Smits (Edward Elgar: Cheltenham

only, comparative method.[52] For its critics, it reproduces the shortcomings of comparative law as a discipline.[53] The debate reflects law's broader methodological anxieties, framing functionalism as a response to law's search for methodological maturity.[54]

Scholars such as Akkermans, Samuel, Chynoweth, and Roberts highlight this disciplinary vulnerability, framing functionalism as a response to law's search for methodological maturity.[55] Geoffrey Samuel believes that the field of law becomes stagnant in comparison to disciplines outside its own domain because of this.[56] Legal studies arguably have shortcomings in their methodology. According to Chynoweth, legal researchers have long struggled to describe the nature of their work to colleagues in other disciplines.[57] As Roberts has remarked, the law is a relative latecomer to methodology, especially when compared to cognate

---

2006) 442, Jan M. Smits, 'Taking Functionalism Seriously: On the Bright Future of a Contested Method', 18 Maastricht Journal of European and Comparatie Law 4 (2011), 554; Christopher A. Whytock, 'Legal Origins, Functionalism, and the Future of Comparative Law' (2009) 2009 BYU L Rev 1879, 1879; Samuel, G., An Introduction to Comparative Law Theory and Method (Bloomsbury Publishing 2014) ch 5 ("Alternatives in Functionalism") p79. https://books.google.co.uk/books?id=H9adBQAAQBAJ (accessed: March 30, 2024).

[52] See Jaakko Husa, 'Metamorphosis of Functionalism - Or Back to Basics' (2011) 18 Maastricht J Eur & Comp L 548; Jan M. Smits, 'Taking Functionalism Seriously: On the Bright Future of a Contested Method' (2011) 18 Maastricht J Eur & Comp L 554; Max Rheinstein & Hans Julius Wolff, 'Ernst Rabel, Septuagenarian' (1944-1945) 19 Tul L Rev 1; F rancesca Bignami, 'Formal versus Functional Method in Comparative Constitutional Law' (2016) 53 Osgoode Hall L J 442; Wolfgang Faber & Claes Martinson, 'Can Ownership Limit the Effectiveness of EU Consumer Contract Law Directives? - A Suggestion to Employ a "Functional Approach"' (2019) 2019 ALJ 85.

[53] See A. V. Tkachenko, 'Functionalism and the Development of Comparative Law Cognition' (2010) 5 J Comp L 71, 71: "Any reflection of functionalist methodology in comparative law sooner or later encounters a logical contradiction"; Iain D.C. Ramsay, 'Functionalism and Political Economy in the Comparative Study of Consumer Insolvency: An Unfinished Story from England and Wales' (2006) 7 Theoretical Inq L 625, 627: "I then suggest that given the limits of functionalism, a focus on interests and ideas might be valuable in explaining continuing similarities and differences between countries"; Christopher A. Whytock, 'Legal Origins, Functionalism, and the Future of Comparative Law' (2009) 2009 BYU L Rev 1879, 2009: "Based on a critical evaluation of functionalism and of legal origins scholarship-which has a close affinity with functionalism-I conclude that comparative law should build upon functionalism's legacy"; Faber, W, 'Scepticism about the Functional Approach from a Unitary Perspective' in *Rules for the Transfer of Movables*: *A Candidate for European Harmonisation or National Reforms?* (Otto Schmidt/De Gruyter european law pub, Berlin, New York 2008) pp 97-122 <https://doi.org/10.1515/9783866537002.97>.

[54] Michaels, Ralf, 'The Functional Method of Comparative Law' (2006) Faculty Scholarship https://doi.org/10.1093/oxfordhb/9780199296064.013.0011 accessed 29 April 2024, p 340.

[55] Bram Akkermans, 'The Functional Method in Comparative and European Property Law', (2013) 2 EPLJ 1, 2.

[56] Van Hoecke, Mark (ed), *Methodologies of Legal Research: Which Kind of Method for What Kind of Discipline?* (Bloomsbury Publishing Plc, London, 2013) accessed 28 September 2023, ProQuest Ebook Central, 207.

[57] Paul Chynoweth, "*Chapter Three Legal research*", (2008), p 28, https://www.studocu.com/row/institution/uganda-christian-university/9543, accessed on 25 May 2023.

disciplines such as sociology and criminology.[58] He also characterises scholars' turn to methods for legal research as "a sign of maturity in legal pedagogy and scholarship, completing law's transition from a narrowly focused vocational education for legal practitioners to a fully-fledged university-based discipline with the reflexive and appropriately critical intellectual foundations."[59] While some, like Husa, regard these debates as futile, they have nonetheless stimulated more reflexive thinking about legal methodology and forced comparatists to confront the limits of functionalism.[60]

In summary, the only constant in functionalism, whether in sociology or in comparative law, is controversy. Yet its significance is undeniable, for it provided the intellectual vocabulary that allowed comparatists to move beyond the narrow focus on domestic legal doctrine. Among the contested variants, equivalence functionalism stands out as especially relevant to the principle of functional equivalence, to which the following section turns.

2.2.2 Equivalence functionalism

Having examined functionalism in general, it is necessary to turn to a specific strand most relevant to this thesis: equivalence functionalism. This approach argues that when different societies confront similar problems, they tend to develop similar legal solutions. Its importance lies not only in expanding the methodological horizon of comparative law but also in laying the intellectual foundation for the principle of functional equivalence in electronic commerce. Understanding equivalence functionalism therefore helps clarify both the origins of the principle and the issues it seeks, or fails, to resolve.

Equivalence functionalism posits that similar problems necessarily cause similar solutions.[61] This statement illustrates the central idea of equivalence functionalism: in comparative law, similar problems across different societies tend to generate similar solutions. Such parallels suggest that problems carry intrinsic features that call forth comparable institutional responses.

---

[58] Roberts, Paul. "Interdisciplinarity in Legal Research", *Research Methods for Law*, edited by Mike McConville and Wing Hong Chui, Edinburgh University Press, 2017, p90–133. JSTOR, http://www.jstor.org/stable/10.3366/j.ctt1g0b16n.10, accessed on 25 May 2023.
[59] Ibid., 90.
[60] Jaakko Husa, 'Functional Method in Comparative Law - Much Ado about Nothing?' (2013), 2 EPLJ 4, 4.
[61] Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011, 356-357.

The principle of functional equivalence supports applying the regulatory model of paper bills of lading to electronic ones, on the assumption that both face similar legal issues and thus require similar solutions. The similar solutions themselves arguably reflect intrinsic properties of the legal issues of paper and electronic bills of lading themselves.

Despite its promise, equivalence functionalism has faced scepticism. Michaels notes that it relies more on illustrative examples than on theory.[62] Critics argue that its assumptions are weak because it overlooks crucial differences.[63] Michaels, drawing on Cassirer, observes that similar problems may lead to different solutions.[64] Such differences arguably arise from culture, history, and legal tradition. Yet solutions remain comparable because they serve the same functions. They are functionally equivalent insofar as they fulfil the same goals.[65]

This arguably aligns with the thesis. If the users of the bill of lading are regarded as a society, then similar problems in electronic and paper bills of lading may lead to different solutions. The fact that both face similar legal issues does not mean they will be resolved in the same way. Unlike societal differences, their divergence stems from technology.

Having reached this point, readers may naturally ask: what exactly is functional equivalence, and how does it connect to equivalence functionalism? Michaels describes 'functional equivalence' as the central concept of functionalist comparative law, rooted in sociology and developed by Rabel and Zweigert.[66]

Given the central role attributed to functional equivalence in comparative law, it is useful to consider how the concept has been defined by leading scholars. Despite its central role, functional equivalence has rarely been defined in clear terms in comparative law, which helps to explain both its wide use and the continuing uncertainty about how it should be understood.

---

[62] Ibid., 358.
[63] See footnote 89 in Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011: Karl Renner, Die Rechtsinstitute des Privatrechts und ihre soziale Funktion: ein Beitrag zur Kritik des Bürgerlichen Rechts (1929; English translation under the title The Institutions of Private Law and their Social Functions by Agnes Schwarzschild, edited by Otto Kahn-Freund, 1949).
[64] See footnote 18 in Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011: Ernst Cassirer, *Substanzbegriff und Funktionsbegriff* (1910).
[65] Ibid.
[66] Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011, 363.

In comparative law, functional equivalence is widely used but not defined in a uniform or precise manner. Michaels offers one of the more explicit and systematic definitions of the concept, describing it as:

> similarity with regard to one function, the presumption is tautological: because only institutions fulfilling the same function are comparable, by definition they must be similar with regard to their quality of fulfilling this function. Nothing is said about any further similarity or difference. The point is so poorly understood in the current debate that it may deserve to be repeated: Functionality leads to comparability of institutions that can thereby maintain their difference even in the comparison. It neither presumes nor leads to similarity.[67]

This definition is cited here not as a conclusive account of functional equivalence, but as an analytical starting point. In my view, this definition is valuable because it anchors a concept that is often left vague, highlighting functionality as the very basis of comparability in law. Yet it also reveals its own circularity: institutions are considered similar only because they are pre-supposed to perform the same function. For this thesis, this tension is instructive. In the case of bills of lading, it is insufficient to assume that paper and electronic ones are comparable merely because both serve the same functions (though it is arguably difficult to replicate all the functions of paper bills of lading online through the principle of functional equivalence).[68] Their technological differences require closer scrutiny. Functional equivalence, therefore, can provide a useful starting point for regulatory analysis, but it cannot on its own justify the full substitution of paper and electronic bills of lading.

If the foregoing discussion has shown the close connection between equivalence functionalism and the functional equivalence principle, it is nevertheless necessary to distinguish them in order to avoid conflating a methodological perspective with a normative principle, and to delineate more precisely the subject matter of this thesis.

Between the two, the common terms ‘function’ and ‘equivalence’ carry different emphases: equivalence functionalism guides comparative analysis, while the functional equivalence principle directs regulatory design in electronic commerce. The term ‘equivalence’ carries the

[67] Ibid., 372.
[68] See the argument in Section 4.4.

same meaning in both the principle of functional equivalence and the doctrine of equivalence functionalism. For the function of both, the term 'function' in equivalence functionalism is complicated, arguably providing guidance for the principle of functional equivalence. Michaels identifies seven meanings of 'function,' ranging from comparability to evaluation. For this thesis, three are most relevant: (i) emphasizing similarity, (ii) enabling comparability, and (iii) providing evaluative tools.[69] These clarify why functional equivalence assumes that paper and electronic bills of lading, facing similar problems, can be compared and sometimes equated.

Specifically, the presumptive function of emphasizing similarity underpins functional equivalence, which assumes a similarity between paper and electronic bills of lading. The comparative function enables direct comparison of paper and electronic bills of lading, supporting a systematic legal framework that promotes consistency and coherence in regulation. The evaluative function allows the principle to assess which form of bill of lading is more effective in a given context, thereby guiding law-making.

In sum, the principle of functional equivalence originates in equivalence functionalism, inheriting both its methodological strengths and its theoretical weaknesses. While it provides a pragmatic basis for comparing paper and electronic bills of lading, it also risks repeating functionalism's circularity by overstating similarity, lacking normative justification, and neglecting technological particularities. These tensions become even more apparent once the principle is transplanted into the field of electronic commerce law, which is the focus of the following section.

2.2.3 Transplant into electronic commerce law

While the previous sections traced the intellectual roots of functional equivalence, this section examines its transplant into electronic commerce law. Its contemporary relevance lies in the digital transformation of trade. The emergence of electronic records, particularly electronic bills of lading, prompted functional equivalence to evolve from a comparative method used to analyse similarities across legal systems into a regulatory principle that guides the legal recognition of electronic records. This shift was driven by technological progress that created new forms of records requiring recognition, and by the inadequacy of the substantive

[69] Michaels, Ralf. (2006). The Functional Method of Comparative Law. Faculty Scholarship. 10.1093/oxfordhb/9780199296064.013.0011, 363.

unification method to address the complexities of the digital environment. It is also found that although the principle of functional equivalence has a solid theoretical foundation, its continued dominance in practice stems more from the slow pace of commercial adoption and the lack of viable alternatives.

One important driver of this regulatory shift lies in the broader digitalisation of trade and its perceived economic significance. The digitalisation of trade is reshaping global commerce. International organisations have highlighted its economic potential. The International Chamber of Commerce estimates that creating a modern digital trade ecosystem could reduce transaction costs across the G7+ by more than 70% and generate trillions of dollars in additional trade by 2026.[70] The World Trade Organisation, in its World Trade Report 2015 on the implementation of the Trade Facilitation Agreement, similarly projects that average trade costs could fall by 14.3% and global trade could expand by up to US$1 trillion annually.[71] Among these trade documents, the bill of lading is particularly significant: McKinsey estimates that digitalising it alone could unlock up to $40 billion in benefits.[72] The emergence of electronic bills of lading, created new types of records that could not be ignored by regulators. Because such records carry essential functions, their recognition demanded a regulatory framework.

A second reason is the limitations of substantive unification, which further highlighted the inadequacy of traditional approaches to harmonising international commercial law. Before the emergence of functional equivalence, the unification of international commercial law largely relied on substantive unification.[73] Since the nineteenth century, legislators and scholars

---

[70] G7 | creating a modern digital trade ecosystem cutting the cost and complexity of trade, https://7703b98d-a40e-40b5-9a19-2340c0e85ea4.filesusr.com/ugd/0b6be5_c8f1719de362441f8277fcdf49240d86.pdf?index=true, accessed on 2 December 2022

[71] See World Trade Report 2015, Speeding up trade: benefits and challenges of implementing the WTO Trade Facilitation Agreement, https://www.wto.org/english/res_e/publications_e/wtr15_e.htm, accessed 31 January 2024 and Trade facilitation, https://www.wto.org/english/tratop_e/tradfa_e/tradfa_e.htm, accessed on 31 January 2024;

[72] Didier Casanova, David Dierker, where Bjørnar Jensen, Ludwig Hausmann and Jaron Stoffels, 'The Multi-Billion-Dollar Paper Jam: Unlocking Trade by Digitalizing Documentation' (McKinsey & Company, 4 October 2022) https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/the-multi-billion-dollar-paper-jam-unlocking-trade-by-digitalizing-documentation accessed 1 December 2022. According to the report, McKinsey analysis based on the interview from the experts, carriers and shippers.

[73] Ole Lando, 'The Lex Mercatoria in International Commercial Arbitration' (1985) 34 *International and Comparative Law Quarterly* 747; Roy Goode, Herbert Kronke and Ewan McKendrick, *Transnational Commercial Law: Text, Cases, and Materials* (2nd edn, OUP 2015).

sought to harmonize international commerce by adopting common concepts and uniform substantive rules, whether through conventions or model laws.[74] This approach had clear advantages: it managed legal risks, improved certainty, and facilitated the role of commercial intermediaries.[75]

Over time, however, the substantive unification method began to reveal its limitations. The proliferation of international instruments produced a 'spaghetti bowl effect'[76]: multiple overlapping conventions and agreements, each with different participants, created fragmentation rather than coherence. Domestic laws, drawing differently on these instruments, diversified further.[77] National courts, when interpreting these rules, often developed divergent understandings of key concepts, which gradually undermined the very aim of harmonisation.[78] Critics sharpened these concerns. Paul Stephan argued that substantive rules typically end up either diluted or captured by special interests, and that similar failures would undermine efforts to unify even procedural rules such as choice of law.[79] In particular, responding to this specific shortcoming, Schellekens, meanwhile, framed the problem as one of online–offline translation: "what holds offline also holds online."[80]

A third reason relates to the need to manage the growing interaction between the offline and online commercial worlds. With the development of technology, commercial and trade activities that were traditionally conducted offline are increasingly carried out in digital

---

[74] Stephan, Paul B., The Futility of Unification and Harmonization in International Commercial Law (June 1999). University of Virginia School of Law, Legal Studies Working Paper No. 99-10, Available at SSRN: https://ssrn.com/abstract=169209 or http://dx.doi.org/10.2139/ssrn.169209, p4-p7.
[75] Roy Goode, Herbert Kronke and Ewan McKendrick, *Transnational Commercial Law: Text, Cases, and Materials* (2nd edn, OUP 2015) Chapter 4.
[76] The spaghetti bowl effect is the multiplication of free trade agreements (FTAs), supplanting multilateral World Trade Organization negotiations as an alternative path toward globalization. The term was first used by Jagdish Bhagwati in 1995 in the paper: "US Trade policy: The infatuation with free trade agreements", where he openly criticized FTAs as being paradoxically counter-productive in promoting freer and more opened global trades. According to Bhagwati, too many crisscrossing FTAs would allow countries to adopt discriminatory trade policies and reduce the economic benefits of trade.
[77] Roy Goode, Herbert Kronke and Ewan McKendrick, *Transnational Commercial Law: Text, Cases, and Materials* (2nd edn, OUP 2015) Chapter 4.
[78] Jose Angelo Estrella Faria, 'Uniform Law and Functional Equivalence: Diverting Paths or Stops along the Same Road - Thoughts on a New International Regime for Transport Documents' (2011) 2 Elon L Rev 1, 15.
[79] Stephan, Paul. "The Futility of Unification and Harmonization in International Commercial Law." (1999). p33.
[80] Schellekens M, 'What Holds Off-Line, Also Holds On-Line?' in Koops BJ, Lips M, Prins C and Schellekens M (eds), *Starting Points for ICT Regulation, Deconstructing Prevalent Policy One-Liners* (IT & Law Series, vol 9, TMC Asser Press 2006) 51.

environments. This shift has forced international commercial legislation to confront a new set of questions: how to bridge differences in legal concepts and theoretical understandings across jurisdictions, and how to manage the relationship between online practices and offline legal frameworks.

In this context, functional equivalence gained traction as a pragmatic alternative: rather than forcing uniform concepts, it allowed regulators to ask whether electronic records could fulfil the same functions as their paper counterparts. Functional equivalence, understood as a teleological argument, pragmatically addresses this by focusing on goals and effects rather than rigid concepts.

While these developments explain why functional equivalence emerged as a principle of electronic commerce law, its practical significance can only be understood by examining how it operates in the current adoption of electronic bills of lading. This thesis conducted semi-structured interviews.[81] It is found that although the principle of functional equivalence has a well-established theoretical background, its continued dominance in practice stems more from the slow pace of commercial adoption and the lack of viable alternatives.

According to the interview, in practice, the adoption of electronic bills of lading has been far slower than anticipated.[82] Interviews with shipping companies, banks, technology providers, and legal practitioners confirm that no more than ten percent of clients currently use electronic documents, with blockchain-based solutions even less common.[83] In practice, electronic bills of lading may be categorized into two types using the legal effect as the criterion.[84] The first category, 'digitisation' bills of lading, involves the use of technology to transfer paper-based information into electronic form. This category dominates current practice, reflecting commercial inertia and a preference for continuity with familiar paper-based processes. These

[81] ERGO II Submission ID: 75827 - Legal and Regulatory Approaches to Electronic Bills of Lading.
[82] According to the interviewees from a third-party electronic bills of lading technology provider (21 October 2022) and COSCO Shipping (17 October 2022).
[83] Reference from the email received from the product manager from the essDOCS (24 November 2022), the interviews from a third-party technology provider (21 October 2022), and the electronic bills of lading platform program leader of the COSCO Shipping (17 October 2022).
The interview with COSCO Shipping was in 17th Oct. 2022, COSCO Shipping subsidiary issues first bill of lading on GSBN blockchain on 17 Jan. 2023. https://www.ledgerinsights.com/gsbn-ebl-cosco-shipping-bill-of-lading-blockchain/, accessed on 28 Feb. 2023.
[84] According to the interviewee from COSCO Shipping (17 October 2022) and a third-party technology provider (21 October 2022).

digitisation models aim to replicate the legal effects of paper bills of lading, which has been the main focus of legislative and institutional efforts in many jurisdictions. Achieving equivalence is therefore central, and in this context, equivalence encompasses both functional and legal aspects. The second type is closely tied to blockchain technology and is named 'digitalisation' bills of lading. This type is not widely used. Currently, the majority of blockchain electronic bills of lading applications are in the pilot phase. Adoption also differs across sectors: bulk cargo markets, where buyers and sellers wield greater bargaining power, are reluctant to abandon established practices, while container shipping, with its scale advantages, is more open to electronic bills of lading.[85] Platforms such as essDOCS demonstrate that effective operation does not require blockchain: trust and certification are sufficient, reflecting a commercial preference for functionality over technological novelty.[86] These realities explain why functional equivalence remains the prevailing regulatory framework: it offers the minimum legal recognition necessary for electronic bills of lading to operate, at a time when more ambitious alternatives are not yet commercially viable.

In summary, technological progress and the inadequacy of the substantive unification method explain why the functional equivalence principle emerged as the central approach for electronic commerce law. Empirical evidence shows that its predominance in practice is sustained not by its theoretical superiority, but by slow adoption and the absence of viable alternatives. The next section examines how functional equivalence has been embedded in international instruments such as the Rotterdam Rules and the MLETR. This also highlights that, while functional equivalence has been codified in major instruments, the very process of transplantation carries forward its inherent limitations, the theme taken up in the following chapter.

2.3 Functional equivalence in international instruments

Section 2.3 examines how the principle of functional equivalence has been embedded in international instruments through the specification of functions and the gradual expansion of regulatory scope. Instead of discussing functional equivalence in the abstract, these texts in this chapter apply it by setting out specific functions, such as signature, uniqueness, and

[85] According to the interviewee a third-party technology provider (21 October 2022).
[86] Reference from the email received from the product manager from the essDOCS (24 November 2022).

negotiability, and giving legal effect to their electronic forms. The Rotterdam Rules still focus on the bill of lading.[87] The MLETR moved further by focusing on the broader category of electronic transferable records.[88] The Convention on Negotiable Cargo Documents (NCD) went further by conferring the function of document of title on a wider category of negotiable cargo documents, covering maritime, air, and railway transport.[89] Through this evolution, functional equivalence has been 'fixed' in rules by linking legal effect to functional criteria and widening its regulatory scope. This approach shows how equivalence works in practice, but also highlights its limits, which will be discussed in Chapter 3.

First, the Rotterdam Rules mark UNCITRAL's first systematic attempt to regulate electronic transport documents within the framework of the international carriage of goods by sea.[90] Unlike UNCITRAL's earlier general e-commerce provisions, the Rules addressed electronic records in the specific context of maritime transport.[91]

Article 1.19 introduced two categories: negotiable electronic transport records and non-negotiable electronic transport records, serving as electronic counterparts to bills of lading and seaway bills. Articles 35–41 confirmed their role as receipts, while Articles 57–58 addressed their evidentiary function as contracts of carriage. Most significantly, the Rules tackled the most challenging function of bills of lading, their negotiability as documents of title, by introducing the concept of exclusive control. Articles 47 and 50–51.4 provided that negotiable electronic transport records could replicate the transferability of paper bills, provided that exclusive control was maintained throughout issuance and transfer.

---

[87] *United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea* (adopted 11 December 2008, not yet in force) UN Doc A/RES/63/122 ('Rotterdam Rules').
[88] *United Nations Commission on International Trade Law (UNCITRAL), Model Law on Electronic Transferable Records* (2017) UN Doc A/RES/71/ UNCITRAL Yearbook, Vol XLVIII, 2017 ('MLETR').
[89] 'Draft UN Convention on Negotiable Cargo Documents to modernize and digitize global trade finalized' (UN Information Service Vienna, 14 July 2025). https://unis.unvienna.org/unis/en/pressrels/2025/unisl378.html accessed 26 August 2025.
[90] Sabena Hashmi, 'The Rotterdam Rules: A Blessing' (2012) 10 Loy Mar LJ 227, 237.
[91] UNCITRAL has developed four existing legal texts aimed at regulating electronic transactions, both domestically and across borders. These texts are known as the UNCITRAL Model Law on Electronic Commerce (MLEC), the UNCITRAL Model Law on Electronic Signatures (MLES), the UNCITRAL Communications Convention (e-CC), and the UNCITRAL Model Law on Electronic Transferable Records (MLETR).

In this way, the Rotterdam Rules arguably embedded the principle of functional equivalence by linking legal recognition to the ability of electronic records to perform the three classical functions of paper bills of lading, receipt, evidence of contract of carriage, and document of title.

Secondly, the MLETR, adopted in 2017, arguably represents UNCITRAL's most significant step in regulating electronic transferable records. Unlike the Rotterdam Rules, which remained tied to bills of lading, the MLETR abstracts the framework to cover all 'electronic transferable records', including bills of lading, warehouse receipts, and promissory notes.[92] This broadening of scope arguably reflects a shift from regulating specific maritime documents to establishing a general model for electronic substitutes of transferable instruments.

The MLETR defines an ETR as an "electronic record that complies with Article 10," thereby linking legal recognition to functional criteria.[93] Two aspects stand out. The first is the scope: while the Working Group initially considered including purely digital instruments (records existing only online), the final text restricted itself to electronic equivalents of paper-based transferable documents.[94] In my view, this choice created a regulatory gap, leaving blockchain-based electronic bills of lading outside the scope of the Model Law. The second is about the functional anchoring: the MLETR operationalizes functional equivalence through the twin criteria of 'singularity' and 'control.'[95] Singularity requires that only one authoritative record exists for a given obligation, while the 'control' substitutes for possession by identifying who has the legal power to demand performance. These provisions, found in Articles 10 and 11, embody the pragmatic attempt to replicate paper-based functions, uniqueness, possession, and transferability, in the electronic environment.[96]

Understanding why the MLETR adopted this particular formulation of functional equivalence requires attention to its drafting history. For the settlement of the functional equivalence, it took a long time. During the initial stages of drafting the MLETR, the Working Group considered whether it might depart from the principle of functional equivalence.[97] Ultimately, it decided to

---

[92] A/CN.9/WG.IV/WP.139, para. 33; A/CN.9/863, para. 91; see also A/CN.9/797, para. 23.
[93] MLETR, Article 2, "Electronic transferable record".
[94] A/CN.9/WG.IV/WP.139, para. 31.
[95] A/CN.9/834, para. 86, Singularity is a functional and operational method adopted in the Model Law to achieve the functional equivalent of uniqueness in an electronic environment.
[96] MLETR, Article 10 and 11.
[97] A/CN.9/437, para. 21.

adopt the concept of 'control' from the Rotterdam Rules, interpreting it as a form of functional equivalence in relation to 'possession.'[98]

This approach can be traced back to 1996, when UNCITRAL's Model Law on Electronic Commerce (MLEC) first incorporated functional equivalence as a legislative technique.[99] The earliest substantive explanation of the principle appears in a 1997 report of UNCITRAL's Electronic Commerce Working Group, Planning of Future Work of Electronic Commerce: Digital Signatures, Certification Authorities, and Related Legal Issues. In paragraph 12, the Working Group elaborated on functional equivalence in the specific context of signatures:

> "Article 7 of the UNCITRAL Model Law on Electronic Commerce is based on the recognition of the functions of a signature in a paper environment. In the preparation of the Model Law, the Working Group discussed the following functions traditionally performed by hand-written signatures: to identify a person; to provide certainty as to the personal involvement of that person in the act of signing; to associate that person with the content of a document. It was noted that, in addition, a signature could perform a variety of functions, depending on the nature of the document that was signed. For example, a signature might attest to the intent of a party to be bound by the content of a signed contract; the intent of a person to endorse authorship of a text; the intent of a person to associate itself with the content of a document written by someone else; the fact that, and the time when, a person had been at a given place."[100]

This passage is arguably significant because it identifies three core functions of a handwritten signature, identification, confirmation of personal involvement, and association with a document's content, while acknowledging that signatures can serve additional functions depending on context. These elements later formed the foundation for applying the principle of functional equivalence to electronic signatures. From this early articulation, the functional

---

[98] A/CN.9/797, para. 28: "the peculiar needs posed by negotiable electronic records might require a discussion on the possibility of deviating from such principles."
[99] Yu Guo, The "Singularity" Problem and Solution of Electronic Transferable Records Legislation, Peking University Press, 2019, p129. [郭瑜，《电子可转让记录立法的"单一性"难题和破解》 (北京大学出版社 2019) 第 129 页].
[100] A/CN.9/WG.IV/WP.71, Planning of Future Work on Electronic Commerce: Digital Signatures, Certification Authorities, and Related Legal Issues, para. 12.

equivalence was arguably initially conceived to address the relationship between electronic and handwritten signatures.

It is arguably evident that functional equivalence was initially introduced to address the relationship between electronic signatures and traditional handwritten signatures. This approach was subsequently extended to encompass all electronic transferable records, becoming a fundamental pillar of the MLETR. By focusing on function rather than form, functional equivalence arguably mitigates the challenges posed by formal paper-based requirements. Consistent with this principle, the MLEC, the Model Law on Electronic Signatures, the Electronic Communications Convention, and related legislative instruments set out the conditions under which electronic records can achieve the same legal effect as their paper-based counterparts.[101] Then we can conclude that the functional equivalence approach begins by the purposes and functions served by traditional paper-based requirements. This analysis then guides the determination of how these purposes or functions can be fulfilled through electronic means.[102] We can see rather than defining a computer-based counterpart for each specific type of paper document, the approach focuses on the essential functions underlying primary paper form requirements. It then establishes criteria which, if satisfied, confer on an electronic record the same legal recognition as its paper-based equivalent.[103] Therefore, the presence or absence of paper originals or paper components does not influence whether an electronic record satisfies the requirements of a paper environment. As stated in the Explanatory Note to the Convention, functional equivalence mainly refers to the formal requirements of the paper environment, aiming at providing formal requirements for electronic documents and making them equivalent to paper documents according to standards, but the intention of the convention is not to change the traditional rules of paper, nor to create additional substantive rules for electronic records.[104]

---

[101] A/CN.9/834, p13, para. 89. Also, A/CN.9/WG.IV/WP.115, para. 31-32.
[102] Legal Issues Relating to the Use of Electronic Transferable Records, para. 31; Electronic Communications Convention, Explanatory Note, para. 51.
[103] Ibid.
[104] Electronic Communications Convention, Explanatory Note, para. 48: the focus of the Convention is to facilitate "paperless" means of communication by offering criteria under which they can become equivalents of paper documents, but the Convention is not intended to alter traditional rules on paper-based communications or create separate substantive rules for electronic communications.

Furthermore, in my perspective, the characteristics of 'combining rigidity with flexibility' are taken into account regarding the functional equivalence approach. Flexibility is evident in the establishment of criteria, while rigidity is manifested in the equivalent or unequal consequences. The determination of these standards has long been a focal point in UNCITRAL's Electronic Communications Convention since its adoption in 2005.[105] This approach to defining the relevant criteria is arguably not determined solely by reference to the electronic equivalent itself, but rather by reference to the functions achievable in paper environment. However, due to the inherent complexity in defining the concept of 'function', the criteria for determining such functions are likely to vary, leading to discussions about the flexibility of the set standards. As for the rigid consequences, they can be categorized into only two possibilities: either equivalent or not equivalent.

Guo's analysis delves into this flexibility and rigidity, thoroughly examining the two primary factors that influence functional equivalence, namely technology neutrality and party autonomy.[106] She asserts that the legal framework governing ETR adopts a relatively loose standard, which places the burden of risk on users. Guo goes on to consider an example of such risk allocation, namely when an obligor under the bill of lading, typically the carrier, faces overlapping claims because different parties hold separate originals of the same bill of lading, making it impossible to determine the rightful claimant. This situation leads to potential legal disputes or even multiple lawsuits, which create complex legal issues. She concludes that when an electronic transferable record governed by the MLETR is used as collateral in a secured transaction, users may be exposed to financial risks, meaning that in such cases the risks are borne by users rather than by service providers.[107]

Unlike paper documents, electronic records under functional equivalence are not unique, giving rise to the problem of 'non-single rights', which the MLETR addresses through single window facilities.[108] By adopting the standard of functional equivalence, it becomes possible to

---

[105] For example, see "electronic communication convention", "explanatory note", para. 51, 52, 133.
[106] Yu Guo, *The Singularity Problem and Solution of Electronic Transferable Records Legislation* (Peking University Press 2019) 133 [郭瑜, 《电子可转让记录立法的"单一性"难题和破解》 (北京大学出版社 2019) 第 133 页].
[107] Yu Guo, *The Singularity Problem and Solution of Electronic Transferable Records Legislation* (Peking University Press 2019) 145 [郭瑜, 《电子可转让记录立法的"单一性"难题和破解》 (北京大学出版社 2019) 第 145 页].
[108] UNCITRAL: A/CN.9/897, para. 88-91; A/CN.9/768. para. 51; Also, about the "single window facilities": A/CN.9/768; A/CN.9/804, para. 2-3, 90; A/CN.9/863, para. 107.

allocate the additional risks arising from digitalisation. Such allocation, which primarily places the risk on users rather than on service providers, renders the risk more transparent and predictable, rather than eliminating it altogether.

To illustrate how different regulatory models allocate risks in the context of electronic signatures, this section compares the MLETR with the PRC Electronic Signature Act.[109] The MLETR adopts different methods compared to the Electronic Signature Act to allocate risks. MLETR only adopts technology neutrality, so it is attributed to the result of consistent or inconsistent legal results, while the Electronic Signature Act in contrast adopts a technology-specific model: user passwords constitute electronic signatures. In my opinion, two conditions must be met under Art. 13 to prove the feasibility of this method: first, it must enable the identification of the transaction identity and the confirmation of the transaction content.[110] Secondly, it must conform to other documents , that is, the user holds exclusive control over the electronic signature when used for signing and has full control over any changes made to the electronic signature or data message after signing, irrespective of their form or content.[111] A party claiming that the user password constitutes an electronic signature bears the burden of proof showing that this method is reliable, so that the user password and signature have the same legal status. In such a scenario, the court arguably has no room for discretion.[112] Finally, technology providers and users jointly bear the risk that electronic signatures cannot meet all the functions of signatures. This comparison illustrates how a technology-specific model, unlike the MLETR's technology-neutral approach, reallocates risks ex ante and limits judicial discretion.

In contrast, the standard adopted by MLETR for functional equivalence is arguably more permissive, which in my view is consistent with aims of promoting technology at its best. Imposing more technology-specific conditions could arguably restrict the adoption of some technologies and impede the development of potential technologies. The Secretariat states as a reason for adopting a more flexible approach that it aligns with technology neutrality, advocating for a system-neutral approach and allowing the incorporation of various models

---

[109] *Electronic Signature Law of the People's Republic of China* (中华人民共和国电子签名法) (adopted at the 11th Meeting of the Standing Committee of the 10th National People's Congress on 28 August 2004, amended 24 April 2015, 29 April 2019.
[110] Ibid., art 13.
[111] Ibid.
[112] Ibid., art 14.

based on registry, token, distributed ledger, and other technologies.[113] The principle of technology neutrality is further elucidated in official documents, with the Working Group emphasizing the importance of considering technology neutrality evident in previous UNCITRAL texts, such as the Model Law on Electronic Commerce, the Model Law on Electronic Signatures, and the Electronic Communications Convention. According to this principle, the law should not prioritize or favour specific technologies. Embracing technology neutrality ensures that the law encompasses all conceivable models.

Up to this point, the discussion has outlined how MLETR has established the principle of functional equivalence. As Harvey succinctly summarizes, its essence lies in recognizing the fundamental disparities between paper and digital mediums; identifying the underlying objectives of the rules governing the paper medium; assessing the attributes of the new digital medium to determine the feasibility of introducing functionally equivalence regulations; and formulating the rules governing the new digital medium.[114]

For the final international instrument to be considered here, the most recent development is UNCITRAL's project on Negotiable Cargo Documents (NCDs), which concluded in 2025.[115] This project arguably represents a significant extension of the functional equivalence principle, both in terms of its regulatory scope and the functions it recognizes.

The NCD framework expands the scope of negotiable instruments to include all modes of transport, sea, railway, and air, rather than focusing solely on maritime bills of lading.[116] It constitutes a functional breakthrough: for the first time in UNCITRAL's legislative work, the status of document of title is expressly attributed to an electronic negotiable cargo document.[117]

This development signals an evolution in the application of functional equivalence. In the Rotterdam Rules, electronic records were mainly recognized for evidentiary purposes (receipt

[113] UNCITRAL, A/CN.9/WG.IV/WP.13, p4, para. 13.
[114] David John Harvey (2019), *Collisions in the Digital Paradigm: Law and Rule Making in the Internet Age*, Bloomsbury Publishing, 60.
[115] UNCITRAL, 'Draft Convention on Negotiable Cargo Documents' (UN Doc A/CN.9/1213, July 2024).
[116] UNCITRAL, 'Draft Convention on Negotiable Cargo Documents' (UN Doc A/CN.9/1213, July 2024), Article 1; A/CN.9/1205, para. 22.
[117] UNCITRAL, 'Draft Convention on Negotiable Cargo Documents' (UN Doc A/CN.9/1213, July 2024), Article 7.

of goods and contract of carriage), while the MLETR elevated them to the level of transferable records by introducing the criteria of singularity and control.[118] The NCD project goes one step further, functionally anchoring transfer of proprietary rights in electronic negotiable documents. In doing so, it arguably upgrades the evolution of functional recognition: from receipt of goods, evidence of the contract of carriage to transferability and, ultimately, the document of title. This marks the first international recognition that electronic records can serve not only as contractual evidence and transferable instruments, but also as digital documents of title.

In my view, from the Rotterdam Rules to the MLETR, and to the Convention on NCD, the distinctive status of the electronic bill of lading as a maritime-specific instrument has been diluted. First, the scope has expanded: traditionally, the electronic bill of lading was the central focus of the discussion, but under the MLETR and the NCD it is no longer treated in isolation; instead, it has been subsumed into a broader framework covering both the ETR and the negotiable cargo documents. Secondly, the shift of functional aspect is equally evident. The Rotterdam Rules still placed the bill of lading at the core, preserving its three functions. The MLETR moved further by abstracting these functions under the concept of electronic transferable records. The NCD went a step further by explicitly granting the document of title function to the wider category, freeing it from the strict confines of functional equivalence. Finally, under the NCD, the electronic bill of lading is no longer regulated as a distinct maritime instrument, but is instead subsumed within a general convention governing negotiable cargo documents, thereby losing its former status as an independent focal point of international legislative attention. Taken together, these developments demonstrate that the specialty of the electronic bill of lading has been progressively eroded, it is arguably now more of a ‘subspecies’ of electronic records.

Section 2.3 has demonstrated that functional equivalence is not applied in the abstract but concretized in international instruments by certain functions anchoring and by expanding the scope. This evolution demonstrates both the strength and the limitation of functional equivalence: while it has enabled legal recognition of electronic records step by step, it has also diluted the distinctive role of the electronic bill of lading. These developments set the stage for the next chapter’s focus on the limitations of functional equivalence as a regulatory principle.

[118] See above.

2.4 Conclusion

This chapter first traced the theoretical underpinnings of the principle of functional equivalence in sociology and legal theory. It showed that both functionalism and equivalence functionalism, while offering useful insights, reveal inherent theoretical limitations. The chapter then examined how functional equivalence entered the field of electronic commerce law and became fixed as a principle through international instruments, analysing the concrete process. While this process enabled functional equivalence to operate as a practical legislative technique, it also revealed structural limitations that remain unresolved. Importantly, the chapter has shown that although the principle of functional equivalence has a solid theoretical foundation, its continued dominance in practice stems more from the slow pace of commercial adoption and the lack of viable alternatives. The next chapter will explore these limitations in greater detail, drawing on doctrinal analysis and interview evidence. It will focus on three aspects: the intrinsic weaknesses of the principle, the practical problems in its application, and the external challenges in cross-border contexts.

Chapter 3 Limitations of the Functional Equivalence Principle: Using Interview Evidence

3.1 Introduction

Chapter 3 examines the limitations of the principle of functional equivalence in the regulation of electronic bills of lading. Although functional equivalence provides the conceptual foundation for treating electronic records as the legal equivalent of paper-based documents, its application in practice reveals a number of constraints, particularly as electronic bills of lading move beyond formal legal recognition and enter more complex commercial use.

Chapter 2 sets out the theoretical background and development of functional equivalence. Building on this discussion, Chapter 3 examines the limitations of the principle of functional equivalence in the specific context of electronic bills of lading across three dimensions. Section 3.2 analyses the intrinsic weaknesses of the principle itself, including its limited scope, its reliance on unclear concepts, and its difficulties in replicating certain functions of paper-based instruments. Section 3.3 turns to practical problems, showing how the interaction of flexible requirements with rigid outcomes, the search for reliable methods, and the reliance on technological neutrality create uncertainty, particularly in the context of electronic bills of lading. Section 3.4 examines external challenges, focusing on how functional equivalence operates with difficulty in cross-border environments, where unresolved issues of private international law, institutional fragmentation, and standardisation difficulties exacerbate legal uncertainty. These discussions suggest that while functional equivalence remains an important regulatory principle, its capacity to address the legal challenges of electronic bills of lading is subject to identifiable inherent limits.

3.2 Intrinsic limitations: problems of the principle itself

This section identifies three intrinsic limitations of functional equivalence. The first is its limited scope: by relying on offline rules, it may not always be able to deal with records that lack offline equivalents or involve unique online roles. The second is its unclear concepts: different international instruments use overlapping but inconsistent terms. The third is its limited

functions: the principle mainly secures formal validity, while substantive effects are left to domestic law, which may make uniform outcomes difficult to achieve.

3.2.1 Limited scope

The scope of functional equivalence is constrained by its inherent design: it connects the online and offline realms through functional bridges, with offline rules serving as the benchmark.[119] This approach faces two specific challenges: first, some online records lack direct offline equivalents and therefore fall outside the coverage of offline regulations. Secondly, some roles are unique to the online process and have no corresponding roles in the offline world. These complexities show the difficulty of achieving full equivalence between online and offline worlds, even when relying primarily on functional equivalence. As a result, regulation struggles to bridge the gap between the online and offline worlds.

(i) one lacks direct offline equivalents falling outside offline regulations

A subset of ETRs lacks offline counterparts, thereby limiting the establishment of a regulatory connection between offline legal frameworks through functional equivalence. An illustrative example can be found in electronic currencies such as Bitcoin, where it is evident that they do not possess offline equivalents. Similarly, the MLETR explicitly excludes purely online records from its scope, confining itself to electronic records functionally equivalent to transferable paper documents.[120] As a result, blockchain-based electronic bills of lading or other electronic records are arguably left outside its coverage, creating a regulatory vacuum.

The drafting history of the MLETR shows that experts seriously debated whether records existing solely in an online environment should fall within its scope.[121] For example, there was a proposal to delete the phrase “issued on paper” to achieve medium neutrality, but it was rejected on the grounds that such a change would undermine the functional equivalence framework, which takes paper documents as its benchmark.[122] In 2014, the Working Group even attempted to broaden the definition of ETRs to cover fully online instruments; however, by 2016 the final text made clear that such records were excluded and required a separate

[119] A/CN.9/834, paragraphs 43 and 46; A/CN.9/897, paragraphs 54-57.
[120] A/CN.9/WG.IV/WP.139, para. 31.
[121] A/CN.9/863, p16, para. 91.
[122] A/CN.9/768, para. 21, 25-31. A/CN.9/WG.IV/WP.124, para. 14.

definition.[123] This boundary has become more apparent with subsequent technological developments. Blockchain-based electronic bills of lading highlight the gap in the MLETR's applicability, while the UK's Property (Digital Assets etc) Bill 2024 goes further by recognizing certain digital assets, despite lacking traditional analogues, as capable of carrying property rights.[124] These changes suggest that the MLETR framework may need to be reconsidered to address the challenges posed by fully online electronic records.

A similar constraint is found in the Rotterdam Rules. Although they recognize electronic transport records, the framework still relies on paper-based concepts of negotiability and control and therefore does not expressly address records that exist only in digital form.[125]

This suggests that functional equivalence may be less effective for records without offline counterparts. Even where such counterparts exist, new online roles, especially platforms, create further challenges, as the next section explores.

(ii) unique roles and functions in online processes without offline equivalents

Another limitation arises when electronic records do have offline counterparts: functional equivalence can replicate their basic functions, but it remains tied to offline models and struggles to address the new roles created by online systems, especially the legal status of platforms. Consider paper bills of lading and electronic bills of lading, integral components of electronic records, as illustrations.

As noted above in Section 2.2.3, electronic bills of lading in practice may take different forms.[126] For present purposes, it is sufficient to recall two main types identified through interviews with COSCO Shipping and a third-party technology provider. The first, often referred to as digitisation, involves scanning paper bills of lading and uploading them into an electronic system. In such cases, the original bill of lading remains in its paper form, and there is no

[123] A/CN.9/797, p6, para. 23; A/CN.9/WG.IV/WP.135, para. 30.
[124] Property (Digital Assets etc) Bill [HL] 2024–25, Bill 57 https://bills.parliament.uk/bills/3660 accessed 12 August 2025.
[125] A/CN.9/WG.IV/WP.118, para. 54.
[126] According to the interviewees from a third-party electronic bills of lading technology provider (21 October 2022) and COSCO Shipping (17 October 2022). See also this thesis in Section 2.2.3. The first category, "digitisation" bills of lading, dominates the practice: employing technology to transfer paper information into electronic format. It is the equivalent of a paper-bill of lading as most of the organizations and jurisdictions legislatures have been exploring. Achieving equivalence is key to solving the issue; in this case, equivalence includes both functional and legal aspects.

electronic original version. The second, known as digitalisation, is issued directly in electronic form. This type is closely tied to blockchain technology, though its adoption remains limited. Most blockchain-based applications are still in the pilot stage, and many platforms that claim to employ blockchain are in fact not blockchain-based.[127] Nonetheless, the industry acknowledges its potential.[128] In 2018, the VOLTRON consortium completed the world's first blockchain-based electronic delivery, and COSCO Shipping has since been developing its own blockchain electronic bills of lading platform.[129] Some large technology companies have also experimented with tokenized transactions using blockchain electronic bills of lading.[130]

The second type generates and issues electronic bills of lading directly within the system.[131] Such bills lack original paper versions. The distinction between these types of electronic bills of lading reveals a key dichotomy, specifically concerning the offline or online nature of the original documents. This difference prompts further inquiry into the role and function of the system in the circulation of bills of lading. According to the interview, for the first type, the role

[127] According to the interviewees from a third-party electronic bills of lading technology provider (21 October 2022) and COSCO Shipping (17 October 2022).
[128] According to the email from the product manager from the essDOCS (24 November 2022).
[129] Bain & Company, 'Trade finance solution Voltron launches open platform on Corda blockchain' (Press Release, 23 October 2018) https://www.bain.com/about/media-center/press-releases/2018/trade-finance-solution-voltron-launches-open-platform-on-corda-blockchain/ accessed 12 September 2025; COSCO SHIPPING Holdings, 'COSCO SHIPPING issues 100,000th E-Bill of Lading' (News Release, 7 December 2023) https://en.coscoshipping.com/col/col6923/art/2023/art_3b1a5700f8a64d68b32dbac324ca5d86.html accessed 12 September 2025; Asia Cargo News, 'COSCO Specialized Carriers issues its first bulk cargo eBL via GSBN' (23 October 2023) https://asiacargonews.com/en/news/PrintVersion?id=7552 accessed 12 September 2025.
[130] See COSCO SHIPPING Lines, "COSCO SHIPPING Advances Blockchain Innovation with ISO 5909 Distributed Ledger Technology-based Electronic Bills of Lading" (Company News, 3 December 2024) https://na.coscoshipping.com/col/col27438/art/2024/art_98b2093fecc745c6a7b7458bcbe5b901.html accessed 12 September 2025; Lloyd's List, "COSCO issues first bulk electronic bill of lading over blockchain platform" https://www.lloydslist.com/LL1143617/Cosco-issues-first-bulk-electronic-bill-of-lading-over-blockchain-platform accessed 12 September 2025.
[131] According to the interviewees from a third-party electronic bills of lading technology provider (21 October 2022) and COSCO Shipping (17 October 2022). The second type is closely tied to blockchain technology and is named "digitalisation" bills of lading. This type is not widely used. Currently, the majority of blockchain electronic bills of lading applications are in the pilot phase. Many electronic bills of lading platforms that claim to employ blockchain are not, in fact, blockchain-based. The industry acknowledged that blockchain electronic bills of lading have great potential. In 2018, VOLTRON completed the world's first application of blockchain electronic delivery business. Subsequently, other countries' technology platforms have investigated similar applications. As an example, China's largest carrier company COSCO Shipping is currently developing its blockchain electronic bills of lading platform. Some large technology companies have tokenized transactions with blockchain electronic bills of lading.

of the system is relatively straightforward, as it merely serves as a technical provider and facilitates the circulation of electronic bills of lading.[132] In this setting, the system also provides a layer of trust and certification to ensure that electronic records are recognised as functionally equivalent to paper documents. However, compared to blockchain-based systems, its role remains relatively limited.[133] Determining the role is more intricate for the second type, as the system directly generates electronic bills of lading, and all related processes, such as issuance, transfer, endorsement, and take place under its supervision.[134] Interview evidence shows that blockchain-based platforms are designed to overcome the risks of centralised systems, such as manipulation or misuse of data by intermediaries, by distributing records across multiple nodes and ensuring that only those holding private keys can exercise control.[135] At the same time, platforms such as essDOCS demonstrate that trust and certification, rather than blockchain technology, may be sufficient to replicate the functions of paper bills of lading.[136]

The expanded involvement of such platforms also raises questions that relate to the broader debate on technological neutrality, which will be addressed in Section 3.3.2.[137] For this category of electronic bills of lading, the mere transferring offline rules to online may not fully harmonise the rights and obligations among various entities.[138] From this perspective, there is arguably uncertainty over who bears responsibility if the system malfunctions, who ensures exclusivity of control, or how conflicts between multiple claimants are resolved. These issues arguably hinder the circulation of electronic bills of lading and weaken the legal certainty functional equivalence seeks to ensure.

---

[132] In the interview with the third-party electronic bills of lading technology provider (21 October 2022), Questions 13 to 17 focus on the role of the platform.
[133] Ibid.
[134] See for example, Gard, 'Electronic (paperless) trading - trace:original system' (Circular, 3 April 2024) https://gard.no/circulars/2-2024-electronic-paperless-trading-trace-original-system/ accessed 12 September 2025.
[135] Interview with the interviewee from third-party electronic bills of lading technology provider (21 October 2022).
[136] Aphrodite Antonakaki (Product Marketing Manager, essDOCS) to Tengjiao Xu, Email correspondence, November 25, 2022.
[137] See this thesis Section 3.3.2. While technology neutrality holds significant importance in rule construction, effectively mitigating the impact of technology on legislation, it is, however, regrettable that current technologies appear unable to achieve complete neutralization concerning the roles of platforms or systems involved in the circulation of this electronic record.
[138] See this thesis Section 3.3.2.

In summary, the scope of functional equivalence is largely limited to the overlap between online and offline domains. Records without offline counterparts fall outside their reach, while records with offline counterparts may still generate unique online roles that the framework is not always well equipped to accommodate.

3.2.2 Unclear concepts

The principle of functional equivalence operates by mapping electronic records to their paper-based counterparts and applying the corresponding offline rules. However, given the diversity of electronic records, it is often disputed which offline category a particular record should fall under, creating confusion in the choice of applicable rules. The problem is particularly evident in the case of electronic bills of lading.

At the international level, the same electronic bills of lading may be described as an electronic transport document (Rotterdam Rules), an electronic transferable record (MLETR), a negotiable cargo document (Convention on Negotiable Cargo Documents) or a controlled electronic records as outlined by the UNIDROIT.[139] While these concepts are not identical, they share a broadly similar conceptual and functional core.[140] However, they have different legal emphases. Chris Reed refers to this as "categorisation difficulties".[141] Each terminology arguably points to a different offline analogue: transport documents emphasize contractual evidence, transferable records emphasize negotiability, and negotiable cargo documents stress title to goods.[142] As a result, the same electronic bills of lading may be governed by different sets of offline rules, which may lead to conceptual ambiguity and regulatory inconsistency.

The problem is further illustrated in English law. Under English law, electronic bills of lading can be classified as a type of electronic transport document, but by definition they can also fall

---

[139] Rotterdam Rules, Article 1, Definitions; MLETR, Article 2: Definitions; A/CN.9/1213, Draft convention on negotiable cargo documents, Article 2. Definitions, 5; UNIDROIT, Principles on Digital Assets and Private Law (January 2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, Article 1, accessed 10 Jan 2025.
[140] Ibid.
[141] Reed, C. (2010). "Online and Offline Equivalence: Aspiration and Achievement", *International Journal of Law and Information Technology*, Vol. 18, Issue 3, p264.
[142] Rotterdam Rules, Article 1, Definitions; MLETR, Article 2: Definitions; A/CN.9/1213, Draft Convention on Negotiable Cargo Documents, Article 2. Definitions, 5.

within the category of digital assets.[143] This means that they may be governed by the rules applicable to paper bills of lading, and they may also be subject to the rules relating to digital assets. Such overlap highlights the underlying tension of functional equivalence in English law.

At the same time, difficulties arise when applying offline rules to online records, as the underlying logic does not always align. For instance, English law traditionally divides property only into two categories: things in possession and things in action.[144] In order to extend the rules on transport documents to electronic bills of lading, English law introduced the concept of control, thereby allowing the rules of things in possession to be applied to electronic transport documents.[145] However, as digital records, electronic bills of lading also overlap to some extent with what English law now recognizes as a third category of things.[146] This arguably may raise questions about the logical consistency of applying rules to electronic records.

Moreover, the principle of functional equivalence is primarily applied in international rules, which are designed to accommodate differences across jurisdictions.[147] While this approach initially appeared promising, the coexistence of multiple international rules governing electronic transferable records has contributed to regulatory confusion.[148] The requirement to maintain the use of offline rules in the online environment, while preserving functional equivalence, has arguably created a complex and often inconsistent legal framework. As a result, the same electronic bill of lading may be mapped to different offline rules depending on the framework adopted. This may affect consistency: instead of providing a single bridge between online and offline, functional equivalence risks producing fragmented outcomes across regimes.

In conclusion, applying functional equivalence to electronic bills of lading, an important type of electronic record, raises significant challenges in defining and applying legal concepts. The discussion above shows that different international rules, together with the overlap in domestic

---

[143] According to the Electronic Trade Transport Document Act 2023, Definition of "electronic trade document"; Digital assets as personal property: Supplemental report and draft Bill, Digital asset, page iii.
[144] Law Commission, Electronic trade documents: Report and Bill, para. 5.3
[145] Ibid., para. 2.61-2.69.
[146] Digital assets as personal property: Supplemental report and draft Bill, Digital asset, page iii.
[147] See this thesis in Section 2.3.
[148] For example, Rotterdam Rules; MLETR; Draft convention on negotiable cargo documents; UNIDROIT, Principles on Digital Assets and Private Law (January 2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, accessed 10 Jan 2025.

law where electronic bills of lading can be seen as both transport documents and digital assets, may render the legal boundaries unclear. This overlap adds to the regulation more complex and may, in certain circumstances, lead inconsistent results.

3.2.3 Limited functions

One important limitation of the functional equivalence principle lies in the very idea of function on which it is built.[149] The principle secures only formal validity, ensuring that electronic bills of lading, like other electronic records, can stand in for their paper counterparts in form, but it does not necessarily extend to substantive legal effects.[150]

This limitation becomes clear when considering the evidentiary function. Functional equivalence allows an electronic bill of lading to be admitted as evidence.[151] However, as observed in UNCITRAL's Explanatory Note on the Model Law on Electronic Commerce, its probative weight, such as authentication thresholds, presumptive validity, and evidentiary sufficiency, remains governed by substantive law.[152] Since these matters are left to domestic substantive law, which differs across jurisdictions, the evidentiary force of electronic bills of lading in cross-border disputes remains uncertain and often depends on conflict-of-laws rules.[153]

Interview evidence supports this concern.[154] One practitioner noted that while blockchain-based electronic bills of lading systems can resolve operational issues (for example, disputes over cargo quantity or quality), they may not be able to determine the validity of an electronic agreement or the evidentiary weight of an electronic bills of lading. These issues require legal intervention. This suggests that although technology is advanced, the functional equivalence principle may not by itself ensure the substantive legal certainty that commercial actors expect.

---

[149] See this thesis in Section 2.3 about the drafting considerations of the function.
[150] For example, the enforceability under United Nations Commission on International Trade Law (UNCITRAL), Model Law on Electronic Transferable Records (2017) Article 10.
[151] As codified in United Nations Commission on International Trade Law (UNCITRAL), Model Law on Electronic Transferable Records (2017) Article 12.
[152] United Nations Commission on International Trade Law (UNCITRAL), Model Law on Electronic Transferable Records (2017) Explanatory note p39. para. 86.
[153] Ibid., paras 85–87.
[154] Interview with the project leader from COSCO Shipping (17 October 2022).

From this perspective, the division reflects the idea of interfering as little as possible with domestic law while still aiming for technological neutrality. Formal validity rules and private international law work together in layers: functional equivalence acts as a gatekeeper to recognize the legal existence of electronic records, but their actual effects depend on the substantive law chosen by conflict of laws. At a deeper level, there is a tension between technological neutrality and legal certainty.[155] The principle assumes that changing the form of a document does not affect the rights and obligations it carries, but digital technologies in fact reshape how legal relationships exist. This arguably shows that the minimalist approach of functional equivalence may be insufficient on its own to deal with the new challenges created by digital legal relationships.

In summary, these three aspects: limited scope, unclear concepts, and limited functions, indicate that functional equivalence faces constraints in providing a fully stable foundation for regulating electronic bills of lading. Instead of bridging offline and online seamlessly, it may give rise to fragmented and uncertain outcomes, which can affect the legal recognition of electronic bills of lading. Building on this analysis, the next section turns to the practical problems that arise from functional equivalence in operation. It explores how flexible conditions but rigid, binary outcomes, together with the reliance on technological neutrality, create further uncertainty in the use and recognition of electronic bills of lading.

3.3 Practical problems: flexibility and uncertainty

This section explains how the flexible conditions and strictly binary yes-or-no results of functional equivalence, combined with the strong reliance on technological neutrality, may give rise to practical uncertainty for electronic bills of lading.

3.3.1 Flexible requirement v.s. rigid outcome

Reed explains that functional equivalence includes the equivalence of application and the equivalence of outcome.[156] In practice, it operates through flexible conditions while producing a rigid, binary outcome (equivalent or not). This section examines why such conditions are

[155] See this thesis in Section 3.3.2.
[156] Reed, C. (2010). "Online and Offline Equivalence: Aspiration and Achievement", International Journal of Law and Information Technology, Vol. 18, Issue 3, p245.

flexible, and how that flexibility may contribute to uncertainty. The flexibility comes from three sources: different reliability tests for different technologies, open-ended standards on what constitutes a reliable method, and party autonomy through opt-ins or opt-outs. This mismatch between flexible inputs and rigid outcomes highlights the potential instability of functional equivalence across international instruments.

3.3.1.1 Factor one: technology approaches

The tension between rigid outcomes and flexible conditions is particularly apparent in the role of technology. Different technical designs, whether registry-based, token/DLT systems, or centralised databases, require distinct reliability and control tests. The conditions for meeting equivalence are therefore highly flexible, but the outcome (equivalent or not equivalent) remains strictly binary.

In the MLETR, functional equivalence requirements are framed without explicit reference to technology.[157] Technology neutrality is identified as one of its three guiding principles, though in practice it operates more as a broad policy slogan.[158] This principle has its roots in earlier UNCITRAL debates.[159] For instance, the drafting of the Model Law on Electronic Signatures considered three approaches: the minimalist approach, the technology-specific approach, and the two-tiered or two-pronged approach.[160] The minimalist approach, which aligns with technology neutrality, provides minimal legal status to all forms of electronic signatures, considering any technology capable of performing the two primary functions of handwritten

[157] United Nations Commission on International Trade Law (UNCITRAL), Model Law on Electronic Transferable Records (2017) Explanatory note p39. para. 18.
[158] According to the interviews with the COSCO Shipping (17 October 2022) and a third-party electronic bills of lading technology provider (21 October 2022) .
[159] MLEC, Guide, para. 25; MLES, para. 82: e.g. digital signatures relying on asymmetric cryptography; biometric devices (enabling the identification of individuals by their physical characteristics, whether by hand or face geometry, fingerprint reading, voice recognition or retina scan, etc.); symmetric cryptography, the use of PINs; the use of "tokens" as a way of authenticating data messages through a smart card or other device held by the signatory; digitized versions of handwritten signatures; signature dynamics; and other methods, such as clicking an "OK-box"). The various techniques listed could be used in combination to reduce systemic risk (see A/CN.9/484, para. 52).
[160] UNCITRAL, Promoting confidence in electronic commerce: legal issues on international use of electronic authentication and signature methods, https://digitallibrary.un.org/record/657519, para. 82-96. See also B.P. Aalberts & S. van der Hof, Digital Signature Blindness, Analysis of legislative approaches toward electronic authentication, November 1999, http://cwis.kub.nl/~frw/people/hof/ds-fr.htm, p24.

signatures as satisfying the legal signature requirement.[161] The Model Law on Electronic Commerce adopts the minimalist approach in paragraph 1, article 7.[162] The technology-specific approach, on the other hand, emphasizes absolute security against fraud and transmission errors, aiming at the high level of security offered by existing technologies.[163] However, this approach "risks excluding other possibly superior technologies from entering and competing in the marketplace."[164] The two-tiered or two-pronged approach establishes a low threshold of requirements for certain electronic authentication methods to receive a minimum legal status while granting greater legal effect to specific electronic authentication methods.[165] By contrast, the Rotterdam Rules set out requirements for electronic records in Article 9 but do not contain explicit provisions on technology.[166] Unlike the MLETR, they do not rely on technology neutrality as an underlying principle.

This doctrinal uncertainty is mirrored in practice. As one interviewee with extensive experience in digital trade systems explained: "The legal barriers are the biggest barrier... standards exist, but they are granted, not regulatory".[167] She further explained that, in practice, the notion of technology neutrality is often understood by industry actors as amounting to "technology-agnostic data standards", in the sense that the law does not prescribe any specific system architecture, leaving such choices largely to private actors. Such remarks suggest that, while

---

[161] Promoting confidence in electronic commerce: legal issues on international use of electronic authentication and signature methods, para. 83. United Nations Publication Sales No. E.09.V.4 ISBN 978-92-1-133663-4.

[162] "(1) Where the law requires a signature of a person, that requirement is met in relation to a data message if:
"(a) a method is used to identify that person and to indicate that person's approval of the information contained in the data message; and "(b) that method is as reliable as was appropriate for the purpose for which the data message was generated or communicated, in the light of all the circumstances, including any relevant agreement."

[163] Promoting confidence in electronic commerce: legal issues on international use of electronic authentication and signature methods, para. 90.

[164] Stewart Baker and Matthew Yeo, in collaboration with the secretariat of the International Telecommunication Union (ITU), "Background and issues concerning authentication and the ITU", briefing paper presented to the Experts Meeting on Electronic Signatures and Certification Authorities: Issues for Telecommunications, Geneva, 9 and 10 December 1999, document No. 2, available at http://www.itu.int/osg/spu/ni/esca/meetingdec9-101999/briefi ngpaper.html (accessed on 6 June 2008).

[165] Promoting confidence in electronic commerce: legal issues on international use of electronic authentication and signature methods, para. 93. Aalberts and van der Hof, Digital Signature Blindness, para. 3.2.2.

[166] United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (adopted 11 December 2008, not yet in force) UN Doc A/RES/63/122, Annex I (Rotterdam Rules) art 9.

[167] Interview with Dr. Hanane Becha, digital trade expert, Vice Chair of UN/CEFACT (21 November 2022).

technical models proliferate, the absence of binding legal recognition may contribute to uncertainty in the legal status of electronic bills of lading, and may leave market actors, carriers, banks, and traders, facing uneven acceptance across jurisdictions.

3.3.1.2 Factor two: a reliable method

The same pattern of flexible conditions but rigid outcomes is evident in the reliable method standard under Article 12 of the MLETR.[168] Courts are invited to exercise discretion in interpreting reliability, often guided by open-ended element-based rules. This flexibility in conditions contrasts with the binary outcome: either the electronic record qualifies as an electronic transferable record or it does not.

Article 12 of the MLETR embodies the drafters' subjective standard of functional equivalence: the requirement of a reliable method. During the drafting process, three legislative approaches were considered: safe harbour rules, guiding rules of elements, and mandatory minimum requirements.[169] The safe harbour rule provides a safe harbour provision or mere guidance by illustrating when a method would be deemed to meet the reliability standard.[170] The guiding rules of elements propose an illustrative list of factors that may be taken as relevant to the reliability standard.[171] Mandatory minimum requirements stipulate specific and mandatory minimum criteria.[172] A shared characteristic among these approaches is arguably that their standards are open-ended and indeterminate, reflecting the inherent flexibility of functional equivalence conditions.

MLETR ultimately adopted broad and general guiding rules, leaving significant room for national legislatures to decide whether and how to adopt them.[173] The notion of a reliable method complements the objective standards of functional equivalence established in Articles 10 and 11, and it explicitly addresses the burden of proving 'singularity' and 'control' responsibilities without altering those objective standards.[174] If a party intends to assert that an electronic record qualifies as an electronic transferable record, they must provide evidence to

[168] UNCITRAL, *Model Law on Electronic Transferable Records* (2017) art 12.
[169] A/CN.9/797, para. 86.
[170] Ibid., para. 86-87.
[171] Ibid., para. 88-89.
[172] Ibid., para. 86-89.
[173] Ibid., para. 88.
[174] MLETR, Article 10-11.

demonstrate that the method employed for ensuring 'singularity' and 'control' in the electronic record conforms to the standards prescribed in Article 12.[175] Consequently, the ensuing question pertains to the uncertainty inherent in the standards laid out in Article 12, necessitating legal interpretation. Divergent legal interpretations may lead to ambiguity in the application of the subjective standard of functional equivalence. This ambiguity translates into practical uncertainty for electronic bills of lading, as their recognition may vary depending on how courts interpret the reliability of the underlying system.

This issue also arises in practice. A senior banking lawyer noted: "Electronic presentation under letters of credit is less than 1%, and customers are still worried about whether ports will accept it."[176] She added that banks "take a passive role, simply following client instructions, often logging into several third-party platforms. APIs exist, but they are expensive to set up and not consistent".[177] These comments show the problem with Article 12 of the MLETR: the idea of a reliable method gives considerable discretion in deciding what counts as reliable, but the legal outcome is still a yes-or-no decision. This mismatch may contribute to uncertainty that directly lowers adoption rates, leaving banks and traders cautious and often unwilling to rely on electronic bills of lading.

3.3.1.3 Factor three: party autonomy

Party autonomy further illustrates the gap between flexible conditions and rigid legal results. By allowing parties to select different technological methods, or even to opt out entirely, international rules widen the range of acceptable approaches. However, despite this flexibility, the assessment of functional equivalence ultimately leads to a binary legal outcome: equivalence is either established or denied. Even where different methods exhibit only marginal differences in their degree of compliance with the relevant standards, the legal outcomes may diverge.

The emphasis on party autonomy in international instruments, as observed in the Rotterdam Rules and MLETR, grants parties the freedom to choose the use of electronic forms and

[175] Ibid., Article 12.
[176] According to the interview with Bank Officer, Bank of China (22 November 2022).
[177] According to the interview with Bank Officer, Bank of China (22 November 2022). Application Programming Interfaces (APIs) are technical tools that allow different platforms to connect and exchange data.

alternative methods, contributing to the uncertain nature of functional equivalence.[178] Under the Rotterdam Rules, Article 79 limits the scope of mandatory provisions to those expressly listed, rendering any contractual derogation from those provisions of no effect. Article 10 allows parties to exercise their autonomy by choosing to utilize or forego the use of electronic forms. Similarly, the MLETR, through Article 4, recognizes the autonomy of the parties' will, enabling them to exclude the application of certain rules while opting for alternative methods. This party autonomy offers a relatively flexible standard for functional equivalence.

Interview evidence supports this theoretical point by showing how party autonomy may result in inconsistency in practice. As noted on the previous page, a senior banking lawyer explained that banks "play a passive role, simply following client instructions, often logging into several third-party platforms; APIs exist, but integration is costly and fragmented".[179] This shows that banks play only a limited and reactive role: they follow client instructions rather than actively promoting electronic bills of lading. As a result, the decision is effectively pushed back to trading parties, who may each prefer different platforms. A shipping company lawyer gave a similar account, noting that even when electronic bills of lading are available, "exporters and importers often disagree on whether to use them, and where trust is low, paper is chosen instead".[180] The ability of parties to opt out indicates that functional equivalence alone may not ensure uniform certainty, but instead leaves adoption dependent on bargaining power. Likewise, a product manager from an electronic bills of lading platform observed that adoption "depends on existing habits. P&I recognition helps, but it is not essential."[181] These findings suggest that party autonomy, while intended to preserve flexibility, in practice fragments the market. The choice to use or reject electronic bills of lading is exercised unevenly across industries and jurisdictions, reinforcing the uncertainty already present in functional equivalence.

The three factors, technology approaches, the 'reliable method' standard, and party autonomy in allowing choice, show that functional equivalence rests on flexible conditions but produces rigid yes-or-no outcomes. This mismatch may affect its effectiveness and contribute to legal

[178] Rotterdam Rules Article 10, 79; MLETR Article 4.
[179] According to the interview with Bank Officer, Bank of China (22 November 2022).
[180] According to the interview with COSCO Shipping (17 October 2022).
[181] According to the interview with a third-party electronic bills of lading technology provider (21 October 2022).

uncertainty and slower adoption of electronic bills of lading.

3.3.2 Limits of technological neutrality

Functional equivalence is arguably built on the principle of technological neutrality. In practice, the functional equivalence approach operates on the assumption that the law should remain neutral as to the technological means employed, recognising any system capable of performing the relevant functions as legally equivalent. This section argues that while technological neutrality is attractive as a method to avoid obsolescence, in the electronic bills of lading context it may amplify variance, thereby undermining the certainty that functional equivalence was meant to provide.

3.3.2.1 Conceptual foundations and critiques

Any discussion of the background of technological neutrality must start with a simple question: is technology neutral? The idea of technological neutrality has been widely invoked in law, but its meaning and validity remain contested. Maxwell and Bourreau outline three layers of the concept: first, legal or technical rules should focus on objectives rather than mandating particular methods; second, the same regulatory principles should apply regardless of the technology used; and third, regulators should not favour specific technologies or direct the market towards 'winners'. [182] These three layers have formed a broad academic consensus that neutrality helps make law adaptable and resistant to obsolescence.[183] Greenberg, for example, argues that neutrality saves lawmakers from constant revision by using broad and flexible terms.[184]

---

[182] Winston J Maxwell and Marc Bourreau, 'Technology Neutrality in Internet, Telecoms and Data Protection Regulation' (2014) 35 Computer Law & Security Review 407, 407.

[183] See examples, Bert-Jaap Koops, 'Should ICT Regulation Be Technology-Neutral?' in Bert-Jaap Koops, Miriam Lips, Corien Prins and Maurice Schellekens (eds), Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-Liners (Asser 2006); MLEC, Guide, para. 25; Explanatory note by the UNCITRAL secretariat on the United Nations Convention on the Use of Electronic Communications in International Contracts, para. 48; UNCITRAL, A/CN.9/WG. IV/WP.13, p4, para. 13; Chris Hoofnagle, 'Should Regulation Be "Technology Neutral"?' (University of California, Berkeley, School of Law, School of Information) <https://hoofnagle.berkeley.edu/2018/02/02/should-regulation-be-technology-neutral/>, accessed May 2024; Sherzod Shadikhodjaev, 'Technological Neutrality and Regulation of Digital Trade: How Far Can We Go?' (2021) 32(4) European Journal of International Law 1221–1248 <doi:10.1093/ejil/chab054>; Tim Wu, 'Network Neutrality, Broadband Discrimination' (2003) 2 J on Telecomm & HighTech L 141, 142.

[184] Brad A. Greenberg, 'Rethinking Technology Neutrality' (2016) 100 Minn L Rev 1495, 1513.

But is this really the case? The idea of technology neutrality originally comes from the question: "is technology neutral?" However, neutrality itself is not easily defined. Authoritative dictionaries, including legal dictionaries, do not provide a clear meaning of 'technology neutrality'. The term 'neutrality' is usually defined in the context of states staying out of conflicts, which offers little guidance here.[185] Whelchel therefore argues that neutrality cannot simply mean "having no effect", and reframes the question as "is technology value free?"[186]

This question has long divided scholars. Miller, for example, defends the Value-Neutrality Thesis, arguing that technology is neither good nor bad in itself, but this view has been widely challenged.[187] Heyndels shows that the debate turns on different assumptions about what technological artefacts are.[188] Critical theorists go further: Marcuse, as cited by Delanty and Harris, insists that technology is never neutral but embedded in social relations and systems of domination, "technology cannot be separated from its use; the technological society is a system of domination." [189] These disagreements illustrate that neutrality is not a given fact but a contested claim. This has direct implications for law: if technology is never value-free, then legal doctrines that rely on the assumption of neutrality, such as functional equivalence, are themselves built on unstable ground.

In contrast to the intense debates, the legal community has arguably largely embraced a technology-neutral approach over a technology-specific one. As will be seen in the following, lawmakers and scholars argue that neutrality extends the life of the law and ensures equal treatment of both old and new technologies. The US government first formalized this principle in its 1997 Framework for Global Electronic Commerce, which declared that rules should be

[185] For instance, Black's Law Dictionary defines neutrality as the state of a nation that does not take sides in conflicts, while Merriam-Webster defines it as the refusal to take part in a war between other powers. Similarly, Cambridge Dictionary and Collins English Dictionary also describe neutrality as a neutral position, particularly in the context of war.
[186] Whelchel, R J, 'Is Technology Neutral?', in IEEE Technology and Society Magazine, vol. 5, no. 4, pp. 3-8, Dec. 1986, doi: 10.1109/MTAS.1986.5010049.
[187] Miller, B, 'Is Technology Value-Neutral?' (2021) 46 Science, Technology, & Human Values 53 <https://doi.org/10.1177/0162243919900965>.
[188] Heyndels, S, 'Technology and Neutrality' (2023) 36 Philos Technol 75 <https://doi.org/10.1007/s13347-023-00672-1>, 1.
[189] Marcuse H, *One-Dimensional Man* (Routledge & Kegan Paul 1964); Delanty, G, and Harris, N, 'Critical theory and the question of technology: The Frankfurt School revisited' (2021) 166(1) Thesis Eleven 88 <https://doi.org/10.1177/07255136211002055>.

"technology-neutral" and "forward-looking."[190] Since then, many legislative instruments have adopted the same stance.[191]

This strong preference, however, has arguably left little room for critical reflection. Legal provisions often assume neutrality without examining its meaning or limitations. As Reed notes, consensus was reached on the term long before its substance was fully understood.[192] Only in 2006 did Koops offer a systematic analysis of technology neutrality beyond the telecoms field.[193] Since then, critical voices have grown louder. Greenberg, for example, argues that neutrality is often flawed, self-defeating, and not truly neutral.[194] Veerpalu and da Cruz Rodrigues e Silva similarly highlight its weaknesses, offering a model to test neutrality in blockchain cases.[195] Yoo goes further, suggesting a shift from neutrality to "network diversity", allowing multiple systems to coexist and potentially providing a more effective framework.[196]

Therefore, these perspectives suggest that the neutrality debate spans multiple disciplines and theories, each offering different insights into the role and impact of technology in society. This matters for law because the way we understand neutrality directly shapes how functional equivalence is interpreted and applied to instruments like the electronic bill of lading.

In summary, these perspectives suggest that technology is never wholly neutral but always carries social, economic, and political weight. For law, this means that assuming technological neutrality as the foundation of functional equivalence may present challenges: by treating

---

[190] Clinton White House (Archives.gov). 'A Framework for Global Electronic Commerce' https://clintonwhitehouse4.archives.gov/WH/New/Commerce/read.html accessed 6 May 2024.
[191] See examples, UNCITRAL *Model Law on Electronic Commerce with Guide to Enactment 1996* (United Nations 1999); UNCITRAL, *Model Law on Electronic Transferable Records* (United Nations 2017); UNCITRAL *Model Law on Electronic Signatures with Guide to Enactment 2001* (United Nations 2002); *United Nations Convention on the Use of Electronic Communications in International Contracts* (adopted 23 November 2005, entered into force 1 March 2013) 2898 UNTS 3; Regulation of the European Parliament and of the Council on harmonised rules on fair access to and use of data (Data Act) COM (2022) 68 final; Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act) COM (2021) 206 final; Regulation of the European Parliament and of the Council on European data governance (Data Governance Act) (EU) 2022/868; Electronic Trade Documents Act 2023, c. 30 (UK).
[192] Chris Reed, 'Taking Sides on Technology Neutrality' (2007) 4 SCRIPTed 263, 265.
[193] Bert-Jaap Koops, 'Should ICT Regulation be Technology-Neutral' in Bert-Jaap Koops, Miriam Lips, Corien Prins & Maurice Schellekens, *Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-Liners* (TMC Asser Press 2006) 77, 77-79.
[194] Brad A. Greenberg, 'Rethinking Technology Neutrality' (2016) 100 Minn L Rev 1495, 1495.
[195] Anne Veerpalu & Eduardo da Cruz Rodrigues e Silva, 'Hitting the White Ball: The Technology Neutrality Principle and Blockchain-Based Applications' (2019) 15 Indian J L & Tech 300, 301.
[196] Christopher S. Yoo, 'Beyond Network Neutrality' (2005-2006) 19 Harv JL & Tech 1, 57.

different technologies as interchangeable so long as they perform the same function, legislators may overlook the embedded values and unequal effects of those technologies. This gap helps explain why functional equivalence, though flexible in form, often creates legal uncertainty in practice. In the context of electronic bills of lading, different technological systems embed different structures, trust mechanisms, and patterns of risk allocation. When functional equivalence is implemented on the basis of technological neutrality, legal frameworks tend to focus on functional performance rather than on structural differences between systems. To better understand these implications, it is useful to examine how technology neutrality has been implemented in electronic commercial law.

3.3.2.2 Technology neutrality in electronic commercial law

This section examines two key areas in electronic commercial law: regulatory approaches and the debate between technology neutrality and technology specificity. First, we will explore the main regulatory methods: modifying existing laws, creating specific regulations, and allowing self-regulation. Each has its benefits and challenges. Next, we will analyse the principle of technology neutrality, which ensures equal legal status for different technologies, and its implications compared to technology-specific regulations.

Electronic commercial law responds to technological change through three main approaches. The first is amending existing law to cover new technologies, often by applying technology neutrality so that different systems are treated alike, as seen in UK law on electronic trade documents and UNCITRAL's frameworks.[197]

The second approach is creating specific rules for defined technologies, such as the UK Law Commission's third category of digital assets or Hong Kong's licensing of virtual asset platforms.[198]

---

[197] UK Law Commission, Electronic trade documents: Report and Bill; UNCITRAL Working Group IV.
[198] For the UK: Law Commission, 'Digital Assets' <https://lawcom.gov.uk/project/digital-assets/> accessed 14 January 2024; for the Hong Kong: Securities and Futures Commission, 'New Measures to Regulate Virtual Asset Trading Platforms' (31 May 2023) https://apps.sfc.hk/edistributionWeb/gateway/EN/news-and-announcements/news/doc?refNo=23PR5 accessed 14 January 2024; Dentons, 'Hong Kong's New Licensing Regime for Virtual Asset Trading Providers Takes Effect' (5 June 2023) https://hongkong.dentons.com/en/insights/articles/2023/june/5/hong-kongs-new-licensing-regime-for-virtual-asset-trading-providers-takes-effect accessed 14 January 2024.

The third approach employed by electronic commercial law to respond to technological changes is self-regulation, where industry bodies such as BIMCO and DCSA develop standards, though coverage and authority may vary across sectors and jurisdictions.[199]

Among these, the first approach reflects technology neutrality most clearly: it avoids naming technologies and thus seeks future-proof the law. Yet critics note that by refusing to define technologies, neutrality may delay effective regulation, weaken investors and consumer protection, and leave wide discretion to courts.[200] Interview evidence is consistent with these concerns, suggesting that such uncertainty over legal recognition remains a practical barrier to the wider use of electronic bills of lading.[201]

Electronic commercial law is one of the fields where the principle of technology neutrality is most frequently applied, as it is so technology-related. Terms such as technology-neutral, technology-specific, technology-favouring, technology-stimulating, technology-driven, and technology-triggered have become common in the field of electronic commercial law.[202] In electronic commercial law, the contrast between technological neutrality and technology specificity is evident.[203] However, the discussions arguably are not as deep as in the social sciences, largely because technological neutrality seems to dominate the field.[204]

---

[199] See examples, Mark E. Budnitz, 'Privacy Protection for Consumer Transactions in Electronic Commerce: Why Self-Regulation Is Inadequate' (1998) 49 S C L Rev 847; Leon Y. Xiao, 'Regulating Loot Boxes as Gambling? Towards a Combined Legal and Self-Regulatory Consumer Protection Approach' (2021) 4(1) Interactive Entertainment Law Review 27; Abdul Halim Barkatullah and Djumadi, 'Does Self-Regulation Provide Legal Protection and Security to E-Commerce Consumers?' (2018) 30 Electronic Commerce Research and Applications 94; Lawrence Lessig, Code and Other Laws of Cyberspace (Basic Books 1999), 3-8; DCSA, 'DCSA Publishes Beta Releases of Standards for the Booking Process 1.0 and the Bill of Lading 2.0' (DCSA) <https://dcsa.org/newsroom/resources/beta-releases-of-standards-for-the-booking-process-1-0-and-the-bill-of-lading-2-0/> accessed 18 May 2022; Feng Wang, 'Blockchain Bills of Lading and their Future Regulation' [2021] Lloyd's Maritime and Commercial Law Quarterly 503, 503; also see Robert Baldwin, Martin Cave and Martin Lodge, *The Oxford Handbook of Regulation* (Robert Baldwin, Martin Cave, and Martin Lodge ed, Oxford University Press 2010) 147-148.

[200] Gabriele Gagliani, 'Cybersecurity, Technological Neutrality, and International Trade Law' (2020) 23(3) Journal of International Economic Law 723-745 https://doi.org/10.1093/jiel/jgaa006 accessed 14 January 2024.

[201] According to the interviews with COSCO Shipping (17 October 2022) and technology provider (21 October 2022).

[202] Bert-Jaap Koops, "Should ICT Regulation be Technology-Neutral?" in Bert-Jaap Koops, Miriam Lips, Corien Prins & Maurice Schellekens, *Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-Liners* (TMC Asser Press 2006) 77, 77-78; Chris Reed, 'Taking Sides on Technology Neutrality' (2007) 4 *SCRIPTed* 263, 264-266.

[203] Chris Reed, 'Taking Sides on Technology Neutrality' (2007) 4 SCRIPTed 263, 282-284.

[204] There is a chart about the comparisons of the Technology dependent legislation and Technology independent legislation, on page 17 of B P Aalberts and S van der Hof, Digital Signature Blindness (ITeR,

In what specific way does the principle of technology neutrality play a role in the field of e-commerce law? The embodiment of it in electronic commerce law mainly lies in that it provides equal legal status for different types of technologies without favoring or excluding any specific technology. By not specifying the type of technology, the law allows various forms of electronic signatures, electronic records, and related payment systems, as well as the electronic bill of lading, the research object of this thesis, to be legally used in compliance.

First, the technical neutrality of electronic records is reflected in the fact that the law allows all forms of electronic records to enjoy the same legal status as traditional paper records, without forcing the use of specific software or platforms. For example, whether enterprises choose cloud storage technology or blockchain technology, if these electronic records meet the basic security and authentication standards, the law recognizes their legitimacy.[205] Secondly, electronic bill of lading is an important application in the field of shipping. Technology-neutral laws allow the use of different electronic bill of lading systems without limiting specific technical means. For example, the blockchain-based electronic bill of lading system and other electronic platforms can be legally used as long as they can ensure security and reliability.[206] Finally, the technical neutrality of electronic signature is another important embodiment of electronic commerce law. Take the UNCITRAL Model Law on Electronic Commerce as an example, which stipulates that any form of electronic signature will have legal effect if it meets the authentication and security standards.[207] This means that different electronic signature methods are legally recognized whether using digital signature, fingerprint identification or

---

no 32, Kluwer 2000); Ali R, 'Technological Neutrality' (2009) 14(2) Lex Electronica 1, 12; Scholars refer to this characteristic as "time-proof"; For example, Explanatory note by the UNCITRAL secretariat on the United Nations Convention on the Use of Electronic Communications in International Contracts, para. 48; UNCITRAL Model Law on the Use and Cross-border Recognition of Identity Management and Trust Services (2022), para. 45-50; para. 117, https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/mlit_en.pdf, accessed on 3 April 2024; and MLETR; Sherzod Shadikhodjaev, 'Technological Neutrality and Regulation of Digital Trade: How Far Can We Go?' (2021) 32(4) European Journal of International Law 1221, 1222; B P Aalberts and S van der Hof, Digital Signature Blindness (ITeR, no 32, Kluwer 2000), 15-17.

[205] 'IA Electronic Transactions Law: General Principles' (Online Readiness Assessment Guide for Cross-Border Paperless Trade) <https://readiness.digitalizetrade.org/legal-guide/ia-general-principles> accessed 19 May 2024.

[206] Thomas Krebs, 'Electronic Bills of Lading, Transnational and English Law: Blocking the Blockchain?' (2024) Uniform Law Review unad022, https://doi.org/10.1093/ulr/unad022.

[207] United Nations Commission on International Trade Law (UNCITRAL), 'Model Law on Electronic Commerce' (1996) https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_commerce accessed 19 May 2024.

facial recognition technology.[208] This technology neutrality provides enterprises and individuals with more freedom and choice space for electronic signature on different technology platforms, which is helpful to promote the development of e-commerce.[209]

In summary, technology neutrality can combine the three principles together. The principle of functional equivalence, the principle of technology neutrality are in my opinion complementary to each other. Reed deduced two main elements of the principle of technology neutrality: fundamental rules should be the same online as offline (or more broadly, for online technological activities and equivalent offline); and legal rules should not favour or discriminate against a particular technology.[210] Koops incorporated the principle of technology neutrality into his legislative objectives, identifying four main legislative purposes for its use, including achieving functional equivalence between online and offline, and non-discrimination against technologies with equivalent effects.[211] Koops says "if the effects of a technology are regulated rather than the technology itself, the regulation will usually establish functional equivalence between off-line and on-line worlds"[212]

This understanding is similar to the four rationales behind the principle of technology neutrality introduced by Van der Haar: non-discrimination, sustainability, efficiency, and consumer certainty.[213] The non-discrimination rationale requires that regulations do not favor one technology over another.[214] In addition, the sustainability rationale indicates that the principle of technology neutrality requires regulations to be flexible and open to technological change.[215] By not being specific to any one technology, regulations become future-proof, as existing

[208] 'Are Electronic Signatures Legal?' (Pipedrive, 22 September 2021) https://www.pipedrive.com/en/blog/are-electronic-signatures-legal accessed 19 May 2024.
[209] 'Use of Electronic Signature for Commercial Transactions in Mexico' (Mayer Brown, 30 June 2020) <https://www.mayerbrown.com/en/insights/publications/2020/06/use-of-electronic-signature-for-commercial-transactions-in-mexico> accessed 19 May 2024.
[210] Chris Reed, 'Taking Sides on Technology Neutrality' (2007) 4 SCRIPTed 263, 266.
[211] Bert-Jaap Koops, "Should ICT Regulation be Technology-Neutral?" in Bert-Jaap Koops, Miriam Lips, Corien Prins & Maurice Schellekens, *Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-Liners* (TMC Asser Press 2006) 77, 83-90.
[212] Ibid., 85.
[213] Van der Haar IM, *The Principle of Technological Neutrality: Connecting EC Network and Content Regulation* (Doctoral Thesis, [s.n.] 2008) 96-102.
[214] Ibid., 97.
[215] Ibid., 98.

regulations can apply to technologies that did not exist at the time of drafting.[216] Efficiency calls for the creation of dynamic, functional rules that can evolve with technological developments.[217] Consumer certainty is also enhanced.[218] According to this rationale, when consumers consider services to be interchangeable, technology neutrality ensures that such services are regulated in a similar manner.

Taken together, these rationales indicate that technological neutrality operates as part of a broader regulatory framework. In electronic commercial law, this framework commonly incorporates principles such as functional equivalence. However, when applied to instruments like the electronic bill of lading, this principle reveals several practical limitations, which will be discussed next.

3.3.2.3 Practical problems with electronic bills of lading

A major obstacle to the adoption of electronic bills of lading is the lack of generally accepted standards, which has contributed to their persistently low utilisation rate. This section examines how the limitations of technological neutrality may manifest in the regulation and practice of electronic bills of lading.

This problem reflects the broader concerns of technological neutrality discussed in the literature. Aalberts and van der Hof, for instance, provide a detailed comparison of technological neutrality and technology-specific approaches from a general perspective. They illustrate that technological neutrality raises a number of challenges. It may give rise to legal uncertainty, as the lack of specific guidelines can lead to inconsistent interpretations and applications.[219] Additionally, it often functions more as a political buzzword than as a clearly defined legal concept, which may affect its effectiveness.[220] The language of neutrality can also undermine support for already proven and available technologies, potentially stifling their adoption.[221] On the other hand, while it leaves room for new technologies to develop and capture the market, this openness may also lead to fragmentation and a lack of

[216] Ibid., 99-100.
[217] Ibid., 101-103.
[218] Ibid.
[219] Aalberts BP and van der Hof S, *Digital Signature Blindness* (2000) Tilburg University, 17.
[220] Ibid.
[221] Ibid.

standardisation, which are precisely the challenges currently faced in the electronic bill of lading context.[222]

Interview evidence supports this.[223] Stakeholders reported that the electronic bill of lading platforms and systems used by different parties may be incompatible, and this lack of interoperability may hinder the seamless exchange and recognition of electronic bills of lading in different jurisdictions and industries.[224] This incompatibility mainly arises from the lack of commonly accepted standards. Without such standards, different platforms cannot work together smoothly, which may make it difficult to exchange documents across systems and often leads parties to fall back on paper. This incompatibility, as interviewees emphasized, may be one factor why electronic bills of lading have not been widely adopted.[225]

A major concern is that the lack of generally accepted standards for electronic bills of lading arguably creates a risk of inconsistencies in their creation, transmission, and verification. Such inconsistencies, in turn, are likely to generate legal uncertainty and inefficient operation. The industry organisations DCSA, BIMCO, FIATA ICC and SWIFT have formed the FIT Alliance, which has been working to achieve a unified standard for electronic bills of lading on different platforms.[226] As they stated, "the FIT Alliance will work to generate awareness about the importance of common and interoperable data standards and common legislative conditions across international jurisdictions and platforms."[227] Sue Probert, Chairman of UN/CEFACT, praised the alignment of DCSA standards with the UN/CEFACT multimodal transport reference data model, and emphasized that such cooperation is for global interoperability and cross-border seamless transactions.[228] Oswald Kuyler, general manager of Digital Standards Initiative

---

[222] Aalberts BP and van der Hof S, *Digital Signature Blindness* (2000) Tilburg University, 17.
[223] ERGO II Application Submission ID: 75827 - Legal and Regulatory Approaches to Electronic Bills of Lading.
[224] According to the interviewee from COSCO Shipping (17 October 2022).
[225] This argument evidenced by "Ocean carriers issue around 45 million bills of lading a year. In 2021, only 1.2%of these were electronic," see DCSA, 'Major Boost for Electronic Bills of Lading as Liner Companies Pledge 100% Adoption by 2030' (BIMCO, 17 February 2023) https://www.bimco.org/insights-and-information/general-information/20230217-ebl-commitment-dcsa accessed 21 May 2024.
[226] FIT Alliance, 'FIT Alliance: Electronic Bill of Lading' (FIT Alliance, 2023) https://www.fit-alliance.org/ accessed 22 May 2024; Digital Container Shipping Association, 'DCSA Begins Final Phase of eBL Platform Interoperability Proof of Concept' (DCSA, 12 July 2022) https://dcsa.org/newsroom/dcsa-begins-final-phase-of-ebl-platform-interoperability-proof-of-concept accessed 21 May 2024.
[227] Digital Container Shipping Association, 'About Us' (DCSA, 2023) https://dcsa.org/about-us accessed 22 May 2024.
[228] Sue Probert, 'Analysis: A New Dawn for Electronic Bills of Lading' (The Loadstar, 2023) https://theloadstar.com/analysis-a-new-dawn-for-electronic-bills-of-lading/ accessed 22 May 2024.

(DSI) of the International Chamber of Commerce (ICC), pointed out that the COVID-19 epidemic has brought the urgency of digital transformation, and that standardized electronic bills of lading is the basis of this transformation, suggesting that it can significantly improve the efficiency of global trade.[229] However, the current utilisation rate of electronic bills of lading remains low and it appears reasonable to conclude that the application of this standard is not significant at present.

The principle of technology neutrality assumes that all technologies can perform the legal functions required by the bill of lading equally effectively. In practice, however, the three core functions arguably are not equally easy to replicate. As Goldby notes, the three functions of the bill of lading are not equally easy to replicate through systems: while receipt of goods and serving as evidence of the contract of carriage can be achieved relatively easily, reproducing the document of title function remains far more challenging.[230] This uneven performance calls into question the assumption of neutrality and highlights gaps in legal reliability.

A further limitation is that even if the basic functions of electronic bills of lading can be replicated through technology, vulnerabilities arguably may still undermine legal certainty. This suggests that the assumption of technological neutrality overlooks the translation of technical risks into legal risks. Some recent cases demonstrate that electronic trading systems are vulnerable to new security threats, reinforcing the point that technical risks can directly translate into legal risks.[231] For instance, security threats such as data manipulation or system failure demonstrate that a technically compromised system cannot provide the same level of legal certainty.[232] In this sense, neutrality assumes interchangeability across systems, but in practice, differences in reliability and resilience directly translate into differences in legal trust.

---

[229] Port Technology Team, 'DCSA Publishes Data Standards for Electronic Bill of Lading' (Port Technology International, 2020) https://www.porttechnology.org/news/dcsa-publishes-data-standards-for-electronic-bill-of-lading/ accessed 22 May 2024.
[230] Miriam Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (OUP 2019) 57–63.
[231] See A.P. Møller - Mærsk A/S, 'Cyber Attack Update' (28 June 2017) https://investor.maersk.com/news-releases/news-release-details/cyber-attack-update accessed 22 May 2024; Josephine Wolff, 'How the NotPetya Attack is Reshaping Cyber Insurance' (Brookings, 1 December 2021) https://www.brookings.edu/blog/techtank/2021/12/01/how-the-notpetya-attack-is-reshaping-cyber-insurance/ accessed 22 May 2024; Michael Schmitt & Lieut Col Jeffrey Biller, 'The NotPetya Cyber Operation as a Case Study of International Law' *EJIL: Talk!* (11 July 2017) https://www.ejiltalk.org/the-notpetya-cyber-operation-as-a-case-study-of-international-law/ accessed 12 September 2025.
232 See Joseph O. Eichenhofer, Elisa Heymann, Barton P. Miller and Arnold Kang, 'An In-Depth Security Assessment of Maritime Container Terminal Software Systems' (2020) IEEE Access 8 IEEE 126686, DOI: https://doi.org/10.1109/ACCESS.2020.3008395; 'Legal Risks Behind Electronic Bills of Lading: Assessing

Different countries and regions may adopt different regulatory approaches that reflect their unique legal, economic, and technical backgrounds, and such differences in regulation may present obstacles to the international use and recognition of electronic bills of lading. Following the adoption of Legislative Decree 1492, Peru cancelled the obligation to check the original paper bill of lading before the goods were released.[233] Also, the principle of technology neutrality does not inherently solve the security challenges related to electronic transactions, and network threats, data leakage and fraud risks may require specific technical measures.[234] What is more, the implementation of new technologies in line with the principle of technology neutrality may require significant investment in infrastructure, training, and adaptation, which can be challenging for smaller companies or companies in less technologically advanced regions.[235]

Above all, Section 3.3.1 and 3.3.2 highlight two central constraints of functional equivalence. First, the reliable method, as set out under Section 3.3.1 above, may introduce uncertainty, leading to tension between flexible requirements and rigid outcomes. Secondly, its reliance on technological neutrality may amplify variance and obscures the embedded values of different systems. These inherent weaknesses may affect the certainty that functional equivalence was meant to ensure. Building on this critique, the next section turns to the external challenges, in particular cross-border legal and institutional obstacles, that further complicate the effectiveness of functional equivalence in practice.

3.4 External challenges: cross-border legal and institutional obstacles

Section 3.3 showed that functional equivalence has certain internal weaknesses. These problems are further complicated in cross-border trade, where different legal systems,

---

Legal Recognition' (LegalBusinessOnline, 23 June 2025) https://www.legalbusinessonline.com/node/87002 Accessed 12 September 2025.

[233] República del Perú, Decreto Legislativo que aprueba disposiciones para la reactivación, continuidad y eficiencia de las operaciones vinculadas a la cadena logística de comercio exterior, Decreto Legislativo N° 1492 (10 May 2020) https://busquedas.elperuano.pe/dispositivo/NL/1866212-4 accessed 22 May 2024.

[234] See *MSC Mediterranean Shipping Company S.A. v Glencore International AG*, [2017] EWCA Civ 365.

[235] According to the interview with a third-party electronic bills of lading technology provider (21 October 2022).

institutional practices, and claims of digital sovereignty collide. This section examines these external challenges, focusing on private international law and institutional fragmentation.

3.4.1 Challenges of private international law

The principle of functional equivalence was meant to bring offline legal rules into the online world by matching functions. But in cross-border situations, this approach faces additional challenges. While concepts such as possession, situs, or place of performance are generally clear within a single jurisdiction, they may become more complex when applied across multiple jurisdictions or in an electronic environment. Different countries define and interpret electronic records in different ways, which makes connecting factors unstable and give rise to inconsistent results in conflict-of-laws cases. So, while functional equivalence may work within a single legal system, it often adds to the confusion in private international law instead of solving it.

The structural challenges arguably originate from two compounding factors: first, as will be seen, the transposition of intricate online concepts into offline legal frameworks necessitates the application of complex and incompatible domestic rules. This complexity is exacerbated by discretionary provisions in national laws that may introduce unpredictable variables in legal interpretation. Secondly, in what follows we will consider the intrinsically borderless nature of digital transactions, particularly exemplified by the global circulation of electronic records, which arguably fundamentally conflicts with territorially-bound legal systems. It is suggested that these dual pressures give rise to coordination challenges in judicial practice, where courts face contradictory imperatives between applying forum law and recognizing foreign legal determinations.

First, functional equivalence has limited capacity to address the breakdown in the digital environment of the traditional connecting factors fundamental to private international law. In the context of determining the seat, traditional private international law relies on physical connecting factors, such as the place of contract performance or the defendant's domicile.[236] However, the decentralised nature of electronic bills of lading poses significant interpretive

[236] See Peter North and JJ Fawcett, Cheshire, North & Fawcett's Private International Law (14th edn, OUP 2008); Albert Venn Dicey, John Humphrey Carlile Morris, and Lawrence Collins, Dicey, Morris & Collins on the Conflict of Laws (15th edn, Sweet & Maxwell 2012).

challenges to these principles. Taking blockchain-based electronic bills of lading as an example, distributed ledger nodes, the locations of data servers, or the execution sites of smart contracts could all serve as potential bases for jurisdictional claims, leading parties to engage in forum shopping.[237] In response to these challenges, the UK Law Commission's 2023 project, Digital Assets and ETDs in Private International Law: Which Court, Which Law?, aims to provide clarity on jurisdictional and choice-of-law issues, emphasizing the continued importance of functional equivalence in resolving private international law disputes.[238] The Commission argues that disputes involving crypto-tokens would be classified as matters of property law, to which the *lex situs*[239] principle applies.[240] In this context, the concept of control serves as a functional equivalent, acting as a key connecting factor in determining the applicable legal framework.[241] In a nutshell, the UK Law Commission adopts a dual principle of functional equivalence and technological neutrality. It advocates respecting the priority of party autonomy in jurisdictional agreements while redefining the meaning of traditional connecting factors, such as the place of performance.[242]

However, while the Law Commission's approach seeks to modernize the framework, it arguably does not resolve the difficulties. The reliance on control as a connecting factor remains contestable in multi-jurisdictional disputes, since the point of location may still be ambiguous.[243] Party autonomy, though emphasized, is subject to mandatory rules and unequal bargaining power, which may limits its effect in practice.[244] Similarly, redefining "the place of performance" in an electronic environment risks producing interpretative disputes rather than

---

[237] See forum shopping in the following work and cases: Trevor C Hartley, *International Commercial Litigation: Text, Cases and Materials on Private International Law* (2nd edn, CUP 2015); Richard Fentiman, *International Commercial Litigation* (2nd edn, OUP 2015); *Spiliada Maritime Corp v Cansulex Ltd* [1987] AC 460 (HL); *Owusu v Jackson* [2005] ECR I-1383 (ECJ).
[238] Law Commission, *Digital Assets and ETDs in Private International Law – Which Court, Which Law?* (Web Project, 2023) https://lawcom.gov.uk/project/digital-assets-and-etds-in-private-international-law-which-court-which-law/ accessed 15 October 2024.
[239] It means that the law of the place where the property is located.
[240] Law Commission, *Digital Assets in Private International Law: FAQs* (January 2025) https://cloud-platform-e218f50a4812967ba1215eaecede923f.s3.amazonaws.com/uploads/sites/30/2025/01/Digital-assets-in-private-international-law-FAQs.pdf, para. 1.100, accessed 5 February 2025.
[241] Ibid.
[242] Ibid., para. 1.49.
[243] Ying Khai Liew, 'Cross-Border Trust Disputes and Choice of Law in East Asia' (2021) 31(1) *Washington International Law Journal* 126, 126–127.
[244] A Mills, 'Limits on Party Autonomy in Choice of Law' in JM Basedow and G Rühl (eds), *Party Autonomy in Private International Law* (Cambridge University Press 2018) 455, 455-490.

clarity.[245] The issue of "clickwrap agreements" is just one illustration of these broader concerns: even with the Law Commission's proposals, functional equivalence continues to struggle with ensuring certainty in cross-border contexts.[246]

Secondly, divergent classifications of electronic records across jurisdictions reduce the effectiveness of the functional equivalence method. The complexity of conflicts in the application of law further reflects the competition of digital sovereignty claims among nations.[247] Electronic trade documents are recognized under the UK's ETDA 2023 as falling within the category of things in possession, while digital assets, also classified as electronic records, are deemed a third category of thing. In some jurisdictions, electronic records are categorized as a form of obligation.[248] This is primarily because they have been granted the same legal validity as traditional paper documents by law, to serve as evidence of contractual relationships, debt obligations, or other legal commitments. Paper bills of lading possess the function of a document of title, whereas other types of electronic records may not necessarily have the same effect in rem (property rights). However, this distinction remains underexplored, nor has it been extensively discussed.

The differing nature of these classifications directly impacts the stability of connecting factors in conflict of laws. When the transfer of rights in an electronic bill of lading involves the location of the data controller, the place where encryption keys are held, and the jurisdiction where the trading platform is registered, traditional principles such as *lex situs* or the *doctrine of the closest connection* struggle to provide clear guidance.[249]

---

[245] Z Chen, 'Jurisdiction and choice of law rules over electronic consumer contracts: The nexus between the concluded contract and the targeting activity' (2022) 29 *Maastricht Journal of European and Comparative Law* 328; D Levina, 'Jurisdiction at the place of performance of a contract revisited: a case for the theory of characteristic performance in EU civil procedure' (2022) 18 *Journal of Private International Law* 266.

[246] Deborah Davis Boykin, 'Survey of E-Contracting Cases: Browsewrap, Clickwrap, and Modified Clickwrap Agreements' (2012) 68 Bus Law 257; Clifford Fisher, Samuel J. Calderson, Jayden Mougin & Matthew J. Radford, 'Evolution of Clickwrap & Browsewrap Contracts' (2022) 48 Rutgers Computer & Tech LJ 147.

[247] World Economic Forum, *Europe Digital Sovereignty* (January 2025), https://www.weforum.org/stories/2025/01/europe-digital-sovereignty/ accessed 15 January 2025.

[248] For example, the electronic signatures and the electronic contract, they are not the have the effect in rem.

[249] This principle requires courts to evaluate various connecting factors (e.g., place of contracting, performance, domicile of parties, or location of subject matter) to identify the jurisdiction most intimately linked to the legal relationship in question. Adrian Briggs, The Conflict of Laws (4th edn, Oxford University

Thirdly, functional equivalence has limitations in addressing the deeper issues arising from the fragmentation of dispute resolution mechanisms.

Specifically, it fails to bridge the disconnect between procedural and substantive law and cannot resolve challenges related to evidence rules, enforcement of judgments, the limitations of technology-dependent solutions, and the fragmentation of dispute resolution mechanisms. Issues such as admissibility standards for blockchain data, the cross-border enforcement of decentralised arbitration awards, the lack of transparency in smart contract algorithms, and the conflicts between traditional litigation procedures and emerging dispute resolution mechanisms largely fall beyond the immediate scope of the functional equivalence principle. Interview insights further support this gap: while electronic platforms are technically capable of implementing common standards, without clear judicial recognition courts and arbitral bodies remain hesitant to treat digital records on par with traditional documents.[250] This underlines that functional equivalence, by focusing only on function, leaves unresolved the institutional and procedural dimensions of cross-border disputes.

As we have seen, in private international law, functional equivalence does not always provide a complete solution to questions of legal certainty and may coexist with fragmented outcomes. This fragmentation also appears at the institutional and standardisation level, as the next section will show.

3.4.2 Institutional fragmentation and standardisation difficulties

One further external challenge concerns institutional fragmentation and the difficulties of standardisation. Functional equivalence does not fully resolve the problem that different institutions and jurisdictions adopt various rules and standards, which may create fragmentation instead of coherence.

First, institutional fragmentation is evident in the number of actors involved. International organisations (such as UNCITRAL and UNIDROIT), national legislators (such as the UK ETDA 2023 or Singapore's Electronic Transactions Act), and industry associations (such as BIMCO,

Press 2019) 197–201. Defines the principle as "the legal system most closely connected to the substance of the obligation," emphasizing its role in contractual disputes (p. 199).

[250] Interview with Dr. Hanane Becha, digital trade expert, Vice Chair of UN/CEFACT (21 November 2022).

DCSA, or the FIT Alliance) all issue their own frameworks.[251] These initiatives operate at different normative levels and pursue different objectives: UNCITRAL instruments aim at legal harmonisation, UNIDROIT focuses on private law principles, national legislation varies in scope and speed of adoption, while industry standards are largely contractual and voluntary. However, these instruments are often overlapping, inconsistent, or only partially adopted, leaving businesses facing a patchwork of rules.[252]

Secondly, standardisation difficulties further limit the effectiveness of functional equivalence in practice. Although industry initiatives such as the FIT Alliance seek to promote interoperable standards for electronic bills of lading, adoption remains slow and fragmented.[253] Interview evidence suggests that incompatibility among different electronic bills of lading platforms is a key barrier to widespread use.[254] This does not mean that functional equivalence depends on uniform technical standards as a matter of principle. Rather, it indicates that, in the absence of commonly accepted technical and legal standards, functional equivalence alone is arguably insufficient to ensure consistent recognition across platforms and cross borders.

In this sense, functional equivalence does not overcome institutional and technical fragmentation, it sometimes even reinforces it, since the law avoids prescribing clear definitions or standards. As a result, businesses may be required to navigate multiple systems at once, undermining the legal certainty that functional equivalence was designed to provide.

---

[251] UNCITRAL, *Model Law on Electronic Transferable Records* (2017); UNIDROIT, *UNIDROIT Principles on Digital Assets and Private Law* (2022); Electronic Trade Documents Act 2023 (UK); Electronic Transactions Act 2010 (Singapore, Rev Ed 2011); BIMCO, 'Electronic Bills of Lading Clause' (2021); Digital Container Shipping Association (DCSA), *Standards for Electronic Bills of Lading* (2020); FIT Alliance, 'Joint Statement on Driving Standards for Electronic Bills of Lading' (2022).

[252] See this thesis in Section 3.2.2 and 4.2.

[253] FIT Alliance, 'The Complete Guide to Electronic Bill of Lading Adoption for the Bulk Trades' (FIT Alliance, n.d.) https://www.bimco.org/media/wkzp3cjl/fit-alliance-complete-guide-to-bulk-ebl-adoption.pdf accessed 3 September 2025 (noting that while open-source and interoperable standards have been established, widespread adoption remains limited); FIT Alliance, 'What is Interoperability?' (FIT Alliance eBL Guides) https://www.fit-alliance.org/electronicbilloflading accessed 3 September 2025 (pointing out the lack of cross-platform exchange due to persistent system incompatibilities).

[254] Interview with a third-party electronic bills of lading technology provider (21 October 2022) .

3.5 Conclusion

In conclusion, the analysis reveals that the functional equivalence principle has identifiable limitations, both from an internal angle and the perspective of the current external environment.

Various pathways have been explored in theory and practice to respond to these limitations. Reed, building on the principle of technological neutrality, proposed an alternative usage of the functional equivalence principle, stating that it should serve "as a substantive guideline for the application of existing law and the creation of new law", aiming "to achieve functionally equivalent treatment [outcome]".[255] Hildebrandt and Tielemans argue that functional equivalence can function as a legal design method, as utilized in the GDPR.[256] Andreas Furrer and Luka Müller explore alternative solutions to equivalence.[257] Based on the above context, Chapter 4 will propose a new approach and Chapter 5 will examine whether the new approach can serve as an effective alternative to regulate electronic bills of lading.

[255] Chris Reed, "Online and Offline Equivalence: Aspiration and Achievement," International Journal of Law and Information Technology Vol. 18, Issue 3 (2010): 249 // https://doi.org/10.1093/ijlit/eaq006, p248.
[256] Mireille Hildebrandt, Laura Tielemans, Data protection by design and technology neutral law, Computer Law & Security Review, Volume 29, Issue 5, 2013, Pages 509-521, ISSN 0267-3649, https://doi.org/10.1016/j.clsr.2013.07.004.
[257] Andreas Furrer/Luka Müller, Funktionale Äquivalenz» digitaler Rechtsgeschäfte - Ein tragendes Grundprinzip für die Beurteilung der Rechtsgültigkeit von Rechtsinstituten und Rechtsgeschäften im schweizerischen Recht, published on Jusletter, Juni 18, 2018.

Chapter 4 A Proposed Substantive Approach

4.1 Introduction

In Chapters 2 and 3, we thoroughly examined the functional equivalence method of regulating electronic bills of lading. We traced how it entered legal studies from its historical and theoretical foundations and analysed the reasons behind its prominence in regulating electronic records. Through interviews and empirical evidence, we revealed its limitations, showing that it fails to provide a coherent and consistent framework for electronic bills of lading.[258]

This chapter proposes a new substantive approach to regulating electronic records. Unlike functional equivalence and technology-neutrality, anchored in paper-based analogies, the substantive approach takes electronic records as its starting point and regulatory focus. By treating electronic bills of lading as a category of electronic records, the substantive approach seeks to establish a systematic and standardized framework that can effectively address the challenges identified in the previous chapters.

The substantive approach is structured around four dimensions: definition, control, proprietary rights, and custody. Each dimension identifies the conceptual foundation of the issue and sets out a substantive regulatory response, moving from conceptual foundations to concrete proposals. In this way, Chapter 4 proposes a systematic framework that lays the foundation for Chapter 5, where its applicability will be tested against the specific context of electronic bills of lading.

4.2 Definition

This section examines the ways in which “digital assets” and “electronic records” have been conceptualised in existing legal and academic discussion. It demonstrates that current definitions and classifications remain fragmented, reflecting a lack of conceptual consensus in both theory and practice. For the purposes of this thesis, “electronic records” are used as a

[258] See this thesis in Chapter 2 and 3.

broad category, within which the term "digital asset" refers to what is described in Chapter 4 as a "controlled electronic record." Against this background, this section sets out the approach adopted in this thesis, which develops the concept of controlled electronic records by drawing on, and adapting, elements of UNIDROIT's framework to the specific context of electronic bills of lading.

4.2.1 Definition of digital assets

To develop the substantive approach proposed in this thesis, this section first examines how digital assets have been defined. Despite their significance, the concept remains contested and inconsistently defined across scholarship, judicial decisions, and legislation. This uncertainty has produced conceptual ambiguity, thereby underscoring the need for a more systematic framework.

Digital assets, popularly discussed, often appear elusive and contested, especially when combined with tokens and cryptocurrencies, Big Data, domain names, social media accounts, and virtual gaming property and digital content, information stored on Web resources (texts, video and audio files, graphic images, animations, and so on.[259] Not only do digital assets appear somewhat complex to laypeople, but they are also perceived as such by the academic and judicial communities. According to Yakubov Akhtam, the term 'digital asset' has been only rarely used in academic works, and where it does appear, it often lacks consistent definition.[260] Kharitonova J. similarly notes that "there is no unified approach to the understanding of digital assets in the current literature."[261] This scholarly uncertainty provides an important backdrop for the substantive approach advanced in this chapter.

Regarding the courts' stance, taking the UK courts as an example: the legal status of digital assets as intangible property remains unsettled. In *Your Response v. Datateam Business*

[259] Kharitonova J. (2021). Digital Assets and Digital Inheritance. Law & Digital Technologies. vol. 1, no. 1, pp.19-26 DOI: 10.18254/S123456780015732-6, p20.
[260] Yakubov Akhtam. (2022). DOCTRINAL APPROACHES AND INTERNATIONAL EXPERIENCE IN UNDERSTANDING THE DIGITAL ASSET. The American Journal of Political Science Law and Criminology, 4(10), 34–42. https://doi.org/10.37547/tajpslc/Volume04Issue10-05, p35.
[261] Kharitonova J. (2021). Digital Assets and Digital Inheritance. Law & Digital Technologies. vol. 1, no. 1, pp.19-26 DOI: 10.18254/S123456780015732-6, p19.

Media,[262] the Court of Appeal held that "the data manager was not entitled to exercise a common law lien on the database".[263] The Court could not "see any basis on which the extension of the right to exercise a lien over intangible property could rationally be confined to electronic databases"[264] and was "... not persuaded that it is necessary or desirable to extend this form of self-help, based on control rather than possession, to intangible property generally."[265] However, Moore-Bick LJ, giving the leading judgment, also observed that if the parties had wished to extend the right to self-help beyond what the law provided, they could have done so in their contract.[266] This judgment highlights the limits of adapting traditional property doctrines to the digital environment.

In *Fairstar Heavy Transport NV v Adkins*,[267] the Court of Appeal noted at para. 30 that the judge at first instance considered the "preponderance of authority" to point strongly against recognising any proprietary right in the content of information, including emails. The Court of Appeal itself ultimately declined to recognise the existence of any proprietary right in the content of information as such.[268] In *Computer Associates UK Ltd v. The Software Incubator Ltd*,[269] echoing *Your Response v. Datateam Business Media*, Gloster LJ restated that a database stored electronically gave rise to intangible property which does not amount to "goods" and, therefore, "could not be the subject of a common law possessory lien."[270] These decisions show that courts are generally hesitant to treat digital assets as property, even though their economic importance is growing.

However, despite this reluctance, senior policymakers, including the Master of Rolles, have emphasized the substantial economic value of digital assets, reinforcing the urgency developing a coherent legal approach.[271]

---

[262] [2015] QB 41, [2014] EWCA Civ 281, [2014] 4 All ER 928, [2014] 3 WLR 887, [2014] WLR(D) 131, [2014] 2 All ER (Comm) 899, [2014] CP Rep 31, [2015] 1 QB 41, [32].
[263] Ibid., [33].
[264] Ibid., [32].
[265] Ibid.
[266] Ibid., [34].
[267] [2013] EWCA Civ 886, [2014] FSR 8, [2014] BUS LR D2, [2013] 2 CLC 272, [2014] Bus LR D2, [2014] EMLR 12.
[268] Ibid., at [30].
[269] [2018] EWCA Civ 518, [2018] 2 All ER (Comm) 398, [2019] Bus LR 522, [2018] 1 Lloyd's Rep 613.
[270] Ibid., at [32].
[271] Sir Geoffrey Vos, Master of the Rolls: The Economic Value of English Law in Relation to DLT and Digital Assets: Digital Assets Symposium [2022] UKSpeech AJUWY (25 July 2022), para. 5-6.
URL: http://www.bailii.org/uk/other/speeches/2022/AJUWY.html, Cite as: [2022] UKSpeech AJUWY

As mentioned, "'Digital asset' is a broad term without a strict definition."[272] According to Black's Law Dictionary, "digital asset" (1984) is defined as "An electronic record in which someone has a right or interest. Examples include e-mails, text messages, photos, digital music, digital videos, electronic documents, social-media accounts, online accounts, and gaming avatars."[273] It is evident that these definitions are rather broad and do not offer more detailed classifications. They highlight that although broad definitions capture a wide range of cases, they may also blur the distinct regulatory issues that need to be addressed.

Scholars have gone further in defining digital assets, overall: the definitions and scope of digital assets have evolved significantly over time, transitioning from encompassing purely intangible properties to including metadata as part of digital assets. This broadening reflects the diverse nature and expanding scope of what is considered a digital asset today. The former categorisation is notably represented by Cahn. Her detailed classification divides digital assets into four categories: personal, social media, financial, and business assets.[274] This framework has been endorsed and used by scholars like Perrone.[275] Expanding on the idea, S Haworth offers another notable classification of digital assets into four types: (1) Access Information, (2) Tangible Digital Assets, (3) Intangible Digital Assets, and (4) Metadata.[276] She believes Tangible Digital Assets can be converted into physical assets, while Intangible Digital Assets are more complex than tangible ones.[277] She explains that Metadata includes data about the document or website's history, location tags, hidden text, and more.[278] This classification is crucial for the research in this chapter because, according to Haworth's categorisation, electronic bills of

---

[272] Michels, Johan David, and Christopher Millard, 'Digital Assets in Clouds', in Christopher Millard (ed.), Cloud Computing Law, 2nd edn (Oxford, 2021; online edn, Oxford Academic, 17 June 2021), https://doi-org.soton.idm.oclc.org/10.1093/oso/9780198716662.003.0006, accessed 18 Feb. 2024, p178.
[273] Garner, Bryan A., and Henry Campbell Black. Black's Law Dictionary. 2019.
Black's Law Dictionary, 11th edition, p148.
[274] Cahn, Naomi R., Postmortem Life On-Line (July 1, 2011). Probate & Property, Vol. 25, No. 4, p. 36, 2011, GWU Legal Studies Research Paper No. 2012-25, GWU Law School Public Law Research Paper No. 2012-25, Available at SSRN: https://ssrn.com/abstract=2026628, p36-37.
[275] Maria Perrone, What Happens When We Die: Estate Planning of Digital Assets, 21 CommLaw Conspectus 185 (2012). Available at: https://scholarship.law.edu/commlaw/vol21/iss1/7.
[276] S Haworth 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 U. Miami L. Rev. 535, 538-539.
[277] In that article, Haworth does not provide a formal definition of "intangible digital assets". Instead, she uses the term descriptively to refer to non-economic digital traces left online, such as likes, comments, and social media profiles. Her focus is on the posthumous management of such online content, rather than on defining these materials as legal property.
[278] Ibid., also see Joseph Capobianco & Gabrielle R. Schaich-Fardella, Electronic Age Changes in Legal Practice, Which No Attorney Can Ignore, 84 N.Y. ST. B.J. 30, 31 (2012).

lading can be classified as tangible digital assets. This linkage illustrates how definitional clarity can directly support the substantive approach later proposed in this chapter.

Additionally, some scholars categorize from another perspective: broadly without any detailed classification: such as Ibáñez et al., who defines "a digital asset as anything that can be stored and transmitted electronically (using a computer) that can be owned and thus, can have ownership and usage rights associated with it".[279] One scholar offers as a definition: "Digital assets are comprised of abstractions of ones and zeroes, which exclude them from being a prototypical image of property".[280] Another defines digital assets as "information, stored electronically, that is uniquely owned and can be transferred by individuals."[281] Overall, as previously mentioned, there is no unified definition of digital assets.

This survey of definitions and classifications highlights the persistent uncertainty surrounding the very core and meaning of digital assets. Legislative bodies, recognizing the need for clarity, were among the first to act to bridge this gap. This point is well illustrated in the Master of Rolls' speech entitled "The Economic Value of English Law in Relation to DLT and Digital Assets", where he observes: "There may, however, be legal impediments that can only be cleared away by legislation".[282] He refers to the Law Commission's report from March 15, 2022, which was accompanied by an economically drafted seven-clause Electronic Trade Documents Bill, now the Electronic Trade Documents Act 2023, as a good example of how legal impediments can be cleared. This is particularly relevant to the subject of this thesis: electronic bills of lading.

The relationship between electronic bills of lading and digital assets will be examined further in Section 5.2. At this stage, however, the focus shifts to legislative and regulatory approaches, which provide important context for the substantive framework advanced in this chapter. The detailed testing of that framework will be carried out in Chapter 5.

---

[279] Ibáñez, Luis-Daniel Ibáñez, Michał R. Hoffman and Taufiq Choudhr. 2018. Blockchains and Digital Assets. https://www.eublockchainforum.eu/sites/default/files/research-paper/blockchains_and_digital_assets_june_version.pdf.
[280] 9J Marinotti, 'Tangibility as Technology' (2021) 37 Georgia State University Law Review 671, 678.
[281] Matthew Johnson, 'Lex Situs v Lex Digitalis: Predictions on the Jurisdiction Problem of Digital Asset Transactions' (2023) 6 De Lege Ferenda 55, 56.
[282] Sir Geoffrey Vos, Master of the Rolls: The Economic Value of English Law in Relation to DLT and Digital Assets: Digital Assets Symposium [2022] UKSpeech AJUWY (25 July 2022), para. 11.

The UK Law Commission initiated a project on digital assets in 2021 and published its final report in June 2023.[283] In the report, the definition of digital assets is given as "Any asset that is represented digitally or electronically. There are many different types of digital assets, not all of which will be capable of being things to which personal property rights can relate. In this report, we use the term in a broad sense."[284]

In order to clarify what kinds of digital assets may attract property rights, digital assets are further classified: in England and Wales, the law traditionally recognizes two main types of personal property rights: rights relating to things in possession (tangible things), and rights relating to things in action (legal rights or claims enforceable by action).[285] For digital assets that do not fit into these two categories, the Law Commission introduced the concept of The third category of things, considering "The third category of things includes a certain type of asset, namely crypto-tokens".[286]

Further criteria for the third category of things to which personal property rights can relate have been proposed. Thus they should " (1) be composed of data represented in an electronic medium, including in the form of computer code, electronic, digital or analogue signals; (2) exist independently of persons and exist independently of the legal system; and (3) be rivalrous."[287] Since digital assets are intangible and cannot be physically possessed, this classification points out a gap in regulation where current laws are not adequate.

Before addressing this third category, it is necessary to recall why tangibility matters in English law. Tangibility is not one of the criteria proposed by the Law Commission, but rather a traditional requirement in the common law category of things in possession.[288] It therefore operates more as a background assumption of the older classification system, rather than as an independent criterion within the Law Commission's reformulation. As the Law Commission

---

[283] Law Commission, 'Digital Assets' <https://lawcom.gov.uk/project/digital-assets/> accessed 14 January 2024.
[284] Law Commission, 'Digital Assets' <https://lawcom.gov.uk/project/digital-assets/> accessed 14 January 2024, page ix.
[285] Ibid., para. 3.1.
[286] Ibid., para. 2.52.
[287] Ibid., para. 3.59. For a detailed discussion of the concept of rivalrousness, see Section 5.4.2.3(g) below.
[288] Law Commission, *Electronic Trade Documents* (Law Com No 412, 2023) para. 5.9, 5.20, 5.26-5.75; Roy Goode and Ewan McKendrick, Goode and McKendrick on Commercial Law (6th edn, Penguin 2021) ch 2, 57, 62.

itself has observed, however, "the concept of tangibility is not, nor should it be a necessary criterion for the law's recognition of suitability for possession."[289]

This raises the question: does the absence of tangibility mean that all intangible things cannot be possessed? The answer is not necessarily. The Law Commission, in the Electronic Trade Document project, has recommended electronic trade documents should be recognised as capable of possession. Parliament gave effect to this in the Electronic Trade Documents Act 2023.[290]

So, what differentiates the third category of things from electronic trade documents?[291] The difference is that electronic trade documents have their offline physical counterparts, "seeking to replicate the legal functionality of a specific form of tangible thing in the same way that electronic trade documents attempt to replicate exactly the legal functionality of paper trade documents."[292] Meanwhile, this third category of things does not have physical counterparts. In other words, the Law Commission considers that assets without physical counterparts cannot be subjects of possession.

To put this in perspective, using the categorisation by S Haworth that we analysed earlier,[293] electronic trade documents fall under tangible digital assets, while "the third category of things belongs to intangible digital assets. This distinction reflects the principle of functional equivalence, where the separation between the online and offline worlds is blurred: assets with offline physical counterparts and those that exist purely online differ significantly in terms of possession, undoubtedly leading to adverse legal outcomes for the same entities, as set out in greater detail in Chapters 2 and 3 of this thesis.

However, ambiguities remain in the way digital assets are conceptualised. For example, in its Report on Electronic Trade Documents, the UK Law Commission defines digital assets broadly

---

[289] Law Commission, 'Digital Assets' <https://lawcom.gov.uk/project/digital-assets/> accessed 14 January 2024, para. 3.22.
[290] Electronic Trade Documents Act 2023, s 3(1) https://www.legislation.gov.uk/ukpga/2023/38/section/3.
[291] This thesis recognises that electronic bills of lading take different forms, and that certain types may fall within the Law Commission's third category of things. A more detailed discussion of this distinction is provided in Section 5.2.
[292] Law Commission, 'Digital Assets' <https://lawcom.gov.uk/project/digital-assets/> accessed 14 January 2024, para. 3.26.
[293] See this thesis in two pages earlier.

as "assets that are represented digitally or electronically, including crypto assets", while noting that "not all digital assets are capable of attracting personal property rights".[294] They include crypto assets within digital assets, which reflects a degree of tension between, on the one hand, digital assets are identified by their digital or electronic form, while on the other hand, their legal treatment remains constrained by functional considerations, in particular whether they are capable of attracting personal property rights. The aforementioned explanations indirectly highlight the ongoing confusion surrounding the concept and classification of digital assets.

These inconsistencies in the UK approach make it particularly useful to compare with other jurisdictions and institutions. The US approach, similar to UNCITRAL, as well as UNIDROIT, has long relied on the concept of control over intangibles as the functional equivalent of possession of tangibles. By contrast, English law traditionally linked possession exclusively to tangibility, and it was only with the Electronic Trade Documents Act 2023 that control was expressly incorporated as the means by which an electronic trade document may be possessed.[295] Against this background, the approaches adopted by the United States and UNIDROIT merit closer examination.

However, US reforms arguably do not provide a single, comprehensive framework. Instead, they regulate different categories of digital assets through separate legislative modules, each with its own definitional scope and control requirements, reflecting a piecemeal yet pragmatic strategy. Revised UCC Article 12 defines a "controllable electronic record" (CER) in general as a record stored in an electronic medium that can be subject to control as per 12-105.[296] However, this definition excludes certain items, such as controllable accounts, payment intangibles, deposit accounts, electronic copies of records evidencing chattel paper, electronic documents of title, electronic money, investment property. Transferable records, including electronic documents of title, are instead continuing to be governed by Article 7, under a separate and

[294] Report from the UK Law Commission for Electronic Trade Documents, page ix.
[295] Electronic Trade Documents Act 2023, s 2 https://www.legislation.gov.uk/ukpga/2023/38/section/2 accessed 14 September 2025.
[296] Neb. U.C.C. Section 12-105: Control of controllable electronic record. https://1.next.westlaw.com/Document/NE3BEFBB02BEA11EEB845A1520E18825C/View/FullText.html, accessed on 1 Nov. 2023.

distinct control regime.[297] The UCC has further classified electronic records into various categories, including those involving documents of title and electronic money, along with controllable electronic records, which partially overlap with UNIDROIT but carry distinct implications. In all, the concept of control is applied by the US to both purely digital assets online and types of electronic records that have physical counterparts offline.

For the former category of purely digital assets, the 2022 Amendments to the Uniform Commercial Code (UCC) update and modernize the UCC to address emerging technologies. Article 12 now explicitly covers new asset types such as virtual currencies, electronic money, and non-fungible tokens, while modifications to Article 9 address security interests in such assets. In addition, these amendments update terminology to account for digital records, electronic signatures, and distributed ledger technology, provide rules for electronic negotiable instruments, and clarify the rules on hybrid transactions involving both goods and services.[298] A controllable electronic record (CER) is a record stored in an electronic medium that can be subjected to control under 12-105. As noted, this definition is limited, excluding categories such as controllable accounts, payment intangibles, deposit accounts, electronic copies of chattel paper, electronic documents of title, electronic money, investment property, and transferable records.[299]

Among the excluded categories, the most significant for present purposes is the electronic bill of lading, which is the central subject of this thesis. The Uniform Commercial Code (UCC) from 1952 had its Article 7 revised in 2003 to include electronic bills of lading. This meant the official recognition of the status of electronic bills of lading.[300] The revision included the provisions from the Uniform Electronic Transactions Act (UETA) issued in 1999 regarding the legal equivalence of electronic records and signatures with paper documents and handwritten

---

[297] UNIF. COM. CODE & EMERGING TECHS. (UNIF. L. COMM'N & AM. L. INST. 2022), https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=67fe571b-e8ad-caf8-; US Legislation, The Uniform Commercial Code, § 7-106. 4530-d8b59bdca805&forceDialog=1; ULC Wraps Up 131st Annual Meeting: Five New Acts Approved, https://www.uniformlaws.org/discussion/ulc-wraps, 12-102(a)(1), accessed 30 July 2023.
[298] Ibid.
[299] Ibid., 12-102(a)(1).
[300] Miriam Goldby and Weishi Yang: 'Solving the Possession Problem: An Examination of the Law Commission's Proposal on Electronic Trade Documents' [2021] Lloyd's Maritime and Commercial Law Quarterly 605-627, p611.

signatures.[301] Related to electronic bills of lading, the control of electronic chattel paper in UCC Section 9-105 was also revised.

According to UCC § 7-106: Control of Electronic Document of Title: "(a) A person has control of an electronic document of title if a system employed for evidencing the transfer of interests in the electronic document reliably establishes that person as the person to which the electronic document was issued or transferred."[302] These amendments established the concept of control over electronic records, which is key to determining the legal status of electronic documents.

Thus, while electronic bills of lading are digital records that operate through control, they are not treated under Article 12 but left within Article 7. This shows how classification and regulation of digital assets are assembled module by module, rather than through a single, comprehensive definition.

Academic commentary reflects a similar approach. For example, Goldby summarized the definition of document of title as a record with two layers of requirements.[303] She explains, a document of title combines a contractual function (evidencing the contract of carriage and the right to demand delivery) and a proprietary function (enabling the transfer of rights in goods).[304] In the electronic environment, these functions can be preserved if exclusive control replaces possession. This analysis demonstrates how scholars, too, address the issue through targeted adjustments to specific instruments rather than through a coherent theory of digital assets. In sum, English law separates electronic records into two categories: electronic trade documents

---

[301] US Legislation, The Uniform Electronic Transactions Act (UETA), 21 UETA § 16 (b); 15 U.S.C. § 7021 (b). 22 UETA Section 16, Official Comment 3. http://euro.ecom.cmu.edu/program/law/08-732/Transactions/ueta.pdf, assessed on 26.Feb. 2023.

[302] US Legislation, The Uniform Commercial Code, § 7-106.

[303] Goldby, Miriam A., The Electronic Trade Documents Act 2023 and the 2003 Amendments to Article 7 of the Uniform Commercial Code: Do They Do the Same Thing? (July 21, 2023). Available at SSRN: https://ssrn.com/abstract=4517265 or http://dx.doi.org/10.2139/ssrn.4517265, p2-3.
See also UCC §1-201 (16) "Document of title" includes bill of lading, dock warrant, dock receipt, warehouse receipt or order for the delivery of goods, and also any other document which in the regular course of business or financing is treated as adequately evidencing that the person in possession of it is entitled to receive, hold, and dispose of the document and the goods it covers. To be a document of title, a document must purport to be issued by or addressed to a bailee and purport to cover goods in the bailee's possession which are either identified or are fungible portions of an identified mass.

[304] Goldby, Miriam A., The Electronic Trade Documents Act 2023 and the 2003 Amendments to Article 7 of the Uniform Commercial Code: Do They Do the Same Thing? (July 21, 2023). Available at SSRN: https://ssrn.com/abstract=4517265 or http://dx.doi.org/10.2139/ssrn.4517265, p2-3.

and digital assets, while U.S. law distinguishes between controllable electronic records and electronic documents of title, such as electronic bills of lading.

Unlike the modular approach of the UCC, UNIDROIT has advanced a more uniform treatment of digital assets through its Principles on Digital Assets and Private Law.[305] These principles adopt control as the key functional equivalent of possession, but they are drafted at a higher level of generality, covering both purely digital assets and records with physical counterparts. This broader approach provides a useful contrast with the UCC's fragmented strategy, and it more closely anticipates the substantive approach proposed in this chapter. As will be shown in Section 4.2.2, UNIDROIT's definition of electronic records and digital assets forms the starting point for the substantive approach developed in this thesis, though its focus on digital assets generally requires some adaptation when applied specifically to electronic trade documents such as bills of lading.

These examples highlight the central problem: the treatment of digital assets remains fragmented, with no unified definition. This fragmentation underscores the need for a coherent and systematic approach. Section 4.2.2 therefore sets out the proposed substantive approach to definition: it advances a working definition of electronic records (situating electronic bills of lading within it), specifies its scope and criteria, and explains how this definition will anchor the subsequent dimensions: control, proprietary rights, and custody, as well as the application in Chapter 5.

4.2.2 Proposed substantive approach: definition

After comparing different international instruments and their respective definitions of electronic records, this thesis finds that the UNIDROIT approach emerges arguably as the most suitable for the purposes of this thesis. As discussed in Section 4.2.1, UNIDROIT's Principles provide a more uniform treatment of digital assets than the fragmented approaches of the UCC or English law, making them a useful starting point. In particular, its definition of controlled electronic records aligns most closely with the conceptual framework developed earlier. Accordingly, this thesis explicitly adopts UNIDROIT's formulation as the starting point of its

[305] UNIDROIT, Principles on Digital Assets and Private Law (January 2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, Article 1, accessed 10 Jan 2025.

substantive approach. It should be noted, however, that while UNIDROIT's Principles provide the definitional foundation, the substantive approach in this thesis develops beyond them in important respects, especially by tailoring the framework to electronic bills of lading.

Therefore, this thesis adopts the following definition from UNIDROIT:

> "'Electronic record' means information which is (i) stored in an electronic medium and (ii) capable of being retrieved.
>
> (2) 'Digital asset' means an electronic record which is capable of being subject to control."[306]

Controlled electronic records are distinguished from other digital assets based on their categorisation as assets subject to control, as elaborated in Principle 2(2).[307] UNIDROIT further clarifies that control refers to a digital asset wherein a person can establish that they possess (i) exclusive ability to transfer control of the digital asset to another person, (ii) exclusive ability to prevent others from obtaining substantial benefits from the digital asset, and (iii) the ability to obtain substantial benefits from the digital asset.[308]

This substantive approach deliberately departs from the mainstream methods based on the principles of functional equivalence and technology neutrality.[309] It also does not follow the approach in English law, which divides general electronic records into two separate categories: electronic trade documents and digital assets, and regulates them differently. Nor does it adopt the classification under the U.S. UCC, which separates controllable electronic records from documents of title, such as electronic bills of lading, and applies different approaches to each.

In other words, the thesis proposes a substantive approach by incorporating all controlled electronic records and formulating a set of substantive rules based on their characteristics. The

---

[306] UNIDROIT, Principles on Digital Assets and Private Law (January 2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, Article 1, accessed 10 Jan 2025.
[307] Ibid., Principle 2(2).
[308] Draft UNIDROIT Principles on Digital Assets and Private Law, Draft-Principles-and-Commentary-Public-Consultation.pdf (unidroit.org), Principle 2 Definitions, accessed 31 July 2023, p5, para. 11. "Control" is briefly mentioned here, but it will be analysed in great detail in Section 4.3.
[309] See this thesis in Section 2.3.2.

objective of this substantive approach is not digital assets in the abstract, but the controlled electronic records.

However, the substantive approach in this thesis differs significantly from that of UNIDROIT. UNIDROIT's Principles on Digital Assets are not aimed specifically at negotiable documents such as bills of lading, and go so far as to mention that other principles may be applicable to negotiable documents in place of UNIDROIT's approach.[310] According to the foreword of the UNIDROIT project, its approach is not primarily aimed at trade documents but rather at digital assets, which are proprietary in nature.[311] It focuses on private international law, facilitating the efficient global circulation of digital assets and is intended to apply to areas such as insolvency and cross-border secured transactions.[312]

This cautious design reflects the limited ambition of the Principles: they only cover areas where the nature and characteristics of digital assets require clarification, or where ad hoc solutions are needed. The majority of private law matters are left to domestic law.[313] Even where reference is made to other law, the Commentary offers substantial guidance and legal analysis, which is almost as important as the blackletter Principles themselves.[314]

UNIDROIT's approach to the relationship between negotiable trade documents and negotiable documents of title is addressed to some extent in its rules. Paragraph 4.22 provides that states may enact specific legislation granting digital assets the same legal status as traditional paper-based transferable instruments (such as negotiable instruments, documents of title).[315] In particular, if a digital asset meets the minimum technological standards prescribed by law - such as ensuring exclusive control through blockchain and maintaining the immutability of rights - its transfer (e.g., via blockchain transactions) would be legally equivalent to the physical

---

[310] UNIDROIT, Principles on Digital Assets and Private Law (January 2024), para. 3.17, 4.22, 8.2, 14.8.
[311] Ibid., Foreword.
[312] This explains, naturally, the prudent approach adopted by the Principles, which only cover those areas where the nature and characteristics of digital assets required legal clarification or where ad hoc solutions were demanded. The rest – the majority – of private law matters are left to domestic law, although, even where reference is made to "other law" (as it is called), helpful guidance and legal analysis is provided in the Commentary, a part of the instrument which is almost as important as the blackletter Principles themselves.
[313] UNIDROIT, Principles on Digital Assets and Private Law (January 2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, Foreword, page i.
[314] Ibid.
[315] Ibid., para. 4.22.

delivery of a paper-based instrument. The transferee would consequently be entitled to assert rights over monetary claims (such as payment rights under a digital bill of exchange) or ownership of goods (such as delivery rights under a digital warehouse receipt). In essence, such legislation 'deems' digital transactions to be traditional legal acts, thereby preserving existing legal safeguards such as negotiability while ensuring the credibility of digital assets through technological standards. This approach bridges the gap between technological forms and legal frameworks, facilitating the global circulation of digital assets while accommodating different national definitions of traditional instruments.

In this sense, the principle of functional equivalence serves as a mechanism for equating certain digital assets with traditional paper-based transferable instruments. In other words, UNIDROIT's rules adopt a flexible stance toward digital assets that have an offline equivalent but ultimately remain constrained by traditional regulatory frameworks.

Further, UNIDROIT's rules do not conflict with functional equivalence but rather exist in a complementary relationship as general and specific rules. However, this limits the scope of issues they can resolve - digital assets gain recognition, but without a strict classification system, the treatment of different types of digital assets remains unclear. If UNCITRAL's functional equivalence principle is overly reliant on offline frameworks, UNIDROIT's approach, in contrast, is arguably overly broad.

At the same time, UNIDROIT has neither addressed nor responded to potential conflicts with other international instruments. As noted above, UNIDROIT's definition of digital assets largely overlaps with UNCITRAL's definition of electronic transferable records. The Draft defines an electronic record as: "...information which is (i) stored in an electronic medium and (ii) capable of being retrieved; 'Digital asset' means an electronic record which is capable of being subject to control,"[316] a definition that is "consistent with the definition of the term 'electronic record' in Article 2 of the UNCITRAL Model Law on Transferable Records and similar definitions in various national laws."[317] However, the relationship between these two initiatives has not been clearly articulated. Therefore, Section 4.2 focuses on resolving the divergence between these

[316] UNIDROIT, 'Draft UNIDROIT Principles on Digital Assets and Private Law' (unidroit.org) https://www.unidroit.org/wp-content/uploads/2021/07/Draft-Principles-and-Commentary-Public-Consultation.pdf accessed 31 July 2023.
[317] Ibid., p9, 2.

frameworks, despite their similar definitions, by addressing the classification of digital assets.[318] The substantive approach in this thesis therefore seeks to address this gap by clarifying the classification of digital assets and situating electronic trade documents firmly within the category of controlled electronic records.

In essence, as shown in Chapter 2, MLETR strives to achieve functional equivalence between the online and offline world by carefully considering the inherent distinctions between the two media and adapting regulations accordingly.[319] On the other hand, UNIDROIT concentrates on developing comprehensive legal frameworks for digital assets, that is, electronic records which are capable of being subject to control, emphasizing substantive rights and other legal aspects. UNIDROIT's approach departs from the comprehensive use of functional equivalence, as seen in MLETR, to distinguish between the online and offline worlds. Instead, it directly incorporates the relevant electronic records into controlled electronic records and regulates them from a substantive perspective.

This substantive orientation is particularly evident in UNIDROIT's treatment of property law. As noted by the UK Law Commission, "the Cloud Legal Project also said that the UNIDROIT Working Group concluded that password protected Word and Excel files fall within the definition of controllable "electronic record" in the UNIDROIT Principles, meaning that they are, under those principles, things to which personal property rights can relate."[320]

Compared with the approaches adopted by the United States and the UK Law Commission, we can see that in UCC, digital assets as defined by UNIDROIT are categorized into two types: one is controllable electronic records, and the other is documents of title, like electronic bills of lading, which are excluded under UCC 12-102(a)(1) and regulated separately. In both cases, they are defined by control, just like with UNIDROIT. The UK, by contrast, extends the traditional notion of possession to electronic trade documents. While the concept of control is employed in the Electronic Trade Documents Act 2023, it functions merely as the means of establishing

[318] See this thesis in Section 4.2.
[319] See this thesis in Section 2.3.
[320] UK Law Commission final report, 4.86 and footnote 361: UNIDROIT Principles also say that "Principles law may have no material impact or utility for such assets": UNIDROIT Working Group, UNIDROIT Principles on Digital Assets and Private Law (2023) p 19, para. 2.17.

possession under the requirement of the things in possession, rather than being emphasised as an autonomous concept as in the approaches of the US and UNIDROIT.[321]

In summary, neither at the international nor the domestic level does there seem to be a clear resolution on what exactly constitutes a digital asset. The substantive approach of this thesis seeks to overcome this ambiguity by distinguishing different types of controlled electronic records and, more importantly, by clarifying how electronic bills of lading fit within this framework. Based on this classification, it further examines the frameworks applicable to each type, with a particular focus on the regulation of electronic bills of lading from various perspectives.

Accordingly, this thesis defines a controlled electronic record as all the information that is (i) stored in an electronic medium, (ii) capable of being retrieved, and (iii) capable of being the subject of control. No category of electronic record shall be excluded from this scope, provided that the requirements of control are met.

The distinctive feature of this substantive approach is the explicit inclusion of electronic bills of lading within this category, thereby ensuring that the instruments most vulnerable to the limitations of functional equivalence are brought within the scope of a coherent and substantive regulatory framework.

4.3 Control

As set out in Section 4.2, international instruments typically address the issue in terms of digital assets. In the context of this thesis, however, the notion of digital assets corresponds, in substance, to what this chapter refers to as controlled electronic records. This chapter adopts controlled electronic records as the object of regulation, defined as information that is stored, retrievable, and capable of being subject to control. This provides a more precise framework for analysis. The questions then arise: How are such records held? This is a prerequisite for clarifying the rights associated with them.

To answer this question, one might start with how tangible things are held. For instance, in determining A's rights over a cup, three scenarios can be identified: (a) A may possess the cup

[321] UK, Electronic Trade Documents Act 2023.

directly; (b) A may transfer the possession of the cup to B, constituting indirect possession, with B holding the cup on A's behalf; (c) A may transfer his possession and ownership to someone else.

This three-part structure also provides the roadmap for the following discussion. Section 4.3.1 examines (a) direct possession (control), starting with tangible things and then tracing how the idea of control over controlled electronic records has developed in scholarship and case law. Section 4.3.2 proposes a substantive approach to controlled electronic records from the control perspective. Section 4.4 then addresses (c) the transfer of possession and ownership, while Section 4.5 will examine (b) custody as a form of indirect possession.

4.3.1 Control of digital assets

Since controlled electronic records are intangible, possession in the traditional sense does not apply. Instead, legal frameworks such as the MLETR, UCC, and UETA use the concept of control as a functional equivalent. This section examines the historical development of record control, scholarly and judicial perspectives, and the evolution of UK law, particularly with the Electronic Trade Documents Act 2023.

To discuss the control of such records, we will start with possession. Thayer cites Savigny's observation that "Possession is that relation between a subject matter and man which intimates that the man has the animus domini and that he is also able to put it into execution,"[322] though Goode observes no agreed terminology as to the various forms of possession.[323] Goode also emphasizes that the strength of that right depends on his title; the quantum of the right, and on the capacity in which he holds the assets.[324] For tangible things, factual possession is a crucial prerequisite for obtaining legal possession. "Possession in fact, with the manifest intent of sole and exclusive dominion, always imports possession in law."[325] In this regard, Sir Frederick Pollock stated that physical control, legal possession, and the right

[322] Albert S. Thayer, 'Possession' (1905) 18 Harv L Rev 196, p197, citing Savigny… [REF].
[323] McKendrick, Ewan, Royston Miles Goode, Royston Miles Goode, and Royston Miles Goode. 2021. Goode and Mckendrick on Commercial Law Sixth edition/ed. London UK: Penguin Books, 2.40.
[324] Ibid.
[325] F Pollock and R S Wright, An Essay on Possession in the Common Law (Littleton, 1888), 20.

to possess or to have legal possession constitute the three aspects of the nature of possession.[326]

The same principle applies to controlled electronic records, which require this exclusive control to ensure physical possession of tangible things.

How to achieve possession of electronic records becomes a critical issue. Many initiatives have explored this issue. For example, the Rotterdam Rules equate the 'negotiable transferable record' with its paper equivalent, but they do not explain how those possession-related functions are replicated, transformed, or replaced in an electronic environment.[327] Instead, they shift the focus directly to 'exclusive control' as the ultimate solution.[328] As Alba concludes in his article: the notion of exclusive control in the Rotterdam Rules is the ultimate solution on the journey in search of an equivalent to possession.[329] This illustrates how international instruments often bypass the conceptual difficulties of possession by directly shifting the focus to control.

Both the MLETR and the UCC rely on exclusive control as the means to realize the functional equivalence to the electronic records.[330] UETA includes the concept of control, as it clarifies that "Under Section 16 acquisition of "control" over an electronic record serves as a substitute for "possession" in the paper analog."[331] According to the UETA, in the digital space, the concept of 'control' expands past the possession of tangible things: control acts as a functional equivalent to the delivery, endorsement, and possession when it comes to negotiable

---

[326] Ibid., 26.
[327] UNCITRAL, *United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea*, ch 1, art 1, para. 19, <https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/rotterdam-rules-e.pdf> accessed 25 May 2022.
"Negotiable electronic transport record" means an electronic transport record:
(a) That indicates, by wording such as "to order", or "negotiable", or other appropriate wording recognized as having the same effect by the law applicable to the record, that the goods have been consigned to the order of the shipper or to the order of the consignee, and is not explicitly stated as being "non-negotiable" or "not negotiable"; and (b) The use of which meets the requirements of article 9, paragraph 1.
[328] UNCITRAL Consolidated Official Reports on the Preparation of the United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea ("The Rotterdam Rules"), 7.
[329] Manuel Alba, 'The Use of Electronic Records as Collateral in the Rotterdam Rules: Future Solutions for Present Needs' (2009) 14 Unif L Rev 801, 806.
[330] Uniform Commercial Code (U.C.C.) §7-106.
[331] UETA Section 16, Official Comment 3, http://euro.ecom.cmu.edu/program/law/08-732/Transactions/ueta.pdf, assessed on 26.Feb. 2023.

documents of title.[332] Regarding the extent and effect of the MLETR, there is much scholarly debate available in Chapter 2. For example, Alba has argued that all functions of negotiable transport records are provided as same as for the paper bills of lading and the notion of exclusive control performs the same functions as the physical possession of the paper.[333]

The understanding of the court regarding the possession of intangible things is very diverse. In the Singapore case, *Dirak Asia Pte Ltd and another v Chew Hua Kok and another*,[334] the judge discussed the authority of the email user and the email provider, answering whether the defendants have 'possession, custody, and power' over the emails in their email accounts with the email provider. The judge considered that emails stored in the 'cloud', unlike physical printouts or soft copies of emails saved on the computers, cannot be directly possessed by the user; instead, one can only possess the username and password to access the emails in the possession of the email provider.[335] This is identical to the mechanism discussed in 5.2.1.3 regarding Digitalisation bills of lading, where any offline copy is not the original version.

In the US case, *Golden Trade S.r.L. v. Lee Apparel Co.*, the judge explained the actual legal effect of control as when a party has the "practical ability" to access documents, regardless of their legal rights.[336] Similarly, in *Goodman v. Praxair Servs. Inc.*,[337] the case cited the Fed. R. Civ. P. 34(a): "A party need not have possession of documents to be deemed in control of them if the party has the legal right to control or obtain them. And control is not even limited to a legal right to obtain documents,"[338] which means that "control" is treated as a factual concept based on practical ability, rather than on possession. Instead, in *Bank of N.Y. v. Meridien BIAO Bank Tanzania Ltd.*,[339] documents are considered to be under a party's control when that party

---

[332] Ibid.
[333] Manuel Alba, 'Electronic Commerce Provisions in the UNCITRAL Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea' (2009) 44 Tex Int'l L J 387, 409.
[334] See *Dirak Asia Pte Ltd and another v Chew Hua Kok and another* [2013] SGHCR 1 ("*Dirak Asia*").
[335] Ibid., para. 12.
[336] See *Golden Trade, S.r.L. v. Lee Apparel Co.*, 143 F.R.D., 514, 519 (S.D.N.Y. 1992).
[337] Goodman v. Praxair Servs., 632 F. Supp. 2d 494, 2009 U.S. Dist. LEXIS 58263 (United States District Court for the District of Maryland July 7, 2009,
Filed). https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:4WR6-C0Y0-TXFR-1263-00000-00&context=1519360.
[338] Rule 34. Producing Documents, Electronically Stored Information, and Tangible Things, or Entering onto Land, for Inspection and Other Purposes, USCS Fed Rules Civ Proc R 34 (Current through changes received January 23, 2024.). https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:8JD7-1NW2-8T6X-71BR-00000-00&context=1519360.
[339] *Bank of New York v Meridien BIAO Bank Tanzania Ltd* 171 F.R.D. 135 (S.D.N.Y. 1997).

has "the right, authority, or practical ability to obtain the documents from a non-party to the action."[340]

Before the Electronic Trade Documents Act 2023 (ETDA),[341] UK courts did not recognize that electronic documents could be possessed, as demonstrated in *Armstrong DLW GmbH v Winnington Networks Ltd*.[342] Mr. Stephen Morris QC pointed out that "Whilst there has been debate in the context of electronic bills of lading and other electronic documents, the current state of the law has not developed to the point where something which exists in electronic form only is to be equated with a physical thing of which actual possession is possible."[343] In *Computer Associates UK Ltd v. The Software Incubator Ltd*, echoing *Your Response v. Datateam Business Media*,[344] regarding intangible property, the Judge restates that a database stored electronically gave rise to intangible property which does not amount to 'goods' and, therefore, could not be the subject of a common law possessory lien.[345]

The change in attitude in the UK is clearly demonstrated by the project on Digital Assets undertaken by the UK Law Commission.[346] As we mentioned earlier, the UK Law Commission has created a new concept for purely digital things: the third category things. Regarding control of these third category things, the Law Commission concludes that "the concept of control is likely to be appropriate for the vast majority of these third category things", ... however, it "does not think that third category things should be defined by the concept of control directly".[347] The reason is that "control is highly complex, composable and multi-faceted in the context of third category things; and different technology, products and services use control in different ways."[348] Regarding more detailed arguments, the commission starts from the classification of 'factual control' and 'legal control', indicating that the control they refer to, similar to

---

[340] Ibid., 146-47 (S.D.N.Y. 1997).
[341] Elctronic Trade Document 2023, https://www.legislation.gov.uk/ukpga/2023/38, assessed on 2nd December 2023.
[342] [2012] EWHC 10 (Ch); [2013] Ch 156.
[343] [2012] EWHC 10 (Ch); [2013] Ch 156, para. 51.
[344] [2014] EWCA Civ 281; [2015] QB 41.
[345] [2018] 2 All ER (Comm) 398, [2019] Bus LR 522, [2018] 1 Lloyd's Rep 613, [2018] EWCA Civ 518, para. 32.
[346] UK Law Commission, Digital Assets, https://lawcom.gov.uk/project/digital-assets/, accessed on 8 March 2024.
[347] UK Law Commission, Digital Assets, final report, https://cloud-platform-e218f50a4812967ba1215eaecede923f.s3.amazonaws.com/uploads/sites/30/2023/06/Final-digital-assets-report-FOR-WEBSITE-2.pdf, para. 5.3.
[348] Ibid.

UNIDROIT, is a kind of factual control, but factual control over digital objects is complex and technology specific.[349] Furthermore, the Law Commission clearly states that, unlike UNIDROIT and the UCC Committee which define digital assets by reference to the concept of control, the UK has not chosen to define digital assets through control.[350]

Although the ETDA 2023 has no known outstanding effects,[351] there has been no recent update on the Digital Assets project,[352] we are looking forward to future updates for more detailed interpretation from the UK.[353]

In summary, this section discussed the initial question regarding the control of controlled electronic records: How are such records held? It compared this with how tangible items are held and outlined three scenarios, focusing in detail on the first one. The legal understanding of records control has developed over time through laws and court decisions. Since such records cannot be physically possessed, legal frameworks like the MLETR and UCC use 'exclusive control' as a substitute. Courts in different jurisdictions have taken varied approaches to recognize possession of electronic records. The UK Law Commission introduced the idea of a third category of assets, and the ETDA 2023 reflects a shift in approach. What emerges from this comparative review is that control has gradually replaced possession as the legal

---

[349] Ibid., para. 5.13-5.15.
[350] Ibid., para. 5.16.
[351] The indication "no outstanding effects" on legislation.gov.uk merely confirms that all provisions of the Act are fully in force, rather than suggesting the absence of legal effect, see Electronic Trade Documents Act 2023, https://www.legislation.gov.uk/ukpga/2023/38/contents/2023-07-20, accessed on 8 March 2024.
[352] UK Law Commission, Digital assets Current project status, https://lawcom.gov.uk/project/digital-assets/, accessed on 8 March 2024: "We published our final report, which includes our law reform recommendations to Government, on 28 June 2023. On 22 February 2024, we launched a short consultation exercise on draft legislation that would confirm the existence of a "third" category of personal property, in accordance with one of our recommendations in our final report. We seek responses by Friday 22 March 2024."
[353] The UK Law Commission has published consultation papers and FAQs in 2024–2025 on private international law implications for electronic trade documents and broader digital assets, with final reform recommendations expected in 2026. Additionally, the Property (Digital Assets etc) Act 2025 received Royal Assent on 2 December 2025, confirming that digital assets can be objects of personal property rights under English law; see Law Commission, Digital Assets and Electronic Trade Documents in Private International Law (Law Commission Project Page), https://www.lawcom.gov.uk/project/digital-assets-and-electronic-trade-documents-in-private-international-law/, accessed 31 December 2025; Law Commission, Digital Assets and Electronic Trade Documents in Private International Law: Consultation Paper (5 June 2025), https://www.lawcom.gov.uk/publication/digital-assets-and-electronic-trade-documents-in-private-international-law-consultation-paper/, accessed 31 December 2025; Property (Digital Assets etc) Act 2025, https://www.legislation.gov.uk/ukpga/2025/29, accessed 31 December 2025.

mechanism for treating intangible records. However, for electronic bills of lading, which depend fundamentally on possession to perform their functions, this shift raises sharper challenges. Functional equivalence alone is insufficient to preserve these functions in the digital environment. This underscores the need for a substantive approach, one that situates electronic bills of lading squarely within the category of controlled electronic records and develops control as an autonomous concept rather than as a mere substitute for possession. Section 4.3.2 will therefore build on this foundation by setting out such an approach.

4.3.2 Proposed substantive approach: control

This section develops a substantive approach to understanding and regulating the control of controlled electronic records, with particular emphasis on electronic bills of lading. The approach advanced in this thesis treats control as a legally significant factual condition that mediates between technological arrangements and proprietary consequences. While informed by international developments, including the UNIDROIT Digital Assets Principles, the approach adopted here deliberately adapts and refines those ideas to reflect the specific doctrinal and commercial characteristics of electronic trade documents. The rules on control proposed in this chapter are broadly consistent with existing international principles, but are articulated and analysed from a substantive perspective tailored to the operation of electronic bills of lading.

In developing this approach to control, this thesis adopts the framework articulated in the UNIDROIT Principles. The following discussion therefore explains how that framework is understood and applied in this thesis.

In the proposed approach, control of a controlled electronic record is understood as a factual condition constituted by a combination of specific abilities that must be held concurrently by one person. Drawing on the framework reflected in UNIDROIT Principle 6, these abilities include:

“(i) the exclusive ability to prevent others from obtaining substantially all of the benefit from the digital asset;

(ii) the ability to obtain substantially all the benefit from the digital asset; and

(iii) the exclusive ability to transfer the abilities to another person (a 'change of control')."[354]

Under this approach, a 'change of control' refers to the transfer of these factual abilities, subject to limited exceptions to exclusivity, as reflected in UNIDROIT Principle 6.[355] Although control is treated as a factual concept, it is not legally neutral. Rather, the existence of control operates as a precondition for certain legal consequences.[356] In particular, the requirement of exclusivity reflects the close connection between factual control and proprietary effects, since the ability to exclude others lies at the core of proprietary rights, a connection expressly acknowledged in the UNIDROIT framework.[357] This connection is particularly relevant for instruments such as electronic bills of lading, where the right to exclude others from the benefits of the record is the foundation of negotiability.

In adopting the UNIDROIT framework on control, this thesis identifies three features that are particularly relevant for the regulation of controlled electronic records.

First, while UNIDROIT employs functional equivalence to some extent, its approach goes beyond a strict application of this principle. UNIDROIT has mentioned that control is the functional equivalent of the possession of the movables. However, in this context, possession is treated purely as a factual matter, without direct legal consequences. This suggests that UNIDROIT's approach is inspired by offline legal concepts rather than rigidly applying functional equivalence by equating control with possession of tangible assets.[358] As stated in its commentary, control is described as purely a factual matter unrelated to any legal right, functionally equivalent to the possession of tangible objects.[359] Moreover, a 'change of control' is different from the 'transfer of proprietary rights', akin to the distinction between 'the change of possession' and the 'transfer of title' of tangible things, more complicated in the online context. The commentary also provides examples to illustrate that control and proprietary rights are separate: under a custody agreement, one person (the custodian) has control while the proprietary rights are transferred to or remain with another person (the client).[360]

---

[354] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 6.
[355] Ibid., Principle 6.
[356] Ibid., para. 6.1.
[357] Ibid.
[358] Ibid., para. 6.2-6.3.
[359] Ibid., Commentary 1.
[360] Ibid., Commentary 4.

Under the framework adopted here, the role of reliable systems in ensuring the abilities and exclusivity of digital assets.[361] However, it goes beyond the principles of functional equivalence. Unlike UNCITRAL or the UK Trade Act, which explicitly address the establishment of reliable systems,[362] UNIDROIT focuses primarily on the legal aspects of control. The issue of reliability falls within the technological area and can be addressed through interoperability between different systems or platforms, using standards and other regulatory tools to ensure reliability.[363]

Secondly, the Principles adopt deliberately simple terminology. It avoids much legal confusion. For example: To simplify the discourse, the principles refrain from using terms such as delivery or transfer of delivery, opting instead for the unified term 'transfer of control' concerning digital assets.[364] This choice reduces doctrinal confusion but also reveals their generality. It is also important to note that "In this Principle, the term 'ability' is used instead of 'power'. Although the terms have the same meanings, 'ability' aligns more with the concept of control as a factual standard, whereas 'power' carries a more 'legal' undertone."[365]

Thirdly, the approach of UNIDROIT considers the combination with practice. Regarding exclusive ability, it is assumed there is a system for digital assets that reliably establishes these abilities and their exclusivity. This involves the system's responsibility, which will be discussed in detail in the section on custody, particularly regarding platforms for electronic bills of lading. This is also combined with practical explanations of shared control and multi-signature arrangements,[366] and in the section on change of control. It separately discusses: Change of control via PKI[367]: " A public, permissionless, distributed network (Alpha) supports a virtual

---

[361] Ibid., para. 6.10-6.12.
[362] See the MLETR Article 12 and UK Electronic Trade Document Act, 2-Definition of "electronic trade document", (2).
[363] For example, DCSA is exploring relevant standards for interoperability between different systems to achieve seamless interaction between them, see links below: Digital Container Shipping Association, 'Interoperability & Efficiency' (DCSA) https://dcsa.org/our-mission/interoperability-efficiency/ accessed 10 March 2025; The Loadstar, 'DCSA Makes Case for Interoperability with New Standard' (The Loadstar, 4 March 2024) https://theloadstar.com/dcsa-makes-case-for-interoperability-with-new-standard/ accessed 10 March 2025.
[364] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 6, Commentary 4.
[365] Ibid., Commentary 5.
[366] Ibid., Illustration 1, para. 12.
[367] Some information about KPI (Public Key Infrastructure): see Schneier, Bruce. 2015. *Applied Cryptography: Protocols, Algorithms, and Source Code in C* (version Second edition, 20th anniversary edition.) Second edition, 20th anniversary ed. Indianapolis, IN: John Wiley & Sons, p21.

machine (Alpha-VM) that enables the creation and use of electronic records (Beta) in its database (Alpha-DB);"[368] and Change of control via OTP-Device[369]: A private, permissioned, distributed network (Gamma) supports a virtual machine (Gamma-VM) that enables the creation and maintenance of electronic records (Delta) in its database (Delta-DB).[370]

However, the significance of adopting this framework lies in the fact that the UNIDROIT Principles successfully merge theoretical frameworks with practical applications in digital asset control, illustrated by mechanisms like PKI and OTP devices, making them accessible for both legal and technological professionals. They reflect a comprehensive understanding of modern technologies, such as shared control and multi-signature systems, addressing current trends and demands. Furthermore, these principles contribute to international legal uniformity, crucial for the global digital asset market to enhance cross-border transactions and cooperation.

In summary, this section introduces a substantive approach to regulating the control of digital assets, inspired by the UNIDROIT Principles. This approach effectively addresses the complexities of digital asset control while moving beyond the rigid application of functional equivalence and technological neutrality. By focusing on the legal aspects of control, the

---

"In 1976, Whitfield Diffie and Martin Hellman changed that paradigm of cryptography forever [496]. (The NSA has claimed knowledge of the concept as early as 1966, but has offered no proof.) They described public-key cryptography. They used two different keys-one public and the other private. It is computationally hard to deduce the private key from the public key. Anyone with the public key can encrypt a message but not decrypt it. Only the person with the private key can decrypt the message. It is as if someone turned the cryptographic safe into a mailbox. Putting mail in the mailbox is analogous to encrypting with the public key; anyone can do it. Just open the slot and drop it in. Getting mail out of a mailbox is analogous to decrypting with the private key. Generally, it's hard; you need welding torches. However, if you have the secret (the physical key to the mailbox), it's easy to get mail out of a mailbox."

[368] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 6, Commentary 13.

[369] Some information about OTP: see Grimes, Roger A. *Hacking Multifactor Authentication*. John Wiley & Sons, 2021. INSERT-MISSING-DATABASE-NAME, Accessed 29 Feb. 2024, p205.
One-time password (OTP) authentication solutions have been popular for decades and are based on a concept that many people believe to be the cryptographic Holy Grail solution for authentication. The idea is that when a subject is asked to authenticate, they provide a seemingly random set of characters that is valid only for that one request and known or predictable only between the subject and the authentication system. Once used, it will never be generated or used again (i.e., the "one-time" part). So, even if an attacker learns a particular OTP, it will never work again on any other authentication session. Any successful future authentication challenges would use a different, unpredictable, code.

[370] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 6, Commentary 15. Also, PKI and OTP are important roles in the control of digital assets, although studying them is not the focus of this thesis.

approach offers a more flexible and context-sensitive solution to managing controlled electronic records, making it better suited to the evolving digital environment.

4.4 Proprietary right

This section proposes a substantive approach to proprietary rights in controlled electronic records, with a focus on classification and how different types of electronic records (often discussed in the literature under the broader label of 'digital assets') should be treated in terms of proprietary rights. While UNIDROIT offers valuable insights into recognizing such records as subjects of proprietary rights, it does **not** establish a detailed classification or an account of how their rights might differ based on classification.

This section first reviews the existing literature and attitudes toward the proprietary rights of controlled electronic records, then examines how those rights may vary according to its classification, including access information, tangible digital assets, intangible digital assets, and metadata based on S Haworth's classification.[371] Framing the analysis this way allows the thesis to propose category-sensitive proprietary rights and, critically, to state where electronic bills of lading sit within the scheme.

4.4.1 Proprietary rights of digital assets

The previous section discussed the control of digital assets. A further question concerns the legal consequences of a change of control, in particular whether such a change has any implications for ownership.

To clarify the role that control is expected to play in the digital environment, it is first necessary to examine the relationship between possession, control, and title in the offline context. In the law of tangible property, these concepts perform distinct but interconnected functions, and their differentiation provides an essential analytical reference point for any attempt to reconceptualise control in relation to digital assets.

[371] See this thesis on Section 5.2.2. S Haworth 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 U. Miami L. Rev. 535, 538-539.

Building on this foundation, the analysis then turns to a more fundamental question in the digital context: what are the proprietary rights in digital assets, and how do control and title or proprietary rights relate to each other? This inquiry is not merely preliminary. Rather, it operates as a conceptual premise for the subsequent discussion, since questions concerning control, transfer, and legal effects in respect of digital assets ultimately depend on whether digital assets can be an object of property right.

Before the introduction, it is helpful to clarify key terms: property rights, proprietary rights, possession, control, title, and ownership. In the context of this thesis, property rights are "the rights we have in things – all kinds of tangible and intangible things, from land and cars to poems and broadcast frequencies"... "about the rights we have in things which we can enforce against other people and against the state."[372] Proprietary rights are used broadly in this thesis to mean 'proprietary rights' include both proprietary interests and rights with proprietary effects.[373] In UK law, possession is the intentional and exclusive physical control of land or tangible goods, combining both factual control and the intention to possess.[374] In other words, it involves a combination of physical fact and intention, which can be the functionally equivalent of the control of the intangible goods.[375] The relationship between the possession and title under UK law is that "a person acquires a title to, or in respect of, a chattel if and when he or she obtains possession of it; and (b) titles to, or in respect of, chattels are relative."[376]

Ownership in common law originated from the Roman Law notion of *dominium* as "the exclusive, perpetual and sovereign right over a thing".[377] According to Sir Roy Goode, "a person has a real right in goods where he has an absolute or limited interest in them or a right to have

[372] Clarke, A. C. (2020). Principles of property law (Ser. Law in context). Cambridge University Press. March 7, 2024, 1.
[373] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 3, Commentary 4.
[374] UK Law Commission, Digital Assets, final report, https://cloud-platform-e218f50a4812967ba1215eaecede923f.s3.amazonaws.com/uploads/sites/30/2023/06/Final-digital-assets-report-FOR-WEBSITE-2.pdf, para. 3.17-3.19.
[375] Ibid., para. 5.9 and para. 5.17.
[376] Luke Rostill, Relative Title and Deemed Ownership in English Personal Property Law, Oxford Journal of Legal Studies, Volume 35, Issue 1, Spring 2015, Pages 31–54, https://doi-org.soton.idm.oclc.org/10.1093/ojls/gqu016, 32.
[377] Clarke, A. C. (2020). Principles of property law (Ser. Law in context). Cambridge University Press. March 7, 2024, 193.

the goods or their proceeds applied towards satisfaction of an obligation owned to him".[378] He also defined ownership as "title to the absolute interest in goods", where the "absolute interest denoting the residue of rights remaining in a person, or in persons concurrently, after specific rights over the goods have been granted to others".[379] He divides ownership into two categories: legal ownership and equitable ownership.[380] The legal ownership is exemplified by the occasion that the legal ownership to pass from A to B, A must make a present transfer of existing goods which he currently owns or of which he has a power to dispose.[381]

Regarding the relationship between possession and ownership, possession of tangibles is not equivalent to title, and the transfer of rights is not directly synonymous with possession,[382] though both the civil law system and the common law system have their emphases: common law makes a clearer distinction between possession and ownership, whereas civil law often views possession more as a part of ownership.[383] For example, Sir Roy Goode discusses the relevance of possession to the transfer of ownership: "The passing of property does not depend upon delivery; the holding or delivery of possession may be relevant to the acquisition or transfer of ownership."[384]

As we transition from the traditional concepts of property rights, proprietary rights, possession, control, and ownership of tangibles above to their application in the digital sphere, a series of questions naturally emerge in our minds: Does the relationship between control and title in the online world also follow the same principles as in the offline world? Moreover, what are the

---

[378] Prof. R. M. Goode, *Proprietary Rights and Insolvency in Sales Transactions*. (second edition), Sweet& Maxwell, London, 1989, p1.
[379] Ibid., p3.
[380] McKendrick, Ewan, Royston Miles Goode, Royston Miles Goode, and Royston Miles Goode. 2021. *Goode and Mckendrick on Commercial Law* Sixth edition/ed. London UK: Penguin Books, 2.17-2.40. This thesis does not examine equitable ownership, which falls outside the scope of the present analysis.
[381] Prof. R. M. Goode, *Proprietary Rights and Insolvency in Sales Transactions*. (second edition), Sweet& Maxwell, London, 1989, p5.
[382] McKendrick, Ewan, Royston Miles Goode, Royston Miles Goode, and Royston Miles Goode. 2021. *Goode and Mckendrick on Commercial Law* Sixth edition/ed. London UK: Penguin Books, 2.17-2.40.; Luke Rostill, Relative Title and Deemed Ownership in English Personal Property Law, Oxford Journal of Legal Studies, Volume 35, Issue 1, Spring 2015, Pages 31–54, https://doi-org.soton.idm.oclc.org/10.1093/ojls/gqu016, 32.
[383] Van Erp, Sjef, 'Comparative Property Law', in Mathias Reimann, and Reinhard Zimmermann (eds), *The Oxford Handbook of Comparative Law*, 2nd edn, Oxford Handbooks (2019; online edn, Oxford Academic, 9 May 2019), https://doi-org.soton.idm.oclc.org/10.1093/oxfordhb/9780198810230.013.33, accessed 5 Mar. 2024, p1039-1049.
[384] Prof. R. M. Goode, *Proprietary Rights and Insolvency in Sales Transactions*. (second edition), Sweet& Maxwell, London, 1989, p1.

rights associated with digital assets? How is the proprietary right in digital assets transferred? What are the legal effects of a change of control? What are the attitudes of different countries? These questions are all worth exploring. However, due to the rapid advancement and complexity of technology, current research and literature have not yet addressed these very detailed issues comprehensively; instead, the focus has predominantly been on whether digital assets can be considered as property and become an object of property law. In these limited studies and literature, the exploration of whether digital assets qualify as property is also conducted within a restricted scope, with little attention given to the types of property they may constitute.

A representative scholar in this area is Prof. Sjef Van Erp, who addressed two quite key premises: Should the law recognize new objects of property law? And should it recognize new types of property rights?[385] He first discussed what qualifies as an object of property law, clarifying the relationship between market value and an object of property law. Generally, objects of property law have value, but not all with market value can be objects of property law. That is, market value is a necessary but not sufficient condition for an object of property law.[386] He continued discussing what constitutes an object of property law, believing the transferability or marketability of such object is critical.[387] In answering the above two questions, he attempted to address whether 'new property' could be recognized. Using domain names as an example, he discussed the value they represent for the person holding the right to use them and the adverse effects that such an exclusive right may create for others. Following this, Van Erp proposed, "Once a new object of property law has been accepted, the question arises how this new object can be integrated into the system of property law". If compatibility is not possible, should a new property right be created?[388]

Following Van Erp, some scholars have become more specific, exploring the content and nature of electronic records ownership. For example, Aksoy explores the concepts of property,

[385] Van Erp, Sjef, 'Comparative Property Law', in Mathias Reimann, and Reinhard Zimmermann (eds), *The Oxford Handbook of Comparative Law*, 2nd edn, Oxford Handbooks (2019; online edn, Oxford Academic, 9 May 2019), https://doi-org.soton.idm.oclc.org/10.1093/oxfordhb/9780198810230.013.33, accessed 5 Mar. 2024, p1050.
[386] Ibid., p1050-1051.
[387] Ibid., p1051.
[388] Ibid., p1052-1053.

objects of property rights, and the applicability of property law rules.[389] He argues that "controlling the transferability of a thing is not exactly the same as saying that there are property rights in that thing as traditional civilian property theory requires".[390] He primarily illustrates the challenges associated with property rights for records across jurisdictions. But he offer few his own perspectives on the property rights, although highlighting the challenges is useful. Chan goes further, exploring subject-matter, transfer characterisation, and title passing on blockchains.[391] He argues that "the subject-matter of property rights in cryptoassets is a 'transactional ability': the practical ability to effect a blockchain transaction that will be recognised as valid by all other nodes on the blockchain."[392] Among the research related to documentary contexts, Michels and Millard discuss property rights in digital files, such as electronic documents, emails, and photographs, under English law.[393] They argue that while mere information is rightly not considered property, digital files are distinct virtual objects in a computer system.[394] Notably, their analysis is inspired by Benkler's three-layer description of an information network,[395] which leads them to categorize the existence of digital files into three distinct layers: the physical layer, the logical layer, and the content layer. They highlight that the property status of the file as a virtual object at the logical layer is unclear.[396] This three-layered model is greatly enlightening for the study of digital files such as electronic bills of lading, and the authors propose from a more detailed perspective which specific layer the ambiguity of property rights resides in.[397]

---

[389] Pınar Çağlayan Aksoy (2023) The applicability of property law rules for crypto assets: considerations from civil law and common law perspectives, Law, Innovation and Technology, 15:1, 185-221, DOI: 10.1080/17579961.2023.2184140, 192.
[390] Ibid., 196.
[391] Chan, T. (2023) 'The nature of property in cryptoassets', Legal Studies, 43(3), pp. 480–498. doi:10.1017/lst.2022.53, 481.
[392] Ibid., 485.
[393] Michels, J.D. and Millard, C. (2022) 'THE NEW THINGS: PROPERTY RIGHTS IN DIGITAL FILES?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 323.
[394] Ibid.
[395] Michels, J.D. and Millard, C. (2022) 'THE NEW THINGS: PROPERTY RIGHTS IN DIGITAL FILES?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 323, 329, see also Y. Benkler, "From Consumers to Users: Shifting the Deeper Structures of Regulation toward Sustainable Commons and User Access" (2000) 52 F.C.L.J. 561, 561–62.
[396] Michels, J.D. and Millard, C. (2022) 'THE NEW THINGS: PROPERTY RIGHTS IN DIGITAL FILES?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 323, 331.
[397] Ibid., 329-332.

Apart from the scholars, common law and civil law countries have different methods for dealing with the property rights of digital assets. Civil law countries face the challenge of how to classify digital assets within the existing 'property rights' framework and determine the legal nature of the relationship between a digital asset and its holder, tending to regulate through legislation.[398] Most countries, adhering to the civilian tradition, recognize proprietary rights for tangible items, but the recognition of intangible assets is limited and typically occurs only under special circumstances.[399] Common law countries, on the other hand, deal with digital asset issues in a more dynamic way. Their courts are facing these issues, as per their attitude, cases from the UK, Singapore, New Zealand, and Canada, have accepted that digital assets can be conceptualized as (objects of) property.[400]

UK courts have contributed a lot. In *National Provincial Bank v Ainsworth*,[401] Lord Wilberforce announced the main characteristics of property: "It must be definable, identifiable by third parties, capable in its nature of assumption by third parties, and have some degree of permanence or stability."[402] This effectively provided a theoretical basis for subsequent case discussions on whether digital assets are considered property. Against this background, a series of English cases have recognised that certain forms of digital assets, most notably cryptocurrencies, are capable of constituting property. In *Vorotyntseva v Money-4 Ltd*.[403] Birss J observed that there had been no suggestion that cryptocurrencies could not be a form of property.[404] The decision of the English High Court in *AA v Persons Unknown* also held that cryptocurrencies are 'property'.[405] While these decisions do not resolve the status of all digital assets, they demonstrate the willingness of English courts to extend proprietary concepts to at least some kinds of digital assets.

---

[398] Pınar Çağlayan Aksoy (2023) The applicability of property law rules for crypto assets: considerations from civil law and common law perspectives, Law, Innovation and Technology, 15:1, 185-221, DOI: 10.1080/17579961.2023.2184140, 187.
[399] Ibid., 216.
[400] See examples: Singapore case: *B2C2 Ltd. v Quoine Pte Ltd.*; New Zealand case: *Ruscoe v Cryptopia Ltd. (in Liquidation)*; UK cases: *National Provincial Bank v Ainsworth*; *Vorotyntseva v Money-4 Ltd.*; *AA v Persons Unknown*; Canada cases: *Shair.Com Global Digital Services Ltd v Arnold*; *Copytrack Pte Ltd v Wall*.
[401] National Provincial Bank Ltd v Ainsworth [1965] AC 1175.
[402] Ibid., 1247–1248 (HL).
[403] *Elena Vorotyntseva v Money-4 limited and others* [2018] EWHC 2596 (Ch).
[404] Ibid., para. 13.
[405] *AA v Persons Unknown* [2019] EWHC 3556, [2020] 4 WLR 35, para. 57-59.

In *B2C2 Ltd. v Quoine Pte Ltd.* from Singapore,[406] regarding the question of "whether the relevant cryptocurrency, BTC, may even be regarded as a species of property capable of attracting trust obligations", the judge pointed out: "Cryptocurrencies are not legal tender in the sense of being a regulated currency issued by a government but do have the fundamental characteristic of intangible property as being an identifiable thing of value."[407] The judge continued to cite the definition of property rights in the House of Lords decision of *Ainsworth* at 1248: "it must be definable, identifiable by third parties, capable in its nature of assumption by third parties, and have some degree of permanence or stability", considering that digital currencies meet all the requirements of a property object.[408] In the appellate judgment, the appellate judge reiterated that although in the first instance the judge "left open the question of what the precise nature of the property right was, having been satisfied that cryptocurrency could be treated as property in a generic sense."[409]

In *Ruscoe v Cryptopia Ltd. (in Liquidation)* from New Zealand,[410] the court classified cryptocurrencies as 'property', meaning that the digital currencies held by *Cryptopia* are assets that can be owned and controlled, and thus are subject to the principles of property law.[411] The judges first addressed what is property and why it matters here, then proceeded to arguments based on the definition of property in s 2 of the Companies Act: "...property of every kind whether tangible or intangible, real or personal, corporeal or incorporeal, and includes rights, interests, and claims of every kind in relation to property however they arise." This was to ascertain whether digital assets qualify as property. Moreover, they integrated the classic statement of the characteristics of 'property' outlined by Lord Wilberforce in *Ainsworth*, expounding from the following four aspects whether digital assets are property: "(a) Identifiable subject matter; (b) Identifiable by third parties; (c) Capable of assumption by third parties; (d) Some degree of permanence or stability."[412] Finally, the judges concluded that it meets the criteria to be considered a species of 'property'.[413]

---

[406] *B2C2 Ltd v Quoine Pte Ltd* [2019] SGHC(I) 03.
[407] Ibid., para. 142.
[408] Ibid.
[409] *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA(I) 02, para. 138.
[410] *Ruscoe v Cryptopia Ltd (in Liquidation)* [2020] NZHC 728.
[411] Ibid., para. 110-113.
[412] Ibid., para. 104-119.
[413] *Ruscoe v Cryptopia Ltd (in Liquidation)* [2020] NZHC 728, para. 120.

In Canada, In *Shair.Com Global Digital Services Ltd v Arnold*,[414] the Supreme Court of British Colombia accepted that cryptocurrencies could be property within the rules for preservation orders.[415] *Copytrack Pte Ltd v Wall* suggests that ETH was recognised as a species of property susceptible to tracing.[416]

After exploring the premise of whether digital assets can be considered property, the subsequent issues become relatively fixed.[417] As Van Erp stated, "Once a new object of property law has been accepted the question arises how this new object can be fitted into this system of property law."[418] The UK Law Commission's approach exemplifies integration: ETDA 2023 reconceives electronic trade documents as capable of possession, while its digital assets project considers a 'third category' distinct from things in possession and in action.[419] From this entire section, it is evident that unlike the offline world, which is well-established and detailed, the property rights of digital assets are very ambiguous. Although some common law countries have clear stances in some cases, it remains uncertain whether to handle electronic trade law like the UK, by amending existing laws to fit into the existing legal framework, or to create a new set of laws specifically for digital assets. Different countries have different approaches.

UNIDROIT takes a substantive approach to proprietary rights of digital assets, going further than any other jurisdiction. This section outlines and analyses UNIDROIT's approach to providing readers with a clearer understanding of its rationale. UNIDROIT Principle 3 - "General Principles" is about proprietary rights: the primary content is in 3(1): "A digital asset can be the subject of proprietary rights"; 3(2) specifies that in cases of conflict between the principles and

[414] *Shair.com Global Digital Services Ltd v Arnold* 2018 BCSC 1512.
[415] *Shair.com Global Digital Services Inc. v Arnold*, 2019 BCSC 870, para. 33-38.
[416] *Copytrack Pte Ltd v Wall* [2018] BCSC 1709.
[417] For the purposes of this thesis, "electronic records" is used as a broad, umbrella term. "Digital assets" refer to a subset of electronic records capable of being subject to control, and correspond to what this thesis describes as "controlled electronic records". Cryptocurrencies constitute one category of digital assets and are referred to primarily by way of illustration.
[418] Van Erp, Sjef, 'Comparative Property Law', in Mathias Reimann, and Reinhard Zimmermann (eds), *The Oxford Handbook of Comparative Law*, 2nd edn, Oxford Handbooks (2019; online edn, Oxford Academic, 9 May 2019), https://doi-org.soton.idm.oclc.org/10.1093/oxfordhb/9780198810230.013.33, accessed 5 Mar. 2024, p1053.
[419] Electronics Trade Documents Act 2023; Law Commission, Digital Assets: Final Report (Law Com No 256, 2023).

other laws, general principles take precedence; 3(3) stipulates that other specific matters are governed by other laws.[420]

In contrast to the cautious exploration by various jurisdictions, UNIDROIT boldly recognises that digital assets can be the subject of proprietary rights, despite knowing that this issue has been controversial in several jurisdictions.[421] The purpose of this acknowledgment is to clarify the legal consequences of digital assets. It does not address their classification, as "in certain jurisdictions, digital assets must be classified as 'property', 'good', 'thing', or similar concepts."[422]

What is a proprietary right? Commentary 4 clarifies that proprietary rights include both proprietary interests and rights with proprietary effects.[423] What is particularly noteworthy is, that "these Principles provide specific rules for the holding, transfer and use of digital assets, taking into account the specific nature of this asset class".[424]

Other more detailed issues are left to be addressed by other laws, including those specified in Principle 3(3): "(a) whether a person has a proprietary right in a digital asset; (b) whether a proprietary right in a digital asset has been validly transferred to another person; (c) whether a security right in a digital asset has been validly created; (d) the rights as between a transferor and transferee of a digital asset; (e) the rights as between a grantor of a security right in a digital asset and the secured creditor to whom the secured right is granted; (f) the legal consequences of third-party effectiveness of a transfer of a digital asset; (g) the requirements for, and legal consequences of, third-party effectiveness of a security right in a digital asset."[425]

In the commentary, it is mentioned that the above non-exhaustive or non-limitative list is regulated by the other laws of a state, rather than by the Principles.[426] Here, special attention should be paid to the relationship between Principle 3(1) and 3(3)(a), as "A digital asset can be the subject of proprietary rights" and "whether a person has a proprietary right in a digital

[420] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 3.
[421] Ibid., Principle 3, Commentary 1.
[422] Ibid., Principle 3, Commentary 2.
[423] Ibid., Principle 3, Commentary 4.
[424] Ibid., Principle 3, Commentary 5.
[425] Ibid., Principle 3 (3).
[426] Ibid., Principle 3, Commentary 7.

asset" actually refer to two different things. UNIDROIT classifies the situations in 3(3), among which, Principle 3(3)(a) addresses the static condition of whether A has a proprietary right in a digital asset.[427] It concludes "whether a person holds a valid right of ownership in a certain digital asset, is, as a matter of principle, not regulated by these Principles".[428] Principles 3(3)(b) and (c) address the dynamics of acquiring and disposing digital assets, while 3(3)(d) and (e) clarify relationships between parties involved, and 3(3)(f) and (g) focus on external third-party relationships.[429]

In summary, although the UNIDROIT Principles are more innovative than other international initiatives such as UNCITRAL, they nevertheless share the same limitation: the framework remains ambiguous and does not provide a comprehensive or systematic classification of digital assets (controlled electronic records). In practice, most legal systems regulate the property rights of digital assets on a case-by-case basis rather than through a clear, structured classification. This lack of a systematic approach is the first issue. The second issue is that digital assets are often treated as a single category, without distinguishing between different types. Even in the UK, where electronic trade documents are recognized as things in possession and digital assets as the third category of things, the relationship between these two remains unaddressed. While some distinctions have emerged in the regulation of different types of electronic records like the UK, these approaches remain incomplete. Given these challenges, the next section will propose a substantive approach to regulating different types of controlled electronic records.

4.4.2 Proposed substantive approach: proprietary rights

This section proposes a substantive approach proprietary rights in controlled electronic records. Its object is controlled electronic records, of which electronic bills of lading are specific forms. Since electronic bills of lading can be implemented using different technologies (centralised registry systems or decentralised blockchain platforms), they may fall into different categories of digital assets and entail different proprietary rights. It is therefore necessary to

[427] Ibid., Principle 3, Commentary 8.
[428] Ibid.
[429] Ibid., Commentary 8-11.

first outline the classification of digital assets and their proprietary nature. This provides the theoretical basis for the subsequent analysis of electronic bills of lading in Chapter 5.

This section proposes the substantive approach to proprietary rights to digital assets, by adopting S. Haworth's four categories: (1) Access Information, (2) Tangible Digital Assets, (3) Intangible Digital Assets, and (4) Metadata.[430] Different types of digital assets arguably have distinct legal consequences regarding their eligibility for proprietary rights and the nature of those rights.

As UNIDROIT also points out, the classification of digital assets is distinct from their eligibility for proprietary rights.[431] While Principle 3(1) affirms that digital assets can be subject to such rights, how this is implemented depends on each jurisdiction, which may either adapt existing categories or introduce new ones.[432] At the same time, UNIDROIT explicitly refrains from addressing the seven legal issues outlined in Principle 3(3),[433] nor the several issues of property and contract law, nor the intellectual property and consumer protection and other public law issues.[434] Compared to UNIDROIT, the substantive approach of this section does not seek to provide an exhaustive framework but aims to extend beyond the scope of UNIDROIT by exploring the proprietary nature of the four types of digital assets in greater depth.

4.4.2.1 Proprietary right to access information

Access information is often discussed in inheritance law, with some referring to it as mere information.[435] Regarding its definition, it generally refers to the credentials, passwords, PINs, security questions, or other forms of authentication required to access and manage a digital

---

[430] See Section 4.2.1 above. S Haworth 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 U. Miami L. Rev. 535, 538-539.
[431] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 3, para. 3.2.
[432] Ibid., Principle 3(1).
[433] Ibid., Principle 3(3).
[434] Ibid., Principle 3, para. 3.8.
[435] See literatures: Victoria Blachly, 'Planning for Fiduciary Access to Digital Assets' (2015) 29 Prob & Prop 56; Patricia Sheridan, 'Inheriting Digital Assets: Does the Revised Uniform Fiduciary Access to Digital Assets Act Fall Short?' (2020) 16 Ohio St Tech L J 363; S Haworth, 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 U. Miami L. Rev. 535; Patricia Sheridan, 'Inheriting Digital Assets: Does the Revised Uniform Fiduciary Access to Digital Assets Act Fall Short?' (2020) 16 Ohio St Tech L J 363; Jeehyeon Lee, 'Death and Live Feeds: Privacy Protection in Fiduciary Access to Digital Assets' (2015) 2015 Columbia Business Law Review 654 https://ssrn.com/abstract=2591411 accessed 17 Mar. 2025.

asset.[436] According to Samantha D. Haworth, access information, such as account numbers and login credentials, should be given to an executor for the orderly distribution of digital assets.[437]

Access information is generally not considered to have independent property rights.[438] It is arguably more of a tool or means to access other digital assets that have property rights. For example, account password or login credentials are simply ways to access an electronic trading account, while the funds or securities within the account are the assets with property rights. As noted by David M. Lenz, the access information itself is not an asset but a means of accessing other assets.[439] Michels and Millard argue that mere information is not property as well.[440]

Typically, access information is governed more by contract law rather than directly by property law. Many digital platforms' terms of service prohibit users from transferring or inheriting account access rights, meaning access information is not usually seen as an asset that can be inherited or transferred. For example, user agreements with platforms like Apple,[441] Google,[442] and Facebook[443] often state that account access cannot be transferred to others. Therefore, while accounts may contain assets with property rights, access information is just a tool for accessing these assets and does not involve independent property rights.

---

[436] StayinBusiness, Digital Property and Assets, https://www.stayinbusiness.com/resource/digital-property-and-assets/ accessed 17 March 2025.
[437] S Haworth, 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 University of Miami Law Review 535, 537.
[438] Johan David Michels & Christopher Millard, 'The New Things: Property Rights in Digital Files?' (2022) 81 Cambridge LJ 323; David M Lenz, 'Death and Downloads: The Evolving Law of Fiduciary Access to Digital Assets' (2012) 23 Ohio Prob LJ NL 2; J Mummery, 'Property in the Digital Age' in W Barr (ed), *Modern Studies in Property Law*, vol 8 (OUP 2015) 5; *Your Response Ltd. v Business Media* [2014] EWCA Civ 281, [2015] Q.B. 41.
[439] David M Lenz, 'Death and Downloads: The Evolving Law of Fiduciary Access to Digital Assets' (2012) 23 Ohio Prob LJ NL 2.
[440] Johan David Michels & Christopher Millard, 'The New Things: Property Rights in Digital Files?' (2022) 81 Cambridge LJ 323.
[441] Apple Inc, iCloud Terms and Conditions (Apple, updated 2024) <https://www.apple.com/legal/internet-services/icloud/cn_si/terms.html> accessed 18 March 2025.
[442] Google LLC, 'Terms of Service' (22 May 2024) <https://policies.google.com/terms> accessed 18 March 2025.
[443] Meta Platforms, Inc, 'Terms of Service' (1 January 2025) <https://www.facebook.com/legal/terms> accessed 18 March 2025.

In addition, access information involves privacy and data protection issues, especially when dealing with personal digital assets like social media accounts. In such cases, inheriting or transferring access information could infringe on a user's privacy rights. For this reason, many countries' laws, such as the EU's GDPR, restrict the transfer of access information, treating it as something not simply transferable as property.[444] Thus, while access information may intersect with property rights in certain situations, it is generally not viewed as property in itself. In general, access information is not considered an independent property right but more of a means to access other digital assets. However, in certain legal or business contexts, it may be closely related to property rights and protected by relevant laws.

4.4.2.2 Proprietary rights to tangible digital assets

According to the classification of Samantha D. Haworth, tangible digital assets are the second type of digital assets. She defines tangible digital assets as follows:

> "Tangible Digital Assets: This category includes photographs, PDFs, documents, emails, online savings account balances, domain names, and blog posts. Tangible assets are not tangible in the physical sense; they are compositions or property that hold a definable form. These are likely files that can be named and transferred to another. Tangible digital assets can likely be converted into physical assets, such as printing a picture or receiving a check for the value of an online savings account."[445]

According to the above definition of tangible digital assets, these types of assets do not have a physical form, but they are documents with an identifiable form that can be named, stored and transferred. With regard to electronic bills of lading, it is arguable that they belong to this type of tangible digital assets.[446] Electronic bills of lading have a characteristic similarity to such assets: they have the characteristics of being able to be named and transferred. They usually exist in a storable file format (e.g., PDF or a specific electronic record) and are transferable between different subjects, similar to other digital documents. However, electronic bills of lading are unique, which is what makes them different from ordinary documents, photos,

---

[444] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation) [2016] OJ L119/1, art 49.
[445] S Haworth, 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 University of Miami Law Review 535, 537-538.
[446] See the detailed arguments in Chapter 5.2 of this thesis.

emails, etc. mentioned above.[447] This is because the electronic bill of lading requires assurance of its uniqueness to serve its core functions: as a receipt for the goods, as evidence of the terms of the contract of carriage and as a document of title.

The electronic bill of lading performs the three functions identified above. For this reason, current regulation primarily seeks to replicate the legal effects of the paper bill of lading by achieving functional equivalence. In practice, this means ensuring that the three functions are reproduced in electronic form as strictly as possible. However, the principle of functional equivalence faces significant limitations in this process, as discussed in Chapter 3.[448]

For the proprietary right to tangible digital assets, two layers will be discussed: first, can tangible digital assets be an object of property law? This issue has already been touched upon in Section 4.4.1.[449] Secondly, the proprietary right of tangible digital assets will be discussed with a view to establishing whether and how they can be recognised as property, drawing on case law and scholarly analysis.

Case law provides instructive guidance on property rights to digital files under common law. In *Colonial Bank v Whinney*,[450] Fry LJ in the Court of Appeal (dissenting) famously stated that "all personal things are either in possession or in action. The law knows no tertium quid between the two."[451] While Fry LJ's view did not prevail at that stage, the House of Lords subsequently adopted his reasoning, thereby affirming the traditional dichotomy between things in possession and things in action. This dichotomy has long influenced the classification of property.

However, more recent cases demonstrate that courts have not always applied this distinction rigidly. Instead, they sometimes move beyond a mechanical reliance on the two categories, focusing instead on the inherent characteristics of the asset in question. This is evidenced by many cases that have moved beyond a mechanical application of these categories to blur the

[447] Regarding how electronic bills of lading are different from the traditional documents mentioned here, it will be argued in Chapter 5.2.
[448] See this thesis in Chapter 3.
[449] See this thesis Section 4.4.1.
[450] *Colonial Bank v Whinney* (1885) 30 Ch 261 (CA). For a judgment referencing Fry LJ, see *Your Response Ltd v Datateam Business Media Ltd* [2014] EWCA Civ 281, [2015] QB 41 at [26].
[451] *Colonial Bank v Whinney* (1885) 30 Ch 261 (CA) at 285. See also *Your Response Ltd v Datateam Business Media Ltd* [2014] EWCA Civ 281, [2015] QB 41 at [26].

lines, instead focusing on the inherent nature of property. For instance, in the New Zealand case *Cryptopia*,[452] the judge avoids the rigid approach of defining property by merely determining whether an item fits within these two categories, and instead examined whether digital assets possessed the essential attributes of property. As previously mentioned, the analysis of digital assets builds upon the classic statement of the characteristics of 'property' outlined by Lord Wilberforce in *Ainsworth*. On that basis, the following discussion considers whether digital assets satisfy the relevant criteria: "(a) Identifiable subject matter; (b) Identifiable by third parties; (c) Capable of assumption by third parties; (d) Some degree of permanence or stability."[453]

The judges concluded that the digital assets under consideration met the criteria to be considered a species of 'property'.[454] Regarding the evaluation of applying the Ainsworth criteria to digital assets, it has been noted that while many cases have followed this approach,[455] many scholars have offered their distinct insights. Some contend that this approach risks falling into circularity.[456] Others argue that the existing criteria are insufficient. In addition to the four criteria identified in *Ainsworth*, Michels and Millard propose making explicit a fifth criterion: erga omnes, which clarifies the distinction between personal rights and property rights.[457] They point out that without acknowledging this characteristic, the test risks being circular, since it uses the features of property to determine whether something is property. By adding erga omnes as an explicit criterion, the test more effectively distinguishes property rights, which bind the world at large, from merely personal rights.[458] Gray has argued that a resource can only be considered property if it is excludable, meaning that its holder has the ability to exclude

---

[452] *Ruscoe v Cryptopia Ltd (in liq)* [2020] NZHC 728, para. 124.
[453] Ibid., para. 104-119.
[454] Ibid., para. 120.
[455] *Vorotyntseva v Money-4 Ltd (t/a Nebeus.com)* [2018] EWHC 2596 (Ch); *Robertson v Persons Unknown* (ComCt, 15 July 2019); *B2C2 Ltd v Quoine Pte Ltd* [2019] SCHC(I) 3; *Ruscoe v Cryptoppia Ltd* [2020] NZHC 728, [2020] 2 NZLR 809; *Ion Sciences Ltd v Persons Unknown* (Com Ct, 21 December 2020); *Fetch.ai Ltd v Persons Unknown* [2021] EWHC 2254 (Comm); *Lavinia Deborah Osbourne v Persons Unknown and Ozone Networks* [2022] EWHC 1021 (Comm).
[456] Kevin Gray and Susan Francis Gray, *Elements of Land Law* (5th ed, Oxford University Press, Oxford, 2009) at [1.5.29]; and Kelvin FK Low 'Bitcoins as Property: Welcome Clarity?' (2020); 136 LQR 345 at 348-349; Kevin Gray, 'Property in Thin Air' (1991) 50(2) CLJ 252, 293 <http://www.jstor.org/stable/4507540> accessed 21 March 2024.
[457] Michels, J.D. and Millard, C. (2022) 'The New Things: Property Rights in Digital Files?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 326.
[458] Ibid.

others from access or use.[459] Cutts suggests that digital assets must meet the condition of being rivalrous to qualify as property.[460]

Similarly, based on the principles established by Lord Wilberforce, New Zealand judges have articulated their perspectives on whether digital files are considered property in particular cases. Arnold J emphasized the identifiability and transferability aspects of property: in *Dixon v R*, he applied four criteria to conclude that digital files were not mere information but actually qualified as 'property': they could be identified, had a value, were capable of being transferred and had a physical presence, albeit one that could not be detected by means of the unaided senses.[461] In *Henderson v Walker*, Thomas J focused more on the principles of excludability (the ability to prevent others from controlling the property) and exhaustibility (the ability to deprive others of the property's value), highlighting the importance of exclusive control over property.[462] Some regard these tangible digital assets as one type of information. Zech argues that there are three types of information: possessing information, using information and destroying information, and applying the bundle of rights theory to information.[463]
Tangible digital assets possess several characteristics that align with the foundational principles of property law. These assets are identifiable (e.g., by means of unique identifiers or metadata), transferable (through mechanisms like encryption and digital signatures), and subject to exclusive control (via access restrictions or authentication protocols). These factors are crucial in differentiating digital assets from mere information. Financial, sentimental, or cultural value can be attached to these assets, enhancing their legitimacy as property, as they can carry tangible benefits to the holder, whether it be through trading, personal use, or cultural significance.

From the above analysis, it is evident that tangible digital assets can constitute objects of proprietary right. This finding not only challenges the traditional classification of property but also lays the foundation for Chapter 5, which will further argue that certain electronic bills of

[459] Kevin Gray, 'Property in Thin Air' (1991) 50(2) CLJ 252, 268 <http://www.jstor.org/stable/4507540> accessed 21 March 2024.
[460] Tatiana Dancy, 'Crypto-Property: Response to Public Consultation by the UK Jurisdiction Taskforce of the LawTech Delivery Panel' (2019) LSE Law - Policy Briefing Paper No 36, 2–4 https://ssrn.com/abstract=3406736 or http://dx.doi.org/10.2139/ssrn.3406736 accessed 21 March 2024.
[461] *Dixon v R* [2015] NZSC 147, [2016] 1 NZLR 678.
[462] *Henderson v Walker* [2019] NZHC 2184, para. 264-266.
[463] Herbert Zech, 'Information as Property' (2015) 6 J Intell Prop Info Tech & Elec Com L 192, 195.

lading qualify as tangible digital assets and can therefore be recognised as objects of proprietary rights.

4.4.2.3 Proprietary right of intangible digital assets

According to the classification of Samantha D. Haworth, tangible digital assets are the third type of digital assets. She defines intangible tangible digital assets as follows:

> "Intangible assets are 'likes' on Facebook, website profiles, and comments or reviews left on a blog. Internet users can have intangible assets spread over cyberspace in volumes."[464]

Haworth's research focuses on inheritance law. Building on her approach, this thesis suggests applying her definition to this thesis suggests that assets which arise purely online and have no offline equivalent should be classified as intangible digital assets. Intangible digital assets can arguably be further divided into two categories: one that consists of mere information without property rights, such as 'likes' in social media, and another, more complex category, which includes intangible documents like electronic bills of lading, which is the documentary intangibles under the English law.[465] Documentary intangibles, as a type of intangible, are typically categorized alongside pure intangibles. They are documents embodying rights that can be transferred through the delivery of the documents.[466]

Though to some degree, the electronic bills of lading can be classified into this category, with the fact that there is no paper-based original equivalent in the real world. The reason why I argue here that electronic bills of lading are different from the digital files is that traditional digital files or tangible digital assets (discussed in Section 4.4.2.2) do not have the function of being a document of title. Under English law, documents of title such as bills of lading are classified as documentary intangibles.[467] Unlike ordinary documents, documentary intangibles serve as carriers of rights, and those rights usually relate to the goods or other tangible things

---

[464] S Haworth, 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 University of Miami Law Review 535, 538.
[465] Goode and McKendrick, *Goode and McKendrick on Commercial Law* (5th edn, Sweet & Maxwell 2010) chapter 2, paras 2.56-2.58.
[466] Ibid.
[467] Roy Goode and Ewan McKendrick, *Goode and McKendrick on Commercial Law* (6th edn, Penguin 2021) paras 2.56-2.58.

referred to in the document.[468] Because of this unique nature, the 'original' version of an electronic bill of lading is of paramount importance throughout its lifecycle. Unlike a paper bill of lading, its originality exists solely in electronic form, without any offline counterpart.

Intangible digital assets can hold significant economic value and legal implications. However, not all intangible digital assets qualify as property. Pure information, however, is generally not treated as property in law, not because it lacks economic value, but because it lacks the characteristics that allow it to be the object of property rights. For example, the 'likes' on a Facebook page or the comments on a blog post may be considered intangible assets, but determining who owns these assets - whether it is the platform, the user, or a third party - can be legally ambiguous.

However, electronic bills of lading as a kind of electronic documentary intangibles arguably involve proprietary rights, fulfilling the requirements for determining property rights. The owner can transfer or assign their rights to another party. As a documentary intangible, the electronic bill of lading can be transferred through delivery of the document in its digital form. However, the transfer process must ensure that the rights embodied in the document are effectively passed to the new holder, which may require specific legal and technical mechanisms to authenticate the transfer. Proprietary rights also include the right to exclude others from using or benefiting from the asset. For intangible digital assets, this can be particularly challenging due to the ease with which digital content can be replicated and distributed.
The economic value of intangible digital assets can vary widely, depending on the nature of the asset and its potential for monetisation. Some intangible digital assets, such as electronic bills of lading, have clear economic value because they represent rights to tangible goods or services. Other assets, such as social media 'likes' or online reviews, may have more indirect economic value, influencing consumer behavior or brand reputation.

In summary, the proprietary right of intangible digital assets can be analysed case by case, having regard to their specific characteristics and functions. As discussed in Sections 4.4.2, electronic bills of lading, whether they fall into the category of the tangible or intangible digital assets, can arguably be object to proprietary rights.[469]

---

[468] Ibid., para. 2.58.
[469] Metadata, which consists of electronically stored information such as access history, location tags, hidden text, or deleted data, raises distinct legal questions as to control, ownership, and possible

4.4.3 Summary

This section proposed a category-sensitive substantive approach to proprietary rights in controlled electronic records, adapting Haworth's taxonomy and integrating the doctrinal insights of Ainsworth and subsequent case law. In this framework, access information is not itself property; tangible electronic records may attract proprietary rights where exclusivity and transfer are ensured; and, within intangible records, only the documentary-intangible subset qualifies for proprietary treatment. Since electronic bills of lading are controlled electronic records, Chapter 5 will test how this approach applies to electronic bills of lading.

4.5 Custody

This thesis argues that custody provides the appropriate framework for understanding indirect possession in the context of controlled electronic records. The concept of custody mirrors the idea of indirect possession in tangibles.[470] Custody involves a custodian holding a digital asset on behalf of a client, often with specific obligations to protect the asset from unauthorized access or transfer.[471] The custodian's role is to maintain the asset securely while ensuring that the client retains certain rights over it, such as the ability to access or transfer the asset under agreed conditions. In some systems, custody means that the owner retains rights without exercising immediate control, while in others the platform may in fact be able to access or alter the records.[472] Some scholars have considered whether the common law concept of bailment, which arises when a bailee takes possession of goods for safekeeping and owes duties of care and redelivery, might be applied by analogy to digital assets.[473] However, since bailment has traditionally been confined to tangible goods, custody arguably provides a more appropriate

protection under intellectual property law. The author plans to address this issue in a future piece of work.

[470] Kaal WA and Howe H, 'Custody of Digital Assets' (5 October 2021) U of St. Thomas (Minnesota) Legal Studies Research Paper No 22-05 https://ssrn.com/abstract=3936876 accessed 18 March 2025.

[471] Reed Smith, 'The Role of Intermediaries in the Custody of Digital Assets' (Reed Smith, 19 December 2023) https://www.reedsmith.com/en/perspectives/2023/12/the-role-of-intermediaries-in-the-custody-of-digital-assets accessed 18 Mar. 2025.

[472] UNIDROIT, Draft Principles on Digital Assets and Private Law, Public Consultation Document, Study LXXXII – PC (January 2023) Principle 10, Commentary paras 5–7.

[473] Johan David Michels and Christopher Millard, 'Digital Assets in Clouds' in Christopher Millard (ed), *Cloud Computing Law* (2nd edn, OUP 2021) ch 6, s 3.4.

framework for analysing digital assets, where issues of control and proprietary rights must be disentangled.

Against this background, this section explores the concept of custody as it applies to controlled electronic records, focusing on how control is exercised and the legal implications of such arrangements. Drawing on Chapter 4's framework, the discussion distinguishes between custody agreements and non-custodial relationships. By examining these distinctions, the section aims to clarify the extent of control and responsibility in digital asset management, aiming to explore the liability of the platform in the context of electronic bills of lading, which will be discussed in Chapter 5. The analysis will address whether electronic bills of lading platforms function as custodians or operate under a purely contractual relationship, setting the stage for further exploration of regulatory implications.

4.5.1 Custody of digital assets[474]

The reason for exploring the custody of digital assets lies in the fact that electronic bills of lading are processed by platforms or technology companies. These platforms play a critical role in the creation, storage, transfer, and management of electronic bills of lading, functioning similarly to custodians of digital assets. In the digital asset context, a custodian is typically a regulated entity that holds and safeguards assets on behalf of clients, ensuring security, access, and legal protection against unauthorized transfers or the custodian's insolvency.[475] This parallel arguably helps illustrate how electronic bill of lading platforms operate in practice. To clarify the allocation of control between the platform and the user, this arrangement resembles the custodial model in cloud storage services, where the platform is responsible for maintaining the security and accessibility of the data, while users retain control over the electronic bills of lading through passwords, encryption keys, or other authentication mechanisms. However, this dual-control structure raises questions about the allocation of 'power': Does the platform truly have control over the electronic bills of lading, or is it merely

[474] Again, it should be noted that in this thesis the term "digital asset" corresponds to the concept of "controlled electronic records" discussed in Chapter 4.
[475] Tariq Z. Rasheed and Romin Dabir, *"The Role of Intermediaries in the Custody of Digital Assets"*, Reed Smith LLP (perspective, 18 December 2023) https://www.reedsmith.com/en/perspectives/2023/12/the-role-of-intermediaries-in-the-custody-of-digital-assets accessed 16 September 2025; Jason G Allen, Michel Rauchs, Apolline Blandin and Keith Bear, *Legal and Regulatory Considerations for Digital Assets* (Cambridge Centre for Alternative Finance, CCAF Reports 2020) p27-29.

providing technical support? This ambiguity in power distribution becomes particularly significant in scenarios such as dispute resolution, platform insolvency, or restricted user access. Analysing the custodial arrangements for digital assets may help clarify the legal status and regulatory requirements for electronic bill of lading platforms.

However, despite these pressing questions about the allocation of power in custodial arrangements, academic research on the custody of digital assets remains limited. Existing studies often begin with the custody requirements for traditional assets before extending the discussion to digital assets, typically focusing on issues such as hot and cold storage.[476] For the purposes of this thesis, what is most relevant is the analogy with indirect possession of tangibles: custody in digital assets likewise separates legal rights from factual control, a distinction central to understanding the role of electronic bill of lading platforms.[477] The concept of custody in digital assets mirrors the idea of indirect possession in tangibles.[478] Custody therefore refers to a custodian holding a digital asset on behalf of a client, often with specific obligations to protect the asset from unauthorized access or transfer.[479] The custodian's role is to maintain the asset securely while ensuring that the client retains certain rights over it, such as the ability to access or transfer the asset under agreed conditions.

That said, the boundaries of control in custody arrangements are not always clear. In the Singapore case *Dirak Asia Pte Ltd and another v Chew Hua Kok and another*,[480] the judge clarified that the email user does not technically have possession and custody over the emails, as the emails are stored on mail servers and data centers located in remote locations.[481] The judge observed that to this end, the email provider effectively acts as a custodian of the electronically stored information in the user's email account.[482] This further addresses the

[476] See Wulf A. Kaal & Hayley A. Howe, 'Custody of Digital Assets' (2023) 63 *Jurimetrics Journal* 169–95; V Di Nicola et al, 'Resilient Custody of Crypto-Assets, and Threshold Multisignatures' (2020); HJ Lim et al, 'Comparative Analysis of Security Features and Risks in Electronic Wallets' (2025) *Electronics*.
[477] Since this thesis focuses on electronic bills of lading, this section will not provide detailed technological discussions here.
[478] Kaal WA and Howe H, 'Custody of Digital Assets' (5 October 2021) U of St. Thomas (Minnesota) Legal Studies Research Paper No 22-05 https://ssrn.com/abstract=3936876 accessed 18 March 2025.
[479] Reed Smith, 'The Role of Intermediaries in the Custody of Digital Assets' (Reed Smith, 19 December 2023) https://www.reedsmith.com/en/perspectives/2023/12/the-role-of-intermediaries-in-the-custody-of-digital-assets accessed 18 Mar. 2025.
[480] *Dirak Asia Pte Ltd and another v Chew Hua Kok and another* [2013] SGHCR 1 ("*Dirak Asia*"), [12].
[481] Ibid.
[482] Ibid.

question and sheds light on the interesting and broader inquiry into the extent to which a cloud user can be said to have 'power' over the electronically stored information in the possession and custody of a cloud provider.[483] The following section begins with the legal effects of indirect possession in law, then explores how indirect control, or 'custody', of digital assets is achieved, and where the boundaries of 'power' lie.

The boundaries of 'power' in digital custody are shaped by both technical and legal factors. Technically, the custodian's control is limited by the user's ability to access and manage their data through encryption keys or authentication mechanisms. Legally, the custodian's obligations are defined by the terms of the custody agreement, which may include provisions for data security, access rights, and dispute resolution. For instance, UNIDROIT's framework emphasizes that custody agreements must provide clients with special protection against unauthorized transfers and the custodian's insolvency.[484] This ensures that the client's proprietary rights are safeguarded, even if the custodian technically controls the asset.

However, the boundaries of power become blurred in cases of self-custody or non-custodial arrangements. In self-custody, the user retains full control over their digital assets, often through private keys stored on their own devices or in non-custodial wallets. This arrangement shifts the balance of power entirely to the user, eliminating the need for a custodian. Non-custodial wallets, for example, allow users to store and manage their digital assets independently, with the service provider merely offering software or hardware infrastructure. In such cases, the relationship between the user and the provider is purely contractual, governed by the terms of service rather than custody laws.

In conclusion, the analysis of digital assets (controlled electronic records) custody highlights the central tension between legal rights and factual control, a distinction that is equally pertinent to electronic bill of lading platforms. While this section focused on custody as it is understood in the digital asset context, the following section develops this thesis's own approach to custody and in Chapter 5 we will examine how far it may be applied to electronic bills of lading.

---

[483] Ibid., [14].
[484] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 10, Commentary 1.

4.5.2 Proposed substantive approach: custody

This thesis proposes a substantive approach to custody of controlled electronic records. In developing this approach, particular reference is made to the UNIDROIT Draft Principles on Digital Assets and Private Law, which provides a detailed and influential framework for analysing custodial arrangements involving digital assets.

In the substantive approach adopted in this thesis, custody of controlled electronic records is understood as a legal arrangement where one person holds a digital asset on behalf of and for the benefit of another person, the client, in a manner that affords the client protection against unauthorised transfers of the asset and against the custodian's insolvency. This understanding is consistent with the approach set out in Section IV (Articles 10–13) of the UNIDROIT Draft Principles on Digital Assets and Private Law.[485]

On this basis, whether the services provided by a business constitute custody service depends on the nature of the agreement between the business and its client.

In particular, according to UNIDROIT Draft Principles on Digital Assets and Private Law,

> "an agreement for services to a client in relation to a digital asset is a custody agreement if: (a) the service is provided in the ordinary course of the service provider's business; (b) the service provider is obliged to obtain (if this is not yet the case) and to maintain the digital asset for the client; and (c) the client does not have the exclusive ability to change the control of the digital asset within the meaning of Principle 6(1)(a)(iii)."[486]

These criteria reflect the circumstances in which custody arises under the framework drawn upon in this thesis.

In the approach adopted in this thesis, custody is an example of a situation where one person may exercise factual control a digital asset while another person (the client) may have a proprietary right in that asset.[487] This is the case with electronic bill of lading systems, where the platform controls access to and management of the record, while the legal rights in the bill,

[485] Ibid., Principle 10, Commentary 1.
[486] Ibid., Principles 10, (3).
[487] Ibid., Principle 10, Commentary 1.

such as the right to delivery of the goods, remain with the shipper, carrier, or endorsee. The extent to which this model applies to electronic bills of lading will be examined in detail in Chapter 5.

It is noteworthy that Principle 10(2) introduces the concept of 'maintaining' a digital asset, which is broader than the concept of control. The term 'maintain' is defined to encompass two situations: first, where a custodian controls an asset in the sense of the control principle, and secondly, where a custodian receives custody services, meaning that in the presence of multiple layers of custodians, the next layer of custodian is responsible for controlling the asset for the upper layer custodian.[488] It is arguably necessary to focus on dissecting the concept of 'maintain', as this aids in analyzing the extent of 'control' the electronic bill platform has over electronic bills.

In the substantive approach proposed, it is equally important to clarify the situations in which custody does not arise. Under this approach, no custodial relationship exists where a service provider merely supplies the technical means, whether hardware or software, by which a user stores and uses private keys, without assuming responsibility for maintaining or safeguarding the digital asset. In such cases, the relationship between the user and the service provider is purely contractual and governed by the terms of their agreement. This understanding is consistent with the position reflected in the UNIDROIT Draft Principles.[489] In my view, this relationship bears similarities to that between electronic bills of lading platforms and the wallets of digital assets, which will be further elaborated on in Section 5.5.

To further explain why wallets used by users constitute a pure contractual relationship, this thesis examines self-custody and non-custodial wallet arrangements. In this thesis, self-custody is understood as a situation in which users retain control over digital assets by holding their own private keys, whether through software deployed on personal devices or through cloud-based software-as-a-service solutions, an understanding that is consistent with the approach reflected in the UNIDROIT Draft Principles.[490] The shared characteristic of these two

[488] Ibid., Principle 10, Commentary 4.
[489] Ibid., Principle 10, Commentary 10. No custody agreement exists where "the provider of the wallet used by the investor only provides the means (hardware or software) by which the investor stores and uses her private keys".
[490] Ibid., Principle 10, illustration 11-12.

cases is that the client controls the digital assets. This mirrors the control exerted over electronic bills of lading, aiming to replicate the functions of physical bills of lading offline.

UNIDROIT provides an example of a non-custodial wallet (software-as-a-service) arrangement, in which a business offers a non-custodial wallet to users who create their own account and password. This password gives the users access to the "an encrypted file kept by Y on the blockchain containing a 'seed' (a Secret Private Key Recovery Phrase), the users' private keys and addresses of digital assets. The password is not stored by Y and must be kept safe and confidential by the user herself."[491] This practice model closely resembles the way in which digitisation bills of lading are managed on digital platforms.

In conclusion, the substantive approach proposed in this thesis distinguishes custody from non-custodial arrangements by reference to the allocation of responsibility for maintaining controlled electronic records. Building on this, the substantive approach rests on two guiding propositions. First, custody exists where one party maintains controlled electronic records for another in a way that protects proprietary rights despite the separation of control and ownership. Secondly, no custody arises where a provider merely facilitates user self-management of controlled electronic records without assuming responsibility for maintenance or security.

Upon closer examination, electronic bill of lading platforms appear to resemble more of a self-custody or non-custodial scenario, suggesting that their role is primarily contractual, governed by the agreement between the parties. However, the precise determination of whether this constitutes custody, along with related questions such as the necessity of regulation for electronic bill of lading platforms and how such regulation should be implemented, will be addressed in the subsequent analysis. The next chapter will test the implications of this approach in the specific context of electronic bills of lading platforms.

4.6 Conclusion

In response to the limitations discussed in Chapter 3, Chapter 4 proposed a new substantive approach that focuses on controlled electronic records themselves rather than drawing

[491] Ibid., Principle 10, illustration 13.

analogies with their offline counterparts. While this approach draws on the UNIDROIT framework as a point of departure, it departs from it in important respects and adapts its principles to the specific concerns of this thesis.

The approach is structured around four interrelated dimensions: definition, control, proprietary rights, and custody.

First, a controlled electronic record is defined as information stored in an electronic medium, capable of being retrieved, and subject to control. Secondly, control is established when a person has the exclusive ability to benefit from the record, to prevent others from benefiting, and to transfer these abilities to another. Thirdly, proprietary rights in controlled electronic records depend on their classification into categories such as access information, tangible controlled electronic records, intangible controlled electronic records, and metadata. Finally, custody exists where one party maintains controlled electronic records on behalf of another in a way that safeguards proprietary rights despite the separation of control and ownership, whereas no custody arises when a provider merely enables user self-management without assuming responsibility.

A key finding of this chapter is that the substantive approach provides a more coherent and adaptable foundation for electronic bills of lading. This framework sets the stage for Chapter 5, which applies the substantive approach to electronic bills of lading. Moving from theory to practice, the next chapter examines whether the substantive approach can deliver both conceptual clarity and practical regulatory guidance through its four dimensions.

Chapter 5 Applying the Substantive Approach to Electronic Bills of Lading

5.1 Introduction

This chapter applies that the substantive approach set out in Chapter 4 to electronic bills of lading. Using case analysis, it will test whether the framework developed in Chapter 4 can resolve the legal uncertainties surrounding electronic bills of lading and provide a more coherent regulatory foundation.

The following sections assess how the four dimensions of the substantive approach, definition, control, proprietary rights, and custody, apply to electronic bills of lading, thereby testing both its coherence and practical implications.

5.1.1 Purpose and scope

The core objective of this chapter is to scrutinize the 'substantive approach', as detailed in Chapter 4, assessing its applicability and practical efficacy within the specific context of electronic bills of lading. The purpose is not simply to describe the framework but to evaluate its practical effectiveness for regulating electronic bills of lading.

The scope of evaluation in this chapter focuses on the substantive approach's ability to resolve legal issues associated with electronic bills of lading. These issues specifically include the legal definition of electronic bills of lading, the construction of control mechanisms, proprietary nature, and related custody arrangements. This chapter thus validates the substantive approach as a proposed solution, rather than only analysing past problems.

5.1.2 Methodology

The methodology starts by analysing of the legal issues pertinent to electronic bills of lading. The key frame of reference for this initial exploration is an examination of traditional paper bills of lading, from which the electronic bill of lading is functionally derived.

Understanding the legal functions and challenges of paper bills of lading is the logical starting point for identifying what functions electronic bills of lading must achieve and where the difficulties lie. Paper bills of lading perform three core functions, receipt of goods, evidence of the contract of carriage, and, crucially, a document of title, which provide the basis for analysing the electronic context.

The identification and prediction of key legal issues for electronic bills of lading are not based solely on abstract theoretical deduction. Instead, the analysis is supported by qualitative interviews with industry stakeholders and by existing commercial practices, ensuring that the identified issues are of genuine legal and practical significance.[492]

After clearly defining the relevant legal issues, this chapter systematically evaluates how the substantive approach, as conceived in Chapter 4, can address these identified challenges. This evaluation forms the core analytical thrust of the chapter. By predicting issues, this research aims to be forward-looking, anticipating challenges before they escalate or evolve into major legal disputes. This proactive stance is essential for developing durable legal solutions, and the substantive approach is being tested for its potential to offer such foresight or adaptability.

The analysis therefore concentrates on four dimensions: definition, control, proprietary rights, and custody, which correspond to Sections 5.2–5.5.

5.2 Defining electronic bills of lading

This section critically examines the definitional challenges of electronic bills of lading. The central difficulty lies in the fact that they must perform the same key functions as paper bills of lading: receipt, evidence of the contract of carriage, and document of title. However, in a digital environment, these functions are quite difficult to replicate. Unlike paper bills, whose status has been shaped by centuries of commercial practice, electronic bills face both technical and legal uncertainties.

Section 5.2 is structured into four distinct parts:

[492] The qualitative interviews referred to here were semi-structured interviews conducted with stakeholders directly involved in electronic bills of lading practice, including carriers, banks, technology providers, industry standard-setting bodies, and representatives of international organisations. The interview methodology, scope, and ethical approval are set out in Chapter 1, Section 1.3.

Section 5.2.1 will explore the challenges in defining electronic bills of lading. This involves contrasting them with traditional paper bills of lading to highlight the unique difficulties that arise in the electronic context, particularly concerning their definition and scope. It identifies five difficulties: (i) inherited ambiguity from paper bills of lading, (ii) the functional equivalence dilemma, (iii) jurisdictional disparities in legal recognition, (iv) diversification of issuing entities, and (v) incomplete information. These subsections illustrate how definitional weaknesses undermine the development of electronic bills of lading and why a substantive approach offers a more stable conceptual foundation.

Section 5.2.2 will apply the substantive approach to the definition and legal nature of electronic bills of lading as controlled electronic records. Through the examination of specific occasions and relevant legal developments such as the MLETR and national enactments like the UK's ETDA 2023, this subsection will illustrate how the substantive approach can clarify the definition and scope of electronic bills of lading. It will further analyse how this approach supports the characterisation and legal treatment of electronic bills of lading as distinct electronic records, capable of conferring rights and being securely managed.

Finally, Section 5.2.3 will provide an evaluation: assessing the extent of the contribution of the substantive approach to defining electronic bills of lading. This concluding part of the section will critically assess the strengths and limitations of the substantive approach in resolving the identified definitional ambiguities and in establishing a robust legal understanding of electronic bills of lading for the future of digital trade.

By systematically addressing these aspects, this section aims to demonstrate the merits of the substantive approach in overcoming the definitional hurdles that have historically impeded the full legal and commercial potential of electronic bills of lading.

5.2.1 Challenges in definition

It is difficult to create a clear and widely accepted legal definition for electronic bills of lading. The main reason is that electronic bills of lading need to perform the same key functions as traditional paper bills of lading, but in a digital format. This section therefore begins by contrasting the well-established legal features and real-world use of paper bills of lading with the newer and still developing form of electronic bills of lading.

The section then points out identifies the main legal challenges caused by unclear definitions. All these issues reflect the central difficulty: electronic bills of lading cannot fully replicate the essential legal functions of paper bills of lading and, in addition, face their own challenges arising from the electronic environment.

5.2.1.1 Inherited ambiguity from paper bills of lading

The definitional uncertainty surrounding electronic bills of lading is not new. It reflects longstanding ambiguities in paper practice. Historically, bills of lading emerged in medieval Mediterranean trade as simple receipts, later evolving into evidence of contracts of carriage and eventually documents of title.[493] Their legal character has always been shaped by commercial practice rather than fixed legal concepts, which explains why international conventions such as the Hague Rules, Hague-Visby Rules, and Rotterdam Rules refrain from offering precise definitions. Hamburg goes further in Article 16, addressing their nature, reservations, and evidentiary effect.[494] According to the customs of merchants, the bill represented the right of the holder to the delivery of the goods.[495] As Aikens observes, the bill of lading was considered to confer the right of delivery to the holder because it was seen as a document of title. However, the historical evidence on when exactly this function emerged is limited, and common law courts did not treat bills of lading as having such an exclusive function during the early period.[496]

National approaches also diverge: the US Uniform Commercial Code defines a bill of lading as "a document of title evidencing the receipt of goods for shipment issued by a person engaged…", whereas UK law under the Carriage of Goods by Sea Act 1992 and Singapore's Bills of Lading Act 1992 regulate their functions without defining them directly.[497] They regulate the

---

[493] See Sinclair T, *Eastern Trade and the Mediterranean in the Middle Ages: Pegolotti's Ayas-Tabriz Itinerary and its Commercial Context* (1st edn, Routledge 2019); Fusaro M, 'Trade, Violence and Diplomacy' in *Political Economies of Empire in the Early Modern Mediterranean: The Decline of Venice and the Rise of England, 1450–1700* (Cambridge University Press 2015) 129.
[494] United Nations Convention on the Carriage of Goods by Sea (Hamburg, 1978) (the "Hamburg Rules"), Article 16.
[495] Richard Aikens and others, *Bills of Lading* (3rd edn, Routledge 2021), 1.25.
[496] Ibid., 1.26.
[497] US: Uniform Commercial Code (U.C.C.) $1-201(b)(6); UK: The Carriage of Goods by Sea Act 1992 (UK), 4 and 5; Singapore Bills of Lading Act 1992 (Cap 384), which does not define a bill of lading, following the structure of the UK Carriage of Goods by Sea Act 1992.

rights, liability, representation and interpretation for bills of lading, but no direct definition.[498] Chinese Maritime Law follows a functional approach, again defining by reference to functions rather than form.[499]

This functional vagueness rarely disrupts paper practice in the majority of cases: a document boldly headed "BILL OF LADING" is almost universally treated as such. However, in marginal cases, such as negotiable house bills issued by freight forwarders (*Australian Capital Financial Management v Freight Solutions*) or "Vopak BLs" issued in the Singapore bunker oil trade: the courts have been forced to determine whether a given document truly performs the functions of a bill of lading.[500] As highlighted in *Australian Capital Financial Management v Freight Solutions (Vic) Pty Ltd (ACFM v Freight Solutions)*,[501] the New South Wales (NSW) District Court likened bills of lading to an elephant, describing them as easier to recognize than define.[502] In this case, the key issue was whether the negotiable house bills issued by the freight forwarder, together with the negotiable ocean bills, could be considered bills of lading.[503] The judge held that "the bills of lading issued by the Defendant were not negotiable ocean bills or liner bills,"[504] because the issuance of the house bills was not authorized by carrier. Additionally, they were not bearer bills of lading and did not function as documents of title.[505] The bunker oil trade in Singapore and Malaysia illustrates a similar uncertainty, where documents resembling bills of lading may

[498] Bills of Lading Act 1992(2020 revised edition) (UK).
[499] Maritime Law of People of Republic of China, Article 17. The amendments to the Chinese Maritime Law, adopted on 28 October 2025 and entering into force on 1 May 2026, make no change to the definition of a bill of lading, see PKULaw, https://open.pkulaw.com/hwchl/bebde58386c0110dbdfb.html, accessed on November 2025.
[500] See the Hong Kong case of *Vastfame Camera Ltd Birkhardt Globistics* [2005] 4 HKC 117; the New Zealand case of *Emery Air Freight Corporation v Nerine Nurseries Ltd* [1997] 3 NZLR 723 (CA); the Singapore case of *Ocean Projects Inc v Ultratech Pte Ltd* [1994] SGCA 64, [1994] 2 SLR(R) 245.
[501] *Australian Capital Financial Management Pty Ltd v Freight Solutions (Vic) Pty Ltd* [2017] NSWDC 279.
[502] Ibid., para. 66: "In the textbook Bills of Lading, Aikens, Lord and Bools (2006) the learned authors say at paragraph 2.1: "Like an elephant, a bill of lading is generally easier to recognise than to define." See also analysis by Norton Rose Fulbright, 'House v Ocean – The Complexities of Bills of Lading' (Norton Rose Fulbright, 1 October 2018) <https://www.nortonrosefulbright.com/en-sg/knowledge/publications/af4149e0/emhouse-v-oceanem--the-complexities-of-bills-of-lading> accessed 3 June 2024.
[503] Martin Davies, 'Freight forwarder's "house bill of lading"—misleading or deceptive conduct—breach of warranty of authority' (2018) LMCLQ <https://www.i-law.com/ilaw/doc/view.htm?id=391436#CLQ:20181001.1> accessed 3 June 2024.
[504] *Australian Capital Financial Management Pty Ltd v Freight Solutions (Vic) Pty Ltd* [2017] NSWDC 279, para. 82.
[505] Ibid., para. 75-79, 91-101.

function as such in practice until legally challenged.[506] The problem of incomplete information, the need to establish intent for the document of title function, and difficulties in identifying the lawful holder are recurring themes in case law.[507]

When transposed into the electronic context, these definitional ambiguities are not merely inherited but potentially magnified. The legal status and applicability of electronic bills of lading may vary across different countries and regions. Additionally, the technical standards and operational procedures of various electronic bills of lading platforms are inconsistent, making it challenging to uniformly recognize the legal validity and functions of electronic bills of lading in legal practice.

The primary concern is the variation in legal recognition of electronic bills of lading across different countries.[508] Some experts believe that laws, standards, and technology are the three critical factors for promoting electronic bills of lading, with unified legal recognition being particularly crucial.[509] Although international treaties and model laws support the legal status of electronic bills of lading, the specific provisions of domestic laws vary, leading to challenges in their application in international trade.[510] For example, in China, while the Electronic Signature Law of the People's Republic of China and the Contract Law of the People's Republic of China establish the legal validity of electronic signatures and electronic contracts, there is still a lack of clear legal guidance on the specific operation and implementation of electronic bills of

---

[506] As in *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100, where the judge considered the question "When is a bill of lading not a bill of lading?".

[507] In *Arc-en-Ciel Produce Inc v The Ship "BF Leticia"* 28 2022 FC 843; [2022] Lloyd's Rep Plus 105, the judge distinguished between the seaway bill and bills of lading to determine whether the documents involved fall within the scope of Hague-Visby Rule. In *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100, the judge considered the question "When is a bill of lading not a bill of lading?". Further relevant cases include *The Cherry and others* [2003] 1 SLR(R) 471, esp para. 27; *Sze Hai Tong Bank Ltd v Rambler Cycle Co Ltd (PC)* [1959] 2 Lloyd's Rep 114; [1959] AC 576, at 586; *East West v DKBS* [2003] Q.B. 1509; [2003] 1 Lloyd's Rep 239 esp at [61].

[508] See for examples, UNCITRAL, *Model Law on Electronic Transferable Records* (2017); Electronic Trade Documents Act 2023 (UK); Electronic Signature Law of the People's Republic of China (adopted 28 August 2004; amended 24 April 2015 and 23 April 2019); Regulation on Implementation of the Provisions of the Commercial Act Regarding Electronic Bills of Lading (South Korea); Electronically Recorded Monetary Claims Act (Japan); Electronic Transactions Act 2010 (Singapore, Rev Ed 2011).

[509] Trade Finance Global, 'Electronic Bills of Lading: Are We There Yet?' (Trade Finance Global, 17 May 2023) <https://www.tradefinanceglobal.com/posts/electronic-bills-lading-are-we-there-yet/> accessed 25 May 2024.

[510] UNCITRAL, Model Law on Electronic Transferable Records (2017).

lading.[511] This can limit the practical use of electronic bills of lading in trade, as some businesses and legal entities may doubt their legal validity. However, the 2025 revision of the PRC Maritime Law introduces a new section on "electronic transport records", which formally recognises the legal status of electronic bills of lading and clarifies the conditions under which they are treated as equivalent to traditional paper documents.[512] In the United States, the UETA and the Electronic Signatures in Global and National Commerce Act (E-SIGN Act) provide a legal framework for electronic bills of lading.[513] However, in practice, the use of electronic bills of lading must still comply with specific industry and state requirements, adding to the consistency challenges of applying electronic bills of lading across different jurisdictions.[514]

A primary reason why the recognition of electronic bills of lading remains inconsistent across jurisdictions is the lack of a clear definition. From a certain perspective, the legal issues associated with electronic bills of lading are similar to those of paper bills of lading. The determination of whether a paper document qualifies as a bill of lading can depend on whether its back clearly specifies its function, such as delivery of goods against the presentation of bills of lading or other features indicating the parties intended the document to serve as a contractual document and/or a document of title.

Clearly indicating its function as a document of title is crucial in distinguishing between seaway bills and bills of lading. This distinction is significant for the liability involved in delivery without presentation. If it is a seaway bill, then the document is not a bill of lading, and the shipowner is not liable for delivery without presentation, whereas for a bill of lading, the carrier would be liable. This principle was affirmed in *The Rafaela S*,[515] where the House of Lords held that a straight bill of lading, despite being non-negotiable, was still a bill of lading because it required

---

[511] Electronic Signature Law of the People's Republic of China (adopted 2004, as amended) and the Contract Law of the People's Republic of China (1999). The Contract Law of the People's Republic of China was repealed with effect from 1 January 2021, and its provisions were incorporated into the Civil Code of the People's Republic of China.
[512] Maritime Law of the People's Republic of China (2025 Revision), ch IV s 5 "Electronic Transport Records" (adopted 2025, effective 1 May 2026).
[513] Uniform Electronic Transactions Act (US, 1999); Electronic Signatures in Global and National Commerce Act (E-SIGN), 15 USC §§ 7001–7031 (2000); UCC § 7-106 (Amended 2003).
[514] BIMCO, *Electronic Bills of Lading Clause 2014* (BIMCO) https://www.bimco.org/contractual-affairs/bimco-clauses/current-clauses/electronic-bills-of-lading-clause-2014/ accessed 18 September 2025.
[515] *J I MacWilliam Co Inc v Mediterranean Shipping Co SA (The Rafaela S)* [2005] UKHL 11, [2005] 2 AC 423.

presentation for delivery. The case underscores the centrality of the document of title function in determining liability and highlights why clarity of function is essential for both paper and electronic bills of lading.

Observing the definitions from international organisations and various countries, the main methods of defining electronic bills of lading are as follows.

The first method takes functional equivalence as the approach to define electronic bills of lading. It posits that the functional equivalent of paper bills of lading is electronic bills of lading. Examples of this definition usually mention traditional bills of lading first, followed by their electronic form.[516] The primary critique of this approach is that electronic bills of lading cannot naturally fulfill all the functions of paper bills of lading, leading to circular reasoning.[517] It presumes that electronic bills of lading are valid because they are said to perform the same functions as paper bills of lading, while at the same time justifying their validity by reference to the very fact that they are treated as equivalent. This circular reasoning does not independently demonstrate that electronic bills of lading can in fact fulfil all the functions of their paper counterparts.

The second approach categorizes electronic bills of lading as electronic records or electronic transport records. This definition shifts focus from the functions of the bill of lading to its electronic nature, using a generalized description of 'record' to define it. This approach is exemplified by international organisations. In the Rotterdam Rules, electronic bills of lading are considered a type of electronic transport record.[518] Similarly, under the MLETR, electronic bills of lading are classified as electronic transferable records.[519] This understanding was confirmed

[516] Like the MLETR, Rotterdam Rules.
[517] H van Boom, 'Certain Legal Aspects of Electronic Bills of Lading' (Academia.edu, 2016) https://www.academia.edu/19631708/Certain_Legal_Aspects_of_Electronic_Bills_of_Lading accessed 27 May 2025; Sicong Chen, 'The Electronic Bill of Lading – A Problem of Functional or Legal Equivalence?' (2021) https://www.researchgate.net/publication/350192580_The_Electronic_Bill_of_Lading_-_A_Problem_of_Functional_or_Legal_Equivalence accessed 27 May 2025; Stephen C Chukwuma, 'Can the Functions of a Paper Bill of Lading Be Replicated by Electronic Bill of Lading' (2013) 3(10) Public Policy and Administration Research 99 https://www.iiste.org/Journals/index.php/PPAR/article/view/7106 accessed 27 May 2025.
[518] Rotterdam Rules, 2008) art 1(18), definition of "electronic transport record".
[519] UNCITRAL, Model Law on Electronic Transferable Records (2017) art 2(d).

in interviews, which showed that electronic bills of lading are commonly understood in practice as the electronic version of paper bills of lading.[520]

In conclusion, the definitional uncertainty of electronic bills of lading is not merely technical but structural, inherited from the paper regime and amplified in the electronic environment. While functional equivalence offers a convenient starting point, it risks circularity and fails to resolve the deeper ambiguity over the document of title function. By contrast, categorising electronic bills of lading as controlled electronic records provides greater conceptual clarity, but it also shifts the debate towards the adequacy of the legal framework in securing their functions. Thus, the definitional debate is not only about what electronic bills of lading are, but about how the law chooses to balance continuity with innovation in regulating digital trade documentation.

5.2.1.2 Functional equivalence dilemma

This subsection focuses on the functional equivalence dilemma, which constitutes a key difficulty in defining electronic bills of lading, particularly in relation to the document of title function. The three main functions of paper bills of lading face significant challenges in the transition to electronic bills of lading. As many scholars argue, it is questionable whether electronic bills of lading can equivalently fulfill all the functions of their paper counterparts.[521] The transfer and verification methods of electronic bills of lading as documents of title will differ from paper bills of lading, raising issues of legal recognition of electronic signatures and electronic authentication.

The most critical difficulty arguably lies in reproducing the document of title function. For paper bills of lading, its absence can mean the document is not a true bill of lading (e.g. *Vopak BL* cases)[522]. For electronic bills of lading, this involves challenges with electronic signatures, authentication, and ensuring a single, controllable 'original'.[523]

---

[520] From the interview with the COSCO Shipping (17 October 2022).
[521] See Thomas Krebs, 'Electronic Bills of Lading, Transnational and English Law: Blocking the Blockchain?' (2024) Uniform Law Review unad022, 6-7; M Hwaidi and G Ferris, 'Switching from Paper to Electronic Bills of Lading: Part 2. Fundamental Sociological Structure, Distributed Ledger Technology and Legal Difficulties' (2020) 25(5) Journal of International Maritime Law, 16-18.
[522] See this thesis in 5.2.1.1.
[523] Ibid.

In paper bills of lading, this function is captured by the phrase "delivery of goods against presentation of the bill of lading," by other indicators that parties intended to operate the documents as contractual documents and/or as documents of title. Without such a feature, the document may still serve as a contractual document, but it would not qualify as a bill of lading in the full legal sense.[524] The 'Vopak BL' in *The Star Quest*[525] illustrate this point. In *Phillips 66 International Trading Pte Ltd v Owner and/or Demise Charterer of the vessel Star Quest*[526]*and* the *"Luna" and Another Appeal*[527], the Vopak Terminal in the Port of Singapore generated several documents in respect of bunkers supplied to the vessels, including a document issued in triplicate entitled "Bill of Lading" ("the Vopak BLs").[528] The High Court of Singapore noted that the Vopak BLs had several unusual features. For instance, no express port of discharge was stated in Vopak BL.[529]

As illustrated in *Phillips 66 International Trading Pte Ltd v The Owners* and "the *Vopak BL* case", the documents issued by Vopak were held not to be bills of lading because they lacked the third function of a bill of lading. The third function means "the transfer of which operates as a transfer of the constructive possession of the goods covered therein since it is generally agreed that a document can have that status only if it does have to be produced to the carrier by the person claiming delivery of goods".[530] In other words, the essence of this function is captured in the phrase "delivery of goods against presentation of the bill of lading." Where this phrase is absent on the bills of lading, the document ceases to function as a true bill of lading. The court in *Star Quest* confirmed this by holding that the Vopak bills did not constitute bills of lading in law.[531] This problem translates directly into the electronic context: electronic bills of lading may

---

[524] *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100 at [17]-[21]; *BNP Paribas v Bandung Shipping Pte Ltd* (SGHC) [2003] SGHC 111; [2003] 3 SLR(R) 611, para. 26; See *Jl MacWilliam Co Inc v Mediterranean Shipping Co SA (The Rafaela S)* [2003] EWCA Civ 556; [2003] 2 Lloyd's Rep 113, para. 45; *SA Sucre Export v Northern River Shipping Ltd (The Sormovskiy 3068)* (QBD (Admlty Ct)) [1994] 2 Lloyd's Rep 266, para. 272.
[525] *The Star Quest* [2016] SGHC 100.
[526] *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100.
[527] *The "Luna" and Another Appeal* [2022] 1 Lloyd's Rep. 216 [2021] SGHC 84.
[528] Ibid., at para. 10; *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100, at para. 6.
[529] *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100, at para. 6.
[530] Carver T, Treitel G and B. R, *Carver on Bills of Lading* (Sweet & Maxwell 2017), para. 6-024.
[531] *Phillips 66 International Trading Pte Ltd v Owner and/or Demise Charterer of the vessel Star Quest and the Luna and Another Appeal* [2020] SGHC 86 [90].

superficially resolve disputes that arise in paper practice over whether the document expressly stipulates delivery against presentation. But this does not address the more fundamental concern: whether an electronic system can guarantee the uniqueness, control, and legal recognition necessary for such a stipulation to carry the same substantive effect as in the paper context.

Closely related is the problem of identifying the lawful holder. In paper bills of lading, statutory frameworks such as s 5(2)(a) of Singapore's Bills of Lading Act clarify that the named consignee in possession of the bill becomes the lawful holder, provided possession is obtained in good faith.[532] The courts have consistently treated the manner of acquisition as irrelevant. For example, in *UCO Bank v Golden Shore Transportation Pte Ltd*,[533] the Court of Appeal confirmed that a consignee in possession of the bill becomes the lawful holder under s 5(2)(a), regardless of the chain of transfer. Similarly, in *The Aegean Sea*,[534] 'good faith' was interpreted narrowly to connote honest conduct, not the mode of acquisition. Together, these cases underscore that for paper bills, once possession and good faith are shown, lawful holder status is established.

By contrast, electronic bills of lading operate very differently, though the court considered the definition of a lawful holder unrelated to 'the way' in which a party becomes the lawful holder of a paper bill of lading. Some systems that issue electronic bills are closed, such as Bolero, essDOCS or E-Title, but others, such as Wave BL are accessible to the public.[535] Therefore, 'the way' in which a party becomes the lawful holder is quite different via different systems and especially for third parties involved who do not have access to the systems and platforms.

The possession and circulation of bills of lading, including their issuance, holding, transfer, and endorsement, become more complicated in the electronic environment than in the traditional paper-based system. Unlike tangible possession of paper bills, electronic 'possession' is

---

[532] Singapore's Bills of Lading Act 1992 (Cap 384, 1994 Rev Ed Sing), s 5(2)(a).
[533] *UCO Bank v Golden Shore Transportation Pte Ltd* [2005] SGCA 42, [2006] 1 SLR(R) 1.
[534] *The Aegean Sea* [1998] 2 Lloyd's Rep 39 (CA), at [19].
[535] "E-Bills of Lading THE SMART CHOICE GOING FORWARD?", https://www.khaitanco.com/sites/default/files/2021-12/E-bills%20of%20lading%20-%20Article%20Legal%20Era.pdf#:~:text=Until%20recently%2C%20EBLs%20could%20be%20used%20effectively%20only,central%20registry%20such%20as%20Bolero%2C%20essDocs%20or%20E-Title; "Bolero Rulebook and Title Registry", https://www.bolero.net/rulebook-and-title-registry/; "essDOCS Solutions", https://www.essdocs.com/solutions, accessed on 9 May 2023.

mediated by technological tokens and identity checks, creating vulnerabilities to fraud, hacking, or unauthorised access.

In other words, this relatively straightforward rule is disrupted in the electronic environment. Electronic bills of lading are issued, transferred, and endorsed through different technological platforms, each with distinct methods of verifying identity and assigning control. Closed systems like Bolero and essDOCS restrict access to members, while open systems such as Wave BL allow wider participation. As a result, 'the way' in which a party becomes the holder, irrelevant for paper bills, becomes a decisive issue in electronic bills of lading. Furthermore, while possession of a paper bill is tangible and visible, electronic 'possession' is mediated by passwords, tokens, or title registries, creating vulnerabilities to fraud, hacking, and unauthorised access.[536]

In conclusion, the difficulties of replicating the document of title function and of identifying the lawful holder demonstrate why the notion of functional equivalence cannot provide a stable foundation for electronic bills of lading. These two challenges expose the structural limits of treating electronic bills of lading as mere digital counterparts of paper bills and highlight the need for a substantive approach.

5.2.1.3 Legal recognition and jurisdictional disparities

The legal recognition of electronic bills of lading varies significantly across jurisdictions, creating uncertainty in their cross-border applicability. Unlike paper bills of lading, whose status has been stabilised by centuries of commercial practice despite definitional ambiguities, electronic bills depend primarily on statutory reform and international harmonisation. This makes the absence of a universal definition more problematic in the electronic context than in the paper-based one.

Furthermore, while deep roots in commercial practice and the reliance on customary usage often fill definitional voids for paper bills of lading (as illustrated by the bunker oil scenario where documents function as bills of lading despite potential definitional ambiguities),[537] this

[536] Aviv Gaon, 'Electronic Bills of Lading and Blockchain Technology' (2020) 25 *Uniform Law Review* 673, 687–689.
[537] As mentioned earlier in *Phillips 66 International Trading Pte Ltd v The Owners* and "the *Vopak BL* case".

dependence on uncodified practice can be a double-edged sword. It allows trade to flow smoothly in many routine transactions. However, when disputes arise, as evidenced by the numerous cited cases, the absence of a clear, codified definition compels courts to interpret custom, intent, and function, leading to case law and potential unpredictability. This reliance on custom for paper bills of lading establishes a challenging precedent for electronic bills of lading, which, being relatively new, lack a comparable depth and breadth of established commercial practice to fall back on. The unresolved legal challenges surrounding paper bills of lading are not merely theoretical: they translate into tangible commercial consequences, including costly litigation, uncertainty in the transfer of title, and vulnerabilities to fraud. These enduring issues form a precarious foundation upon which the more complex systems for electronic bills of lading are currently being constructed.

The comparison with paper bills of lading shows the danger of importing existing uncertainties into the digital environment. If the functional approach already generates definitional ambiguities in paper bills of lading, it becomes even less reliable for electronic bills of lading, where uniformity and cross-border legal certainty are crucial. This underlines a broader difficulty with relying solely on functional equivalence: unless the functions can be replicated consistently across jurisdictions and platforms, functional equivalence provides only a precarious foundation for the development of electronic bills of lading.

5.2.1.4 Diversification of issuing entities

A notable development in the law of bills of lading has been the diversification of issuing entities. Traditionally, bills of lading were issued only by carriers. Over time, however, other actors such as freight forwarders or even terminal operators began issuing documents that resemble bills of lading. Courts have occasionally been asked to decide whether such documents qualify as true bills of lading, particularly where they purport to be negotiable. For example, in *ACFM v Freight Solutions* exemplifies this, where the court examined whether negotiable house bills issued by a freight forwarder could be considered bills of lading.[538] The court concluded they were not, as their issuance was not authorized by the carrier, they were not bearer bills, and they did not function as documents of title.

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

The same issue is likely to become more acute in the electronic environment. Unlike paper bills of lading, which still operate within relatively established industry practices, electronic bill of lading platforms may be operated by third-party technology companies rather than traditional shipping companies or freight forwarders, complicating the legal status of issuing entities. This adds a new layer of complexity to the legal status of the issuing entity: the platform provider is not a party to the contract of carriage. However, it plays a decisive role in the creation, transfer, and control of the electronic bill of lading. As demonstrated by disputes over non-carrier issuance in the paper context, the question of whether documents produced outside the traditional shipping relationship can assume the legal character of bills of lading may become even more acute for electronic bills of lading.

In addition, the proliferation of different electronic platforms raises problems of compatibility and interoperability. Each system may have its own method for creating, endorsing, and transferring bills of lading, which complicates recognition across different jurisdictions and between different trading parties. This is not simply a technical issue, but a legal one: the fragmentation of issuing practices could undermine confidence in the electronic bill of lading as a reliable and uniform legal instrument. Therefore, the diversification of issuing entities, which in the paper world remains relatively limited and exceptional, has the potential to become systemic in the digital world, highlighting the urgent need for legal frameworks that clarify the role and status of technology providers in the issuance of electronic bills of lading.

The above also illustrates the broader difficulty of relying on functional equivalence: if the underlying functions of paper bills of lading cannot be consistently replicated across diversified digital platforms, functional equivalence becomes an unstable foundation for electronic bills of lading. Additionally, compatibility and interoperability issues among different electronic bill of lading platforms need to be addressed.

In conclusion, the diversification of issuing entities, already problematic in paper practice, becomes more acute in the electronic context where technology providers play a central role. Without clear legal recognition of these actors, the reliability and uniformity of electronic bills of lading remain in doubt.

5.2.1.5 Incomplete information

The problem of incomplete information on paper bills of lading also exists with electronic bills of lading. Crucial information on the front of the bills of lading document is incomplete, such as a reference to the location of discharge.[539] Because bill of lading contains or is evidence of the contract of carriage between the shipper and the carrier, incomplete terms may be problematic. Case law illustrates how such issues arise in practice. In *The Boukadoura*,[540] the bill of lading left the port of discharge blank, and the court had to determine whether the omission invalidated the contract of carriage. The judge concluded that while the omission created uncertainty, the document could still operate as a bill of lading if the surrounding circumstances (such as the charterparty terms or trade practice) supplied the missing information.[541] Similarly, in *The Atlas*,[542] the court considered the enforceability of a bill with incomplete voyage details, emphasising that commercial context often determines whether the document can function as a contract of carriage.[543] These disputes underline that the link between the document and the underlying contract of carriage, rather than the mere presence of certain words, is decisive.

When transposed into the electronic environment, the risk of incomplete information becomes more acute. If electronic bills of lading lack crucial information (such as the port of discharge), courts cannot simply rely on external commercial context in the same way as with paper bills. Instead, enforceability will depend on the reliability of the system's data standards and verification protocols. Ensuring the completeness and reliability of information in electronic bills of lading involves the development and application of electronic data exchange standards and data verification technologies.

In conclusion, incomplete or ambiguous information, already problematic in paper bills of lading, poses greater risks in the electronic context. These difficulties expose the limitations of

---

[539] SG Cases: *Phillips 66 International Trading Pte. Ltd. v Owner and/or Demise Charterer of the vessel Star Quest (IMO No. 9529358)* [2016] SGHC 100. See also, in the analogous context of an f.o.b. sale contract failing to identify any port of shipment *Cumming & Co Ltd v Hasell* (1920) 28 CLR 508 at 512; Ewan McKendrick, *Goode on Commercial Law* (Penguin Books, 4th Ed, 2010) at p1034. *The "Luna" and Another Appeal* [2022] 1 Lloyd's Rep. 216 [2021] SGHC 84, where the High Court notes there was no express port of discharge stated in the Vopak BL, and Vopak BL is not the bill of lading.
[540] *The Boukadoura* [1989] 1 Lloyd's Rep 393 (QB).
[541] *he Boukadoura* [1989] 1 Lloyd's Rep 393, 396–397 (QB).
[542] *The Atlas* [1996] 1 Lloyd's Rep 642 (QB).
[543] Ibid., 651–652 (QB).

relying on functional equivalence alone and highlight the absence of a clear legal definition of electronic bills of lading, thereby pointing to the need for a substantive legislative approach. And this whole Section 5.2.1 reinforces the broader theoretical point: if the core functions of paper bills of lading cannot be straightforwardly replicated in electronic form, reliance on functional equivalence alone may be inadequate, pointing instead to the need for a substantive legislative approach.

5.2.2 Applying the substantive approach to definition and nature

This section applies the substantive approach to determine how electronic bills of lading should be defined, with particular focus on whether they qualify as controlled electronic records. We will first review the definitions of electronic bills of lading, combined with the interview evidence to explore what the electronic bill of lading is. Based on explorations, we will then examine whether electronic bills of lading meet the definition of controlled electronic records.

Regarding the definition of the electronic bills of lading in other initiatives, the definition of an ETR in the MLETR is that it "…is an electronic record that complies with the requirements of Article 10"[544]. The working paper of UNCITRAL identifies the purpose of using the term 'ETR' is to apply to electronic records that exhibit functional equivalence to transferable documents or instruments.[545] Bills of lading are transferable documents or instruments.[546] It can be concluded that electronic bills of lading are electronic records that comply with the requirements in Article 10. Similarly, UCC had its Article 7 revised in 2003 to include electronic bills of lading.[547] providing in §7-106 that a person has control of an electronic document of title if the system reliably establishes that person as the one to which the document was issued or transferred.[548] This equates control with possession. The UK Law Commission also affirmed

[544] MLETR, Article 2, "Electronic transferable record".
[545] A/CN.9/WG. IV/WP.139, para. 33; A/CN.9/863, para. 91; see also A/CN.9/797, para. 23.
[546] MLETR, para. 38: "Applicable substantive law should determine which documents or instruments are transferable in the various jurisdictions. An indicative list of transferable documents or instruments, inspired by article 2, paragraph 2, of the Electronic Communications Convention, includes: bills of exchange; cheques; promissory notes; consignment notes; bills of lading; warehouse receipts; insurance certificates;32 and air waybills."
[547] Miriam Goldby and Weishi Yang: 'Solving the Possession Problem: An Examination of the Law Commission's Proposal on Electronic Trade Documents' [2021] Lloyd's Maritime and Commercial Law Quarterly 605-627, p611.
[548] US Legislation, The Uniform Commercial Code, § 7-106.

that when trade documents exist in electronic form, they must replicate the salient features of their paper counterparts to perform the same functions.[549]

Beyond statutory and model law definitions, interviews and industry practice shed light on how electronic bills of lading are understood in reality. These insights help clarify not only what electronic bills of lading are, but also whether they can be conceptualised as controlled electronic records. As discussed in Chapter 2, they fall broadly into two categories: the first category, digitisation bills of lading, dominates the practice: employing technology to transfer paper information into electronic format. Most organisations and national legislatures have been exploring ways to treat it as the equivalent of paper bills of lading.[550] The second type is closely tied to blockchain (DLT) technology, named digitalisation bills of lading, which is not widely used.[551] Currently, the majority of blockchain electronic bills of lading applications are in the pilot phase. [552] The industry acknowledged that blockchain electronic bills of lading have great potential.[553]

Interview evidence further illustrates this divide. In the interview with Hanane Becha, from UN/CEFACT, Vice Chair, she clearly explains the difference between digitalisation and digitisation. The former refers to transforming a paper bill of lading into an electronic bill of lading by uploading or scanning it, while the latter is a digitised electronic bill of lading that does not necessarily exist in paper format at all. A project leader from one of China's largest shipping companies similarly stressed that an electronic bill of lading using digital technology is completely different from an electronic bill of lading where paper bills are scanned and uploaded to the processing platform. Therefore, though in practice a variety of electronic bills of lading exist, there are in essence two distinct forms of electronic bills of lading: one is simply a traditional paper bill of lading that is uploaded into the system through scanning and other methods, and the other is an electronic bill of lading created through digital technology. The biggest difference between the two is that the former has a paper version, while the latter does

[549] UK Law Commission, Electronic trade documents: Report and Bill, para. 3.34-3.38.
[550] As mentioned earlier like UNICTRAL and UNIDROIT.
[551] According to the interviewees from a third-party electronic bills of lading technology provider (21 October 2022) and COSCO Shipping (17 October 2022).
[552] Reference from the email received from the product manager from the essDOCS (24 November 2022), the interviews from a third-party technology provider (21 October 2022), and the electronic bills of lading platform program leader of the COSCO Shipping (17 October 2022).
[553] Ibid.

not necessarily have a paper version of the bill of lading. The most significant legal differences would be which version is considered the 'original'. Original bills of lading are important because they are associated with delivery – one of the three core functions of a bill of lading.

Academic discussions reinforce this distinction. Tyagi mentions that 'digitisation' refers to the conversion of content, whether it exists in hard copy form (such as books, video cassettes, or phonograms) or as an analogous signal, into a digital format. This digital format is represented in binary form, consisting of '0's and '1's.[554] Digitalisation, in contrast to digitisation, is driven by processes, thereby influencing the operations of a value chain.[555] Hanna not only provides a definition for digitisation but also outlines its key milestones and forms.[556] Among these forms, scanning stands out as a typical method of digitisation.[557] Digitalisation's definition is more intricate compared to digitisation because digitalisation is closely intertwined with the transformation of industry digitisation, underscoring its undeniable significance.[558] Similarly, Aalberts and Van der Hof discussed the distinction between electronic signatures and digital signatures as mentioned above. They believe that electronic signatures encompass technologies that serve as alternatives to handwritten signatures, such as scanned images of signatures or PINs.[559] Digital signatures, on the other hand, employ cryptographic encryption to verify the authenticity of electronic communications and ensure their content remains unaltered.[560]

In summary of the above analysis, particularly in conjunction with the interview evidence on electronic bills of lading, I provide two definitions of electronic bills of lading:

[554] Tyagi, Kalpana, Anselm Kamperman Sanders, and Caroline Cauffman, ed. Digital Platforms, Competition Law, and Regulation: Comparative Perspectives. Oxford: Hart Publishing, 2024. Bloomsbury Collections. Web. 25 Mar. 2024, p4-5.
[555] Ibid., p6.
[556] Interviewee from Dr. Hanane Becha, digital trade expert, Vice Chair of UN/CEFACT (21 November 2022).
[557] KT Hanna, 'Definition: Digitization', TechTarget: WhatIs.com, www.techtarget.com/whatis/definition/digitization, accessed on 15 August, 2023.
[558] Stephan Briedenbach & Florian Glatz, 'Digitalisation of Law' (2021) 2021 Ger-Geor J Comp L 1
[559] Aalberts, B.P. & Van der Hof, Simone. (2000). Digital signature blindness analysis of legislative approaches to electronic authentication. The EDI Law Review. 7. 1-55. 10.1023/A:1008995527046, p7.
[560] Ibid.

Digitisation bills of lading refer to the electronic form of paper bills of lading, where the original bill of lading is the paper version, and electronic versions are copies. For example, Bolero[561] and essDOCS[562].

Digitalisation bills of lading refer to electronic bills of lading generated directly online using blockchain/DLT, and other technologies, where the online electronic bill of lading is the original version, and any paper versions are considered copies - for example, Wave BL[563], IQAX, CargoX, edoxOnline, TradeGo, Secro.[564]

The first type of electronic bill of lading, taking Bolero as an example, is not created online at the initial stage of the bill of lading issuance. Instead, it involves signing a paper Bill of Lading offline and then uploading it as a PDF version to form the electronic bill of lading. As stated in the BOLERO FAQs:

> Q. How do I create eBLs? How long does it take?
>
> A: A Bolero eBL is formed of two parts. The first of these is the eBL text. This is created in the same way as a traditional b/l. Rather than issue this as a b/l, this document is then scanned (both sides) to create a PDF document. The carrier (or agent acting on the carriers behalf) logs into the Bolero System and imports this document into Bolero. The next step is to create TRI (shown below), the terms of which will depend on the type of eBL that the shipper has requested. It takes a matter of minutes to create and issue an eBL.
>
> Once the TRI is created this is then electronically signed and sent to Bolero. The Title Registry will record the TRI and will send the eBL to the first Holder (typically the Shipper).

---

[561] Bolero's Digital Trade Finance Platform: The Future of Trade, https://www.bolero.net/, assessed on 2 September 2023.
[562] EssDOCS, https://www.essdocs.com/, assessed on 2 September 2023.
[563] WaveBL mimics traditional Bill of Lading Process, https://wavebl.com/overview/, assessed on 2 September 2023.
[564] BIMCO, Complete Guide to Electronic Bill of Lading Adoption for the Bulk Trades, Published: 17 January 2024, https://www.bimco.org/insights-and-information/general-information/20230828-ebl-guide, assessed on 2 February 2024.

It should be noted, however, that some platforms, including Bolero, have since developed the capability to generate electronic bills of lading natively within the system. As the FAQs state:

> Q. Can I create the eBL directly in Bolero without creating a paper b/l first?
>
> A. Yes, a Bolero eBL can be created directly in the Bolero application. The application combines the b/l text data entered with a Bolero TRI to create an eBL. There is no requirement to create a paper b/l. The eBL including TRI will then be electronically signed and sent to Bolero. The Title Registry will record the TRI and will send the eBL to the first Holder (typically the Shipper).[565]

This approach aligns with the second type of electronic bills of lading, commonly associated with blockchain-based systems: electronic records that are generated, signed, transferred, and managed entirely online. These systems typically assert that their blockchain technology allows for the secure, real-time, and verified exchange of electronic bills of lading along with other trading documents. Within these platforms, users can safely create, sign, endorse, hand over, modify, and submit documents completely online.[566]

As the substantive approach, controlled electronic records means an electronic record which is capable of being subject to control,[567] in which the "'Electronic record' means information which is (i) stored in an electronic medium and (ii) capable of being retrieved."[568] According to this definition, a controlled electronic record, conceptually aligned with digital assets, must satisfy two elements: it must be an electronic record, and it must be capable of being subject to control.

Whether an electronic bill of lading is a controlled electronic record comes down to two questions: (1) Is the electronic bill of lading an electronic record? (2) Can the electronic bill of

---

[565] Bolero, Electronic Bill of Lading for Carriers Frequently Asked Questions (FAQs), p2-3.
[566] See from ELECTRONIC (PAPERLESS) TRADING - TRADEGO EBL SYSTEM, https://www.chinapandi.com/index.php/en/?option=com_attachments&task=download&id=499, assessed on 3 Feburary 2023. Electronic (Paperless) Trading—TradeGo, https://www.piclub.or.jp/en/news/36720, and https://www.piclub.or.jp/wp-content/uploads/2023/01/No.22-023_Electronic-Paperless-Trading%EF%BC%8DTradeGo.pdf, assessed on 3 Feburary 2023.
[567] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 2, Definition (2).
[568] Ibid., Principle 2, Definition (1).

lading be controlled? In this section, we can address the first question, while the second question will be answered at the end of Section 5.3 on Control.

Both digitisation and digitalisation bills of lading are forms of electronic records.

For digitisation bills of lading, the original paper bills of lading are issued, then the paper version is sent to the processing platform, scanned into an electronic version, and then transmitted to the online system or platform. The entire procedure resembles the transmission of information into a physical envelope, which is then sent to the consignee or bank via a similar mail system platform. The information on paper bills of lading is stored in an online system and can circulate within the system, meeting the requirement of being retrievable.[569]

For digitalisation bills of lading, digital signatures and time stamps will be combined with all bills of lading information and any modifications made by various parties. All the information on bills of lading will be packaged, encrypted using hashing algorithms and asymmetric encryption, and transmitted using blockchain technology. Consequently, digitalisation bill of lading is a string of encrypted data in this context, which can be decrypted into a series of information only after decryption by a third-party technology platform and is displayed as the only original bill of lading, which is the only one circulating on the system. Any external or downloaded versions will be displayed as copies.[570]

In conclusion, the substantive approach suggests that electronic bills of lading should be understood not merely through functional equivalence but as electronic records capable of control. Distinguishing between digitisation and digitalisation electronic bills of lading highlights fundamental differences in their legal character, particularly regarding the notion of an ‘original’. This provides a necessary foundation for the following section of the overall evaluation of the substantive approach.

5.2.3 Evaluation

This final part of Section 5.2 looks at both the strengths and the weaknesses of this approach in helping to clarify the definition of electronic bills of lading and in supporting a strong legal

[569] According to the interview from the third-party technology provider (21 October 2022).
[570] According to the interviewee from COSCO Shipping (17 October 2022) and a third-party technology provider (21 October 2022).

framework. The substantive approach offers a better solution. By looking at their key features, it can be determined that, based on the definition and types of electronic bills of lading, they are electronic records within the definition of digital assets (controlled electronic records).

One big advantage of the substantive approach is that it avoids the common 'which comes first' problem that often shows up in functional definitions. Instead of asking an electronic bill of lading to first prove it can function like a paper bill of lading to be an electronic bill of lading, the substantive approach shifts the focus. It begins by defining the electronic bills of lading based on its intrinsic nature as an electronic record that possesses certain essential characteristics - namely, that it can be subject to exclusive control, its integrity can be maintained, and it can be reliably distinguished from copies, typically through the operation of a 'reliable system'.[571] This establishes the electronic bills of lading legal identity based on its inherent digital attributes rather than solely on its ability to mimic a paper-based predecessor.

In conclusion, by focusing on the electronic bill of lading as a controlled electronic record, the substantive approach establishes clear criteria grounded in integrity and controllability, giving it a solid legal footing as a controlled electronic record. Unlike functional equivalence, which leaves definitional uncertainties unresolved, the substantive approach provides a more secure basis for legal recognition. The next step is to assess whether, on this foundation, electronic bills of lading can meet the legal threshold of control. This will be the focus of Section 5.3.

5.3 Control over electronic bills of lading

This section examines the control in relation to electronic bills of lading. Control is central to two of the bill of lading's traditional functions, its role as a receipt for goods and as evidence of the contract of carriage. Although the focus of this section is on control of electronic bills of lading, an examination of how control operates in the paper context provides a necessary analytical reference point. Section 5.3.1 therefore first reviews how these functions operate in the paper context and identifies the legal challenges they pose in the electronic environment. Section 5.3.2 then considers how the substantive approach addresses the legal issues related to control over electronic bills of lading. Finally, Section 5.3.3 evaluates whether this approach offers a more coherent and reliable solution than functional equivalence.

[571] See this thesis in Section 5.2.2.

5.3.1 Legal issues of control

This section addresses the legal issues of control over electronic bills of lading, focusing on how problems originating from paper bills persist or evolve in the electronic environment. It is divided into four parts, each examining a specific challenge. Control is examined because it provides the conceptual foundation for determining how electronic bills of lading produce legal effects in practice. The first two parts address the foundations of control, while the latter sections turn to the implications for carrier liability and contractual relationships.

5.3.1.1 Carrier liability in the electronic context

The receipt function has historically been the first and most basic role of bills of lading.[572] In paper practice, it confirms that the carrier has received the goods in apparent good order and condition, thereby creating reliance for subsequent holders.[573]

Courts in cases such as *Esso Petroleum Co Ltd v Mardon*,[574] *Effort Shipping Co Ltd v Linden Management SA (The Mata K)*,[575] and *Great Elephant Corp v Trafigura Beheer BV (The Atlas)*[576] repeatedly treated the bill of lading as prima facie evidence of the cargo's condition at loading. Where goods were later discharged in damaged conditions, the courts examined the bill of lading's evidentiary value and allocated liability to carriers unless they could rely on recognised exceptions. This demonstrates how, in the paper context, disputes surrounding the receipt function primarily focus on the extent of carrier liability for cargo condition.[577]

When transposed into the electronic environment, this fundamental framework arguably does not materially change. An electronic bill of lading issued as a 'clean' receipt likewise establishes presumptions about the condition of goods. If the cargo is later found damaged, the

---

[572] S.R. Aikens, R. Lord QC, M. Bools QC, M. Bolding, and K.S. Toh SC, *Bills of Lading* (3rd edn, Informa Law from Routledge 2020) https://doi.org/10.4324/9780429026478, 51-52; Časlav Pejović, *Transport Documents in Carriage of Goods by Sea: International Law and Practice* (1st edn, Informa Law from Routledge 2020) https://doi-org.soton.idm.oclc.org/10.4324/9780429197130, 4.2.
[573] Ibid.
[574] [1989] QB 14 (CA).
[575] [1998] AC 605 (HL).
[576] [1996] 1 Lloyd's Rep 145 (CA).
[577] Časlav Pejović, *Transport Documents in Carriage of Goods by Sea: International Law and Practice* (1st edn, Informa Law from Routledge 2020) https://doi-org.soton.idm.oclc.org/10.4324/9780429197130, 4.11.2-4.11.3.

carrier remains potentially liable, subject to contractual and statutory defences. The medium, electronic or paper, does not alter the allocation of liability under the contract of carriage.

The key difference lies not in substantive liability rules, but in procedural and evidentiary aspects. Paper bills have long been vulnerable to disputes over authenticity, forgery, or delay in transmission, which sometimes complicated the allocation of liability.

Electronic bills of lading systems, by contrast, promise greater speed, traceability, and security through digital signatures and blockchain verification. While these technological features do not modify the carrier's obligations as to cargo condition, they may reduce disputes about whether the receipt was validly issued or whether the bill was tampered with.

In short, electronic systems determine *how* the receipt is evidenced, but this does not alter the substantive allocation of carrier liability under the contract of carriage. However, in the electronic context, these issues bring the question of control to the forefront, since determining who has the exclusive ability to issue, access, and rely on the electronic receipt becomes critical to the operation of the receipt function.

5.3.1.2 Impact on the letter of indemnity

Under the paper bill of lading regime, letters of indemnity (LOIs) have developed into a widely used commercial tool. They operate, in many cases, as a practical response to situations where control over the bill of lading cannot be exercised in the usual manner, particularly where delivery is sought without presentation of the original bill. Their functions are diverse: shippers may provide LOIs to obtain clean bills of lading in order to conceal surface damage to cargo.[578] Carriers may rely on LOIs to deliver goods without presentation of the original bill of lading, thereby avoiding demurrage and storage costs caused by delays in document circulation.[579] In some cases, LOIs are used to support amendments to bills of lading, such as changing the port of discharge or adjusting cargo descriptions, thus protecting carriers from liability when

[578] F. d. Arizon and D. Semark, *Maritime Letters of Indemnity* (Informa Law from Routledge 2014) https://doi.org/10.4324/9781315851471, 1.6; Časlav Pejović, *Transport Documents in Carriage of Goods by Sea: International Law and Practice* (1st edn, Informa Law from Routledge 2020) https://doi-org.soton.idm.oclc.org/10.4324/9780429197130, 4.11.
[579] Liang Zhao, 'Letter of Indemnity in Carriage of Goods by Sea: Chinese Law and Judicial Practice' (2017) 47 Hong Kong LJ 265, 265.

following such instructions.[580] LOIs also play a role in international trade finance, where banks may advance funds against LOIs in the absence of bills of lading to ensure smooth transactions.[581] Accordingly, LOIs provide flexibility and efficiency in practice, but at the same time they generate significant legal risks.

In my view, it is a reasonable prediction that the legal issues related to letters of indemnity will be alleviated in the electronic context. Instead, three main improvements can be expected: (i) greater efficiency and transparency, as system records make transactions traceable and reduce delays; (ii) clearer identification of carriers and allocation of responsibility, minimising disputes over roles; and (iii) stronger authenticity and compliance safeguards, since blockchain or other secure technologies can prevent forgery and verify LOIs.

Judicial practice in different jurisdictions demonstrates that the validity and applicability of LOIs remain contentious. The first issue concerns whether non-carriers may claim rights under LOIs. In the Chinese mainland Shipping case, the court recognised that a charterer, although not the carrier, could still be the legitimate beneficiary of an LOI because it issued bills of lading and assumed risks.[582] This suggests an expansion of the scope of beneficiaries. In an electronic bill of lading environment, digital records make it easier to clarify who actually bore risks, but the question remains: will courts accept system records as equivalent to legal recognition of carrier status? In an electronic bill of lading environment, electronic records may make risk

---

[580] Silas Bamigbola, 'Letter of Indemnity (LOI): Definition, Uses, and Real-life Examples' (SuperMoney, 23 October 2023) https://www.supermoney.com/encyclopedia/letter-of-indemnity accessed 5 June 2024.
[581] A Debattista, Bills of Lading in Export Trade (3rd edn, Tottel 2008) 205; B Soyer and A Tettenborn (eds), *Letters of Indemnity in Shipping Practice* (Informa Law 2010) 45–48.
[582] 上海海事法院（2016）沪 72 民初 1006 号民事判决, First Instance Civil Judgment on the Maritime and Commercial Dispute over a Letter of Guarantee between Chinaland Shipping Pte Ltd and Anyang Iron & Steel Co., Ltd. (2016) Hu 72 Min Chu 1006. The original judgment in Chinese: "实践中，保函的出具对象一般为承运人，但向承运人以外可能因签发清洁提单而承担风险的相关主体出具保函的情况也并不少见。涉案提单抬头为船东 SOUTHPORTSEAS.A.，由连云港丰乐国际船舶代理有限公司代表船东签发，故涉案货物运输承运人为船东，原告并非承运人。原告作为与船东签订定期租船合同的租船人，在租期内支付租金，实际运营涉案船舶并享受运输费用的收益，根据其与船东之间租船合同的约定代为签发提单，也将可能因运输业务而承担风险。因此，原告具有要求托运人向其出具保函的利益诉求。" Shanghai Maritime Court, Chinaland Shipping Pte Ltd v Anyang Iron & Steel Co Ltd, First Instance Civil Judgment on the Maritime and Commercial Dispute over a Letter of Guarantee (2016) Hu 72 Min Chu 1006. For example, the judgment noted: "实践中，保函的出具对象一般为承运人，但向承运人以外可能因签发清洁提单而承担风险的相关主体出具保函的情况也并不少见……" [In practice, LOIs are generally issued to carriers, but other entities bearing risks due to the issuance of clean bills of lading may also receive them.]

allocation more transparent, but whether courts will treat these records as equivalent to legal recognition of carrier status remains unsettled.

A second issue concerns conflicts following delivery without production of bills of lading: if a carrier delivers against an LOI but a lawful holder later asserts title to the cargo, whether the carrier may rely solely on the LOI for protection is still highly controversial.[583] This long-standing controversy is unlikely to disappear in electronic settings, though digital traceability may influence how liability is assessed.

A third issue is the validity of clean bill LOIs. Early English cases, such as *The Bremen Max*,[584] leaned toward enforceability, holding that as long as the carrier delivered goods in accordance with the LOI terms, the LOI could be specifically enforced. In an electronic environment, LOIs could theoretically be implemented through blockchain or smart contracts, approaching the effect of specific performance. However, a new question arises: if platform automation produces outcomes inconsistent with the parties' actual intention, would courts still uphold their validity? This highlights the tension between automatic execution and party autonomy. This early position was later qualified in *The Erin Schulte*,[585] adopted a more cautious approach: even when a carrier issued a clean bill under an LOI, it remained liable to the lawful bill of lading holder if the cargo was damaged. By analogy, if an electronic system automatically records a bill of lading as 'clean' despite cargo damage, carriers cannot rely on system outputs to exempt themselves from liability.

A fourth dimension involves reasonable reliance and identity verification. In *The Zagora*,[586] the court held that as long as the master reasonably believed that the recipient represented the party named in the LOI, the LOI remained valid. In electronic platforms, this 'reasonable belief' is transformed into reasonable reliance on platform verification. But if authentication fails, for example due to account hacking, can carriers invoke reliance on system verification to avoid liability? Similarly, in *Songa Chemicals*,[587] the court dealt with a complex chain of charters and standard-form LOIs under IG P&I Club wording. Electronic platforms may record the full

[583] *The Songa Winds* [2018] EWHC 397 (Comm); *The Zagora* [2016] EWHC 3212 (Comm); *The Bremen Max* [2009] 1 Lloyd's Rep 81.
[584] *The Bremen Max* [2009] 1 Lloyd's Rep 81 (QB).
[585] *The Erin Schulte* [2014] EWCA Civ 1382, [2015] 1 Lloyd's Rep 97 (CA).
[586] *The Zagora* [2016] EWHC 3212 (Comm).
[587] *The Songa Chemicals* [2018] EWHC 2929 (Comm), [2019] 1 Lloyd's Rep 604 (QB).

sequence of transfers, clarifying responsibility chains, but if platform-standardised clauses conflict with individually negotiated terms, which will courts uphold? This introduces potential conflicts between 'smart contract standardisation' and party autonomy.

Finally, in the *Chinese case Maxsteel International Inc v Sinotrans*,[588] the Supreme People's Court confirmed the validity of a clean bill LOI, but only after analysing causation and responsibility. In an electronic setting, cargo condition often depends on platform-generated data (e.g., 'clean' or 'damaged'). If such data diverges from the actual condition, can parties still rely on an electronic LOI? The key issue becomes how courts will weigh the credibility of electronic evidence against the carrier's due diligence obligations.

In conclusion, electronic bills of lading may reduce some of the high-frequency uses of LOIs, particularly those caused by delays in physical circulation, but they do not eliminate the core legal controversies. Instead, the continued use of LOIs in the electronic environment shows the practical limits of the systems, as parties still rely on indemnities when control over electronic records is unclear, disputed, or intentionally avoided.In other words, electronic bills of lading weaken some 'old problems' but generate new ones, and LOIs will remain a central feature of international shipping law.

5.3.1.3 Electronic bills of lading and contract of carriage

In the traditional paper-based framework, the relationship between the bill of lading and the contract of carriage has long been contested. Courts have consistently emphasised that, because the contract of carriage is typically concluded before the bill of lading is issued, the bill functions primarily as evidence rather than as the contract itself.[589]

For instance, in *Pyrene v Scindia Navigation Co Ltd*,[590] the court held that a bill of lading issued after loading could not override the terms of a pre-existing contract of carriage. This approach was reaffirmed in cases such as The *Ardennes and Evans v Andrea Merzario*,[591] where courts

[588] *Maxsteel International Inc v Sinotrans Shipping Co Ltd, Sinotrans Mingyue Maritime Co Ltd, Shanghai* [2014] HKEC 758 (CFI).
[589] Aikens, Richard, Richard Lord, and Michael Bools, Bills of Lading (2nd edn, Informa Law from Routledge 2015) 166-167.
[590] *Pyrene Company, Ltd v. Scindia Steam Navigation Company, Ltd.* [1954] 2 QB 402; [1954] 1 Lloyd's Rep. 321.
[591] *The Ardennes*, The (KBD) (1950) 84 Ll L Rep 340; [1951] 1 KB 55. Similar rulings in *Evans v Andrea Merzario* [1976] 1 WLR 1078. and The *Green Island* [1992] Lloyd's Rep 120.

emphasised that prior agreements prevailed even where the bill of lading contained different terms. Nevertheless, as the commercial chain between carrier, shipper, and consignee became more complex, inconsistencies between the terms of the bill of lading and the contract of carriage increasingly gave rise to disputes, particularly in relation to jurisdiction clauses, applicable law, and methods of dispute resolution.

By contrast, electronic bills of lading are often expected, at least theoretically, to mitigate such uncertainties. If an electronic bill of lading system is capable of standardising contractual terms and recording all relevant agreements in real time, it could ensure that the terms contained in the bill of lading remain consistent with those of the contract of carriage. Moreover, a system that enables real-time updates of amendments might reduce information asymmetry, providing parties with clarity as to their rights and obligations throughout the contractual performance.

A further question, however, is whether electronic bills of lading alter the very relationship between the bill of lading and the contract of carriage. In the traditional paper regime, the two are distinct though interconnected: the contract of carriage establishes the rights and obligations between the parties, while the bill of lading primarily serves as evidence and a transferable document of title. According to the interview, in an electronic environment, however, if the platform simultaneously incorporates both the contractual terms and the electronic bill of lading within a single record, the boundaries between the two could become blurred, potentially leading to a functional 'merger' of the bill of lading and the contract of carriage.[592] Such a development could increase consistency and predictability, but it also raises new legal questions. For example, if the electronic bill of lading and the contract are embodied in the same record, would it still be possible to distinguish between their respective functions? Would pre-contractual agreements outside the platform prevail over system-generated terms, or would the platform's record be determinative? Such a merger could fundamentally challenge the traditional evidentiary role of bills of lading, blurring distinctions that courts have consistently upheld in a paper-based context.

In summary, these difficulties highlight a central theme of Chapter 5: relying on paper-based regimes cannot resolve the unique challenges of electronic bills of lading. Instead, a

[592] Interview with a third-party electronic bills of lading technology provider (21 October 2022) .

substantive approach is necessary to examine whether it can provide a stable legal foundation for assessing control and functionality, which will be explored in Section 5.3.2.

5.3.1.4 Transfer of electronic bills of lading

In the context of paper bills of lading, disputes frequently arise regarding whether and how the consignee or subsequent lawful holder acquires contractual rights. While possession of a bill of lading typically signifies control over the goods, the decisive question remains whether that possession is lawful in the legal sense. For instance, in *The Rafaela S*,[593] the House of Lords held that even a straight bill of lading may operate as a document of title, thereby conferring contractual rights on the consignee. The decision illustrated the courts' willingness to stretch traditional concepts of title to reflect commercial reality, but it also revealed the fragility of the legal framework: different jurisdictions may treat the same document differently, creating uncertainty for traders.

A statutory example can be seen in section 2(1)(a) of the Singapore Bills of Lading Act (Cap 384, 1994 Rev Ed), which transfers rights of suit under the contract of carriage to the lawful holder of the bill of lading.[594] However, recent Singaporean judgments have clarified that mere temporary possession or the subjective intention of a bank in holding the bill is insufficient and the statutory test of 'lawful holder' must be satisfied on objective grounds.[595] This means that even in the paper environment, the path from physical possession to enforceable rights is not automatic but requires close legal scrutiny.

Against this background, electronic bills of lading are presented as a solution to evidential and transactional uncertainties. To the extent that electronic bills of lading platforms employ blockchain or other secure technologies, they are theoretically able to record and verify each transfer with immutability, thereby clarifying the chain of custody. However, such technological assurances do not equate to legal legitimacy. Unless amended or judicially interpreted to cover digital instruments, the statutory transfer of rights may not automatically extend to electronic records.

---

[593] *J I MacWilliam Co Inc v Mediterranean Shipping Co SA (The Rafaela S)* [2005] UKHL 11, [2005] 2 AC 423.
[594] *Bills of Lading Act* (Cap 384, 1994 Rev Ed, Sing), s 2(1)(a).
[595] *Sinotrans Container Lines Co Ltd v Daewoo International Corp* [2025] SGCA 33

In short, while electronic bills of lading platforms may provide transparency and evidential certainty in the transfer process, the decisive step, conversion of factual possession into legal rights, remains dependent on legal validation. The risk is not that disputes will disappear but that they will take new forms: whether a digital endorsement satisfies statutory conditions, whether a platform's security breach undermines the chain of title, or whether a digital 'holder' meets the legislative definition of a lawful holder. These challenges demonstrate that the central question in both paper and electronic contexts is not whether transfers can be recorded, but whether those transfers are recognised by law.

In conclusion, all the legal issues surrounding control of electronic bills of lading show while electronic systems improve authenticity, efficiency, and security, reliance on functional equivalence alone cannot overcome the deeper legal uncertainties. Questions about whether electronic records can truly substitute for possession, whether a system-generated 'clean bill' has the same legal weight, or whether digital transfers satisfy statutory definitions of a 'lawful holder' demonstrate the limitations of this approach.

A substantive approach offers a more coherent way forward. This shift sets the stage for Section 5.3.2, which examines how control over electronic bills of lading can be achieved under the substantive approach.

5.3.2 Applying the substantive approach to control

We have argued that electronic bills of lading are a type of electronic records in Section 5.3.1, fulfilling one of the two conditions for the definition of controlled electronic records. Next, we will discuss the second condition: whether they are subject to control. In Section 5.3.2, starting from the lifecycle of electronic bills of lading, we detail the origin and circulation process: from issuance, to transfer, to endorsement, etc., thereby examining whether they are subject to control.

As discussed earlier, electronic bills of lading can broadly be divided into two categories: digitisation and digitalisation. Digitisation bills of lading and Digitalisation bills of lading can meet three factual features of the substantive approach.

The first type, digitisation bills of lading, have their offline paper one as the original version. This part of electronic bills often uses digital certificates to give a secure, unique signature for online

document security.[596] For example, with Bolero, once a paper bill of lading is uploaded, the original "physical document should be destroyed, marked as a copy/draft or secured in some other way"[597] If the holder needs a paper version for customs or regulations, Bolero allows replacing the e-bill with a traditional paper one.

Regarding exclusive control, unlike the second type, the first type of electronic Bill of Lading, whether Bolero or essDOCS, both utilize the registry model to control the documents. This registry model identifies the person in control in a separate independent third-party registry, which is managed by an independent third party.[598] In other words, this central registry, serving as a custodian for the electronic record, guarantees exclusive control through a private key, enabling its possessor to govern the distribution of the goods.

Regarding why Title Registry, Bolero explains in its FAQ is that "a b/l represents rights over the goods described, there is an absolute requirement that the bill be a) unique and b) original. The Title Registry is a database which records the lifecycle of the eBL and ensures that once you have created the eBL it cannot be changed by anybody but you and that it cannot be duplicated as an eBL."[599]

By definition, the registry approach identifies the person in control, not by reference to who holds the unique document.[600] Although the foregoing analysis shows, in the case of the original paper bills of lading, if the paper bills are uploaded online, this would be done through digital certification, also known as a unique signature, to prevent the circulation of multiple sets of original bills.

'Change of control' in the proposed substantive approach refers to the transfer of the person in control, a process functionally equivalent to changing the holder of a bill of lading offline, which is the 'change of possession', but not through the transfer of the bill of lading itself. This relates to how the registry system works: it is based on a contract where users agree to certain rules,

[596] Bolero, Electronic Bill of Lading for Carriers Frequently Asked Questions (FAQs), p1-2.
[597] Ibid., p5.
[598] Elson Ong, 'Blockchain Bills of Lading', CML Working Paper Series, No 18/06, August, https://law.nus.edu.sg/wp-content/uploads/2020/04/020_2018_Elson.pdf, p5.
[599] Bolero, Electronic Bill of Lading for Carriers Frequently Asked Questions (FAQs), p3.
[600] Caslav Pejovic & Unho Lee, 'Blockchain Bills of Lading: A New Generation of Electronic Transport Documents' (2022) 176 Poredbeno Pomorsko Pravo 31, 35.

like those in the Bolero Rulebook[601] and essDOCS' Electronic Shipping Solutions DSUA.[602] Registered and subscribed members can easily transfer control of an electronic bill of lading within this system. However, those who are not members, as they are unable to use the system to transfer possession within it, still need to deal with the original paper bills of lading offline.[603] This further involves the issue of multiple sets of bills of lading circulating, but to put it simply, the copy of the document simply represents the copies. The transfer of control is managed through the Title Registry.

From this perspective, the registry model attempts to guarantee that the holder has the exclusive ability to prevent others from obtaining substantially all of the benefits from the electronic bill of lading and possesses the ability to obtain substantially all of the benefits. It is also able to meet the conditions for the change of control.

The second type of electronic bill of lading works differently from the first type which uses a title registry and electronic signatures. Among the eight systems approved by the International Group of P&I Clubs (IG), six use blockchain technology to this end.[604] They are edoxOnline, Wave BL[605], IQAX, CargoX, edoxOnline, TradeGo, Secro.[606] EdoxOnline and Wave BL operate on the public blockchain. Secro uses a private blockchain. CargoX, based on Ethereum - public blockchain technology - combines on-chain and off-chain data to balance document ownership tracking via blockchain and store essential user info off-chain. IQAX utilises GSBN's blockchain to support document processing, with a focus on security and efficiency. TradeGo also uses blockchain technology. The TradeLens eBL, which is not recognized by the IG, is based on the Hyperledger Fabric solution, a private network where validators (Trust Anchors)

---

[601] Bolero Rulebook and Title Registry, https://www.bolero.net/rulebook-and-title-registry/index.html, assessed on 3 March 2024.
[602] Users Agreement (DSUA), https://www.essdocs.com/company/users-agreement-dsua, assessed on 3 March 2024.
[603] Caslav Pejovic & Unho Lee, 'Blockchain Bills of Lading: A New Generation of Electronic Transport Documents' (2022) 176 Poredbeno Pomorsko Pravo 31, 35-36.
[604] UK P&I, Circular 01/23: Electronic (Paperless) Trading, https://www.ukpandi.com/news-and-resources/club-circulars/2023/circular-01-23-electronic-paperless-trading/, assessed on 2 Feburary 2024.
[605] WaveBL mimics traditional Bill of Lading Process, https://wavebl.com/overview/, assessed on 2 September 2023.
[606] BIMCO, Complete Guide to Electronic Bill of Lading Adoption for the Bulk Trades, Published: 17 January 2024, https://www.bimco.org/insights-and-information/general-information/20230828-ebl-guide, assessed on 2 February 2024.

are known to the network based on cryptographic identities.[607] Naomi Chetrit and others have outlined the advantages of Wave BL in three aspects: fraud prevention, negotiability, and supporting current trade flow.[608]

The following elaborates on how blockchain electronic bills of lading satisfy the three factual capabilities to control of the proposed substantive approach. Unlike the first discussed registry approach in the foregoing section, the method of blockchain electronic bills of lading is through the direct control of the electronic bills of lading,[609] which is the functional equivalent of possession. Based on the definition of digitalisation bills of lading,[610] blockchain is a string of encrypted data which can be decrypted into a series of information only after decryption by a third-party technology platform and is displayed as the only original bill of lading, which is the only one circulating on the system. Any external or downloaded versions will be displayed as copies.[611] The use of digital signatures and time stamps ensures that the authorised transfer is unique.[612] The carrier is paid as per the carriage contract, and the shipper gets a unique token for the electronic bill of lading, giving them total control and providing them with sole authority. This token can be passed on by the shipper to other parties as needed. Each new deal becomes a block linked to previous ones, forming a complete, unalterable transaction record.[613]

Unlike the title registry system, it even can achieve 'change of control' directly without the need for intermediaries.[614] The reason is related to the decentralisation aspect of blockchain technology. According to the interview with COSCO Shipping and the third-party platform

---

[607] TRADELENS, eBL, https://tradelens.zendesk.com/hc/en-us/categories/4404615692177-eBL, assess on 3 March 2024.
[608] Naomi Chetrit, Mayrav Danor, Angelic Shavit, Boaz Yona & Dov Greenbaum, 'Not Just for Illicity Trade in Contraband Anymore: Using Blockchain to Solve a Millennial-Long Problem with Bills of Lading' (2018) 22 Va JL & Tech [ii], p92-99.
[609] See Elson Ong, 'Blockchain Bills of Lading', CML Working Paper Series, No 18/06, August, https://law.nus.edu.sg/wp-content/uploads/2020/04/020_2018_Elson.pdf, p7. Caslav Pejovic & Unho Lee, 'Blockchain Bills of Lading: A New Generation of Electronic Transport Documents' (2022) 176 Poredbeno Pomorsko Pravo 31, 36.
[610] See this thesis in Section 2.2.3.
[611] According to the interviewee from COSCO Shipping (17 October 2022) and a third-party technology provider (21 October 2022).
[612] Elson Ong, 'Blockchain Bills of Lading', CML Working Paper Series, No 18/06, August, https://law.nus.edu.sg/wp-content/uploads/2020/04/020_2018_Elson.pdf, p11-12.
[613] Jake Herd, '"Blocks of Lading": Distributed Ledger Technology and the Disruption of Sea Carriage Regulation' (2019) 18 QUT Law Review 306, 309.
[614] Goldby, M., Electronic Documents in Maritime Trade: Law and Practice, 2nd edn., Oxford University Press, Oxford, 2019, p 329.

provider, the biggest difference between blockchain and traditional technology is 'decentralisation', specifically, the previous e-commerce platforms such as Amazon, and Taobao, have operators behind them, and all the data resided on the operators' servers, which reflects 'centralisation'. The approach is efficient in a way, but privacy and data security cannot be guaranteed. Since the data is kept in plaintext on the operator's server, numerous problems cannot be avoided, including theft by the platform or external actors, data tampering between the counterparty and the platform, infringement of third-party rights, and data leakage.[615]

According to the interviewed manager from a third-party platform, through blockchain, data is saved on each party's server, which is unique. The key is the interaction of the data between the parties: the blockchain parties must first achieve 'consensus' on how to keep track of the data, and the data is not saved on a single server for each party, but rather in ciphertext. Who has access to this data (or 'key') is determined by the 'public key' and the 'private key'. This means that whoever has the key can encrypt and decrypt the data and ultimately hold the data. For example, if party A has the key to the data, then only party A enjoys the right to operate the original bl, other parties cannot modify, if modified, can only tamper with the data on the server of one party, changing in other servers on the node cannot reach a consensus. This is the primary reason why blockchain technology cannot be tampered with, as well as the logic of distributed bookkeeping, which explains the meaning of 'decentralisation'.[616]

The transaction of bulk commodities is well suited for blockchain, which is why businesses develop blockchain platforms in this area. The reason is that the demands of buyers and sellers in the transaction are quite contradictory: buyers typically seek faster delivery and delayed payment, while sellers prefer prompt payment and controlled release of goods, and the interests of several subjects are restrained by one another. If both parties record identical information, the subjects in the transaction chain will participate in creating nodes based on the alliance chain made by all parties, and the parties cannot be convinced to alter the data.[617]

In summary, this section details how electronic bills of lading could meet the 'control' requirement necessary for them to be considered controlled electronic records, building on the

[615] According to the interviewee from a third-party electronic bill of lading technology provider (21 October 2022).
[616] Ibid.
[617] Ibid.

prior establishment of electronic bills of lading as electronic records. It examines the lifecycle of electronic bills of lading, from issuance through transfer and endorsement, and shows the extent to which they are subject to control.

The analysis focuses on two types:

Digitisation bills of lading are often based on original paper documents and utilize a registry system managed by an independent third party to ensure exclusive control. Control is defined by access to this registry, and transfers occur via a 'change of control' within the system. Digital certificates or unique signatures are used to secure online versions derived from paper originals. This model is exemplified in the Bolero Rulebook and FAQ and similarly described in essDOCS' DSUA.[618]

Digitalisation bills of lading primarily use blockchain technology, enabling direct control without intermediaries. Blockchain ensures secure, tamper-proof transfers, with control vested in the holder of the private keys. This decentralised approach aims to overcome privacy and data security concerns associated with centralised operator servers.

The section concludes by examining how both registry-based and blockchain-based electronic bills of lading can satisfy factual abilities for control under the proposed substantive approach, thereby fulfilling the second condition for being controlled electronic records.

5.3.3 Evaluation

This section explores how electronic bills of lading meet the control requirements outlined by the substantive approach. It first establishes that electronic bills of lading are electronic records, fulfilling one condition for being considered controlled electronic records. It then examines whether different models of electronic bills of lading satisfy the control requirements of the substantive approach.

In systems based on the digitisation of paper bills of lading, control is typically exercised through access to a central registry operated by an independent third party, with transfers effected through a formal change of control recorded in that registry. By contrast, in

[618] Bolero, Electronic Bill of Lading for Carriers Frequently Asked Questions (FAQs); essDOCS, *Legal Framework & DSUA* https://www.essdocs.com/dsua-legal-framework, accessed 19 September 2024.

decentralised, blockchain-based systems, control is exercised directly by holders of the relevant private keys, without reliance on an intermediary. To the extent that these systems operate reliably, both types may be regarded as meeting the control requirements of the proposed substantive approach, assuming that exclusivity and integrity are preserved. On this basis, electronic bills of lading could qualify as controlled electronic records, though this remains contingent on technological robustness and legal recognition.

This approach presents both potential benefits and significant limitations. Unlike functional equivalence, which asks whether electronic bills of lading can perform the same functions as paper bills, the substantive approach focuses on whether control over electronic records can on its own support legal validity and the allocation of rights. On the one hand, the substantive approach provides a crucial legal foundation for electronic bills of lading and offers significant advantages in advancing trade digitalisation. By legally recognizing electronic forms, it transcends the traditional reliance on physical 'possession' for paper version, enabling greater efficiency, cost savings, and environmental benefits. Through 'control' mechanisms like DLT or secure registry systems, electronic bills of lading offer superior security against forgery, tampering, and loss compared to paper, enhancing their legal reliability as contractual evidence and goods receipts.

On the other hand, these advantages remain conditional and subject to limitations. The lack of interoperability between electronic bills of lading platforms may undermine the notion of 'exclusive control' and complicate liability allocation. The definition of a 'reliable system' remains largely an untested area of law, with a lack of precedent and industry standards adding to uncertainty in system selection and liability. Inherent cybersecurity risks in electronic systems can also compromise the validity of 'control' and evidentiary value. While electronic bills of lading may reduce LOI needs for delays, LOIs may still arise in other contexts, such as delivery without presentation of the bills of lading, requests for switch bills of lading, or discrepancies in cargo description. Their interaction with electronic systems and applicable legal rules therefore presents new complexities.

In conclusion, Section 5.3 has shown that while control is essential to the receipt and evidentiary functions of bills of lading, relying solely on functional equivalence cannot resolve the legal issues that arise when moving from paper to electronic form. As shown in the discussion of carrier liability and letters of indemnity, the core difficulties do not stem from the electronic medium itself, but from uncertainty over who exercises legally control over the

electronic record in the transaction. These uncertainties continue to generate disputes concerning liability, contractual relations, and the transfer of rights, notwithstanding the use of electronic systems. By reconceptualising electronic bills of lading as controllable electronic records, the substantive approach offers a clearer framework that links technological reliability with legal validity. This sets the stage for Section 5.4, which examines how proprietary rights, grounded in the bill's role as a document of title, are similarly challenged and must also be addressed through a substantive approach.

5.4 Proprietary right in electronic bills of lading

This section explores the most critical function of electronic bills of lading: their role as documents of title. It begins by examining the legal issues surrounding electronic bills of lading (5.4.1). Particular attention is paid to recurring problems such as delivery without presentation and switch bills of lading, both of which complicate recognition of proprietary rights. Building on this analysis, the section then applies the substantive approach to electronic bills of lading (5.4.2), considering different regulatory approaches, the theoretical foundation of a five-layer model, and the legal arguments for recognising proprietary status. Finally, the section provides an overall evaluation (5.4.3), assessing the strengths and limitations of applying the substantive approach to proprietary rights in electronic bills of lading.

5.4.1 Challenges in proprietary right

The proprietary right of bills of lading is anchored in their status as documents of title. In the paper context, this status allows the lawful holder to demand delivery and transfer constructive possession of the goods, thereby bridging contractual rights with proprietary interests.[619] However, the moment this link falters, such as in cases of misdelivery, the proprietary foundation of the bill of lading is shaken. This makes the document of title not just a procedural device but the very core of how the medium of the property rights in goods are recognised and enforced in maritime commerce. When moving to the electronic environment, the same challenges resurface but in new guises: instead of physical possession, the key issue becomes

[619] Paul Todd, 'Electronic Bills of Lading, Blockchains and Smart Contracts', International Journal of Law and Information Technology, Volume 27, Issue 4, Winter 2019, p339–371, https://doi.org/10.1093/ijlit/eaaa002, p344.

whether electronic control and system records can legitimately replicate proprietary effects. Therefore, the following subsections examine how traditional proprietary disputes surrounding paper bills of lading, most notably delivery without presentation and conflicting claims, reappear in electronic form, often in more complex and technologically mediated ways.

5.4.1.1 Delivery without the presentation of bills of lading

One of the clearest illustrations of the tension between document of title and proprietary right is delivery without presentation. In the paper-based setting, this typically arises because the physical flow of the bill of lading lags behind the speed of shipping. Human factors, such as delays in documentation, or the bank's retention of the bill of lading in a letter of credit transaction, often result in goods reaching the discharge port earlier than the document.[620] In such circumstances, carriers face the tension between commercial pressure to release the cargo and the legal duty to deliver only against presentation. In *Standard Chartered Bank (Singapore) Ltd v Maersk Tankers Singapore Pte Ltd*, *UniCredit Bank AG v Euronav NV ("The Sienna")*,[621] and *Fimbank Plc v Discover Investment Corporation (The "Nika")*,[622] the courts addressed issues of causation, consent, and authority, revealing the fragility and complexity of the paper bill of lading as a document of title in practice. The introduction of the electronic bill of lading has not eliminated these disputes but has instead projected them into a new legal context.

First is about causation and attribution of liability. In *The Sienna*[623] the court had to determine whether misdelivery constituted the proximate cause of the claimant's loss.[624] Although the Court of Appeal held the carrier liable. It emphasised that misdelivery is not merely a factual issue but must be analysed at two distinct levels: first, the establishment of liability: whether delivery without production of a bill of lading amounted to a breach of contract; and second, the scope of damages: which consequences can be said to flow sufficiently closely from the

[620] According to the interviewee from a third-party electronic bill of lading technology provider (21 October 2022).
[621] *Standard Chartered Bank (Singapore) Ltd v Maersk Tankers Singapore Pte Ltd* [2022] SGHC 242, [2023] Lloyd's Rep Plus 18, [46].
[622] *Fimbank plc v Discover Investment Corporation (The Nika)* (QBD (Comm Ct)) [2020] EWHC 254 (Comm); [2021] 1 Lloyd's Rep 109.
[623] *Standard Chartered Bank (Singapore) Ltd v Maersk Tankers Singapore Pte Ltd* [2022] SGHC 242, [2023] Lloyd's Rep Plus 18, [46].
[624] Ibid.

breach so as to be recoverable.[625] This analytical approach is developed in the paper bill of lading context, but it assumes even greater significance in the electronic bill of lading context.

In the electronic bills of lading environment, the critical point of causation is no longer the traditional issue of whether the bill of lading arrived later than the vessel, but arguably instead shifts to the authenticity of electronic control and instructions. For example, if the platform record indicates that a delivery order has taken place, but the lawful holder has in fact neither acted nor authorised such delivery, the court arguably need to decide to what extent the carrier is entitled to rely on the platform's status, or whether it must still prove that delivery was causally connected to the holder's actual intention. This arguably highlights the tension between technological reliance and the allocation of liability.

From a proprietary perspective, these causation questions matter because they determine whether and when control exercised through an electronic bill of lading is legally recognised as effecting a transfer of rights. More specifically, it is suggested that in the electronic bills of lading context causation analysis can be understood as involving three interrelated dimensions. First, the carrier's duty of care arguably requires compliance with reasonable verification procedures such as multi-factor authentication, or verification of digital signatures. If such duties are not fulfilled, it may be thought that misdelivery is more likely to be treated as the proximate cause of loss. Conversely, if the carrier has complied with these duties, the causal chain might be regarded as broken by platform malfunction or third-party intrusion. Secondly, it can be suggested that the holder's responsibility for account and key management is relevant: if an account is compromised, the court may assess whether the holder's own negligence contributed to the loss and thereby weakened the causal link. Thirdly, the platform's system security and rule design also arguably play a role: where misdelivery stems directly from a system defect or from flawed operational rules, the platform itself might be considered the proximate cause of the loss, with a corresponding reduction in the carrier's liability.

Building on the discussion above, this analysis indicates that, in the context of the electronic bills of lading, causation is not merely a factual issue but requires a systematic assessment of contractual provisions, platform rules, and the allocation of evidential burdens.

[625] Ibid., at [25]-[26] and [46].

In *The Sienna*,[626] the court focused on whether the parties genuinely intended to present the bill of lading to the carrier. Applied to the electronic context, the key question shifts to whether the lawful holder truly intended to affect delivery or authorisation through the platform. Thus, the dispute is no longer about whether a paper bill has been physically presented, but whether the 'delivery' status displayed on the platform accurately reflects the holder's intention.

However, platform records and the holder's genuine intention do not always the same. Technical malfunctions, account stolen, unauthorised third-party operations, or the unintended activation of automated system rules, all of these can cause a platform to generate a 'delivered' or 'release authorised' status that does not correspond to reality. In such circumstances, the attribution of liability becomes more complex: may the carrier simply rely on the platform's status to justify delivery, or must it still discharge a duty of prudent verification? This question exposes a structural conflict between the carrier's duty of care and the allocation of liability to the platform. In sum, the 'intention of the holder' emphasised in The Sienna has not disappeared in the electronic bills lading context, but has been reframed as a test of consistency between the platform's records and the holder's actual intention. Within this framework, the carrier's diligence and the platform's reliability jointly determine the distribution of liability, making this a central issue for future judicial interpretation and legislative regulation.

In *The "Nika"*,[627] the court identified three circumstances that may legitimise delivery without presentation of a bill of lading: express consent, subsequent ratification, and actual authority.[628] For the electronic bills of lading, each of these scenarios raises new legal challenges: does a 'release cargo' operation on the platform amount to the equivalent of a traditional written instruction? if the system automatically generates a delivery record and the holder remains silent, can this be treated as subsequent ratification? and does the use of a platform account necessarily constitute actual authority, such that if the account is compromised the carrier may still be exonerated? These questions highlight the centrality of

---

[626] *UniCredit Bank AG v Euronav NV* [2022] EWHC 957 (Comm), [2022] 2 Lloyd's Rep 467.
[627] *Fimbank plc v Discover Investment Corporation (The Nika)* (QBD (Comm Ct)) [2020] EWHC 254 (Comm); [2021] 1 Lloyd's Rep 109.
[628] *Fimbank plc v Discover Investment Corporation (The Nika)* (QBD (Comm Ct)) [2020] EWHC 254 (Comm); [2021] 1 Lloyd's Rep 109, para. 26; see also *Standard Chartered Bank (Singapore) Ltd v Maersk Tankers Singapore Pte Ltd* [2022] SGHC 242, [2023] Lloyd's Rep Plus 18; *The Neptra Premier* [2001] SGHC 223, [2001] 2 SLR(R) 754, para. 38.

identity verification, exclusive control, and the evidentiary value of electronic records in the digital context.

Overall, electronic bills of lading do not eliminate the controversies surrounding delivery without presentation in the paper setting. They transpose them into new challenges concerning the authenticity of electronic records, the reasonableness of reliance on platform systems, and the fairness of risk allocation.

This demonstrates that simply pursuing functional equivalence with paper bills is insufficient and only a substantive approach can address the proprietary challenges of electronic bills of lading.

5.4.1.2 Switch bills of lading

The practice of issuing switch bills of lading illustrates the structural fragility of the document of title function. By examining switch bills, this section explores whether electronic bills of lading, and in particular the choice between functional equivalence and a substantive approach, can meaningfully mitigate the risks associated with multiple sets of documents of title.

In triangular trade, it is common for the carrier or its agent to issue a second set of bills of lading (switch bills) to replace the original set and reflect changes in trading arrangements.[629] In the first set, the consignor is typically the seller and the consignee an intermediary such as a broker, freight forwarder, or NVOCC.[630] In the second set, the consignor becomes the intermediary, while the ultimate purchaser is named as consignee.[631] The location of the switch may vary: taking place at the port of loading, the port of discharge, a third location, or even on

[629] M Jagannath, 'Switch Bills of Lading – Revisited', NAU Newsletter, 10 August 2014, https://nau.com.sg/switch-bills-of-lading-revisited/, para. 2; Goldby, Miriam A., 'Managing the Risks of Switch Bills of Lading' (May 8, 2019). NUS Law Working Paper No. 2019/011, NUS Centre for Maritime Law Working Paper 19/03, Available at SSRN: https://ssrn.com/abstract=3384502 or http://dx.doi.org/10.2139/ssrn.3384502, p3.

[630] Non-vessel-owning common carriers, see also Simone Lamont-Black, 'The Freight Forwarder as Carrier: The Purpose of House Bills of Lading' (2024) L.M.C.L.Q. 72, 72-105, 104.

[630] See Goldby, Miriam A., 'Managing the Risks of Switch Bills of Lading' (May 8, 2019). NUS Law Working Paper No. 2019/011, NUS Centre for Maritime Law Working Paper 19/03, Available at SSRN: https://ssrn.com/abstract=3384502 or http://dx.doi.org/10.2139/ssrn.3384502, p3-p4; International Transport Intermediaries Club, Issuance of Switch Bill of Lading, 2013, 1

[631] Goldby, Miriam A., 'Managing the Risks of Switch Bills of Lading' (May 8, 2019). NUS Law Working Paper No. 2019/011, NUS Centre for Maritime Law Working Paper 19/03, Available at SSRN: https://ssrn.com/abstract=3384502 or http://dx.doi.org/10.2139/ssrn.3384502, p3.

board the vessel. Given the function of bills of lading as documents of title, it is essential to ensure that only one valid set is in circulation at any time. In practice, however, multiple sets of paper bills often circulate simultaneously, giving rise to disputes over misdelivery and competing claims. In *UCO Bank v Golden Shore Transportation Pte Ltd*,[632] for example, the respondent failed to retrieve the original bills before issuing the switched set, resulting in litigation. Such cases highlight the fragility of paper-based switching: if the originals are not properly withdrawn, third-party rights are easily jeopardised.

Electronic bills of lading are at least theoretically capable of mitigating some of these risks. Because all switching operations can be recorded and verified in real time, the system may prevent the coexistence of multiple 'originals'. It may also automatically update and synchronise information, allowing relevant parties to access the latest status of the bill and thereby reducing disputes caused by information asymmetry. However, digitalisation does not eliminate disputes; rather, it reframes them. If a platform malfunction or operational error results in parallel versions of an electronic bill of lading, how should liability be allocated? If different electronic bill of lading platforms lack interoperability, might international transactions encounter legal deadlock in the form of 'multiple valid originals'? Moreover, in switching scenarios, the willingness of banks and pledgees to recognise electronic endorsement and transfer remains decisive for the practical viability of electronic bills of lading.

In sum, the challenges revealed by paper-based switch bills, namely the dangers of multiple sets of documents, are not erased by digitalisation. Instead, they are transposed into new legal questions concerning the reliability of platform systems, the harmonisation of standards across platforms, and the acceptance of electronic endorsement and transfer by financial institutions and courts.

In conclusion, the role of bills of lading as documents of title is already complex in the paper context, and digitalisation makes it even more so. Functional equivalence cannot resolve these challenges. A substantive approach, treating electronic bills as controllable electronic records, offers a firmer basis. Section 5.4.2 will examine how this approach applies to the electronic bills of lading.

---

[632] *UCO Bank v Golden Shore Transportation Pte Ltd* (SGCA) [2005] SGCA 42; [2006] 1 SLR(R) 1.

5.4.2 Apply the substantive approach to proprietary rights

The core objective of this section is to substantively argue that electronic bills of lading should be recognised, as controlled electronic records possessing inherent proprietary characteristics, rather than merely as 'functional equivalents' of their paper versions.

For a long time, paper bills of lading, as documents of title, have played an indispensable role in international trade. With the advancement of digitalisation, electronic bills of lading have emerged, and their legal status and attributes have become critical issues urgently needing clarification. This section will critically examine the existing legal framework, including the Electronic Trade Documents Act 2023 and the proposed Property (Digital Assets etc.) Bill, combined with key case law and in-depth academic discussions, aiming to construct a legal argument supporting electronic bills of lading as independent digital objects of property. The central thesis is that the evolution of legal thought and technological capabilities not only allows but also requires us to view electronic bills of lading as an independent form of intangible property.

The argument will be made in four points: first, the current state of electronic bills of lading regulation across different jurisdictions, focusing specifically on the existence of such rights. Secondly, by examining the functions of bills of lading, we will explore the relationship between their functions as document of title and the associated proprietary rights. Thirdly, through the practice of electronic bills of lading, we aim to demonstrate how they can embody proprietary rights and fall under the property rights. Finally, we will investigate how civil law and common law countries can enhance the regulation of electronic bills of lading, particularly with respect to the recognition of their property rights.

5.4.2.1 Regulatory approaches

Current regulations on electronic bills of lading vary across different jurisdictions. However, the proprietary right of electronic bills of lading is seldom addressed. The reason is arguably that the explorations are focused on clarifying the relationship between electronic and paper forms, as well as how to fit into the existing legal framework.

Clause 3 of the UK Electronic Trade Documents Act 2023 allows a person to "possess, indorse and part with possession of an electronic trade document,"[633] provided that the document satisfies certain criteria.[634] From this, it is evident that the UK approach to electronic trade documents, meeting certain conditions, is to extend the possession applicable to tangible trade documents to intangibles. This does not mean that all intangibles are possessable, nor does it address the proprietary rights of intangibles. As the Law Commission reiterated in its digital asset project regarding the non-possessability of intangibles: first, there is no legislation for possession; secondly, it was the policy and practical factors that led to the recommendation that electronic trade documents be treated as possessable.[635] Thirdly, they believe that the key difference between an electronic trade document and digital assets is that the former is intended to replicate the function of its paper equivalent in a specific way, ie, rather than being treated as intangible digital assets under a substantive approach, electronic trade documents are brought within a possession-based framework by analogy with tangible documents.[636]

However, this regulatory method arguably does not solve the issue permanently but mainly serves to meet the legal recognition and acceptance required for electronic bills of lading in practice. As previously discussed, various types of electronic bills of lading, such as blockchain-based ones, employ distinct technological applications: a factor not taken into account.[637] Moreover, the role of processing platforms in their circulation has arguably been overlooked. As the Law Commission points out, while comparing tangible things with special technologies like open-source code and encryption offers advantages, these comparisons fall short of perfection.[638] Following this logic, could electronic bills of lading arguably be considered not just as functional equivalents to paper documents, but also as independent digital assets (controlled electronic records) with inherent proprietary characteristics?

The UK Law Commission, from a property law perspective, categorizes a broader range of digital assets as a 'third category thing', because they are neither things in possession nor

---

[633] UK Electronic Trade Documents Bill, clause 3(1).
[634] UK Law Commission Digital assets: Final report, para. 3.20.
[635] Ibid., para. 3.23, the footnote 134: Electronic Trade Documents (2022) Law Com No 405 from para. 2.61.
[636] Ibid., para. 3.26.
[637] See this thesis in Chapter 2.
[638] UK Law Commission Digital assets: Final report, para. 3.27.

things in action.[639] It concludes that "the law should develop legal principles specific to third category things".[640] Commission accepts that certain items (often digital assets) qualify as objects of personal property rights, even if they do not fit traditional categories, consistent with the views of the courts.[641] Particularly worth emphasizing is the argument made by Timothy Chan and Professor Low: "It is crucial that courts faced with cryptoasset disputes avoid the simplistic analogy between the tangible and intangible."[642] I strongly agree with this statement. The regulation of electronic bills of lading by simply equating online and offline does solve some problems, but many issues, such as the role of platforms, proprietary rights, and custody issues, have not been included in the regulatory framework.

Singapore does not regulate the proprietary rights of electronic records either. The Electronic Transactions (Amendment) Act 2021[643] primarily introduces electronic transferable records, within which bills of lading are considered as a 'transferable document or instrument'.[644] An 'electronic transferable record' means an electronic record that complies with all the requirements of section 16H.[645] Singapore's legislative framework reflects the functional

[639] Ibid., para. 3.1.
[640] Ibid., para. 3.30.
[641] Ibid., para. 3.39.
[642] Ibid., para. 3.50.
[643] Singapore Electronic Transactions (Amendment) Act 2021 (No. 5 of 2021), https://sso.agc.gov.sg/Acts-Supp/5-2021/Published/20210312?DocDate=20210312, accessed on 11 March 2024.
[644] Singapore Electronic Transactions (Amendment) Act 2021 (No. 5 of 2021), https://sso.agc.gov.sg/Acts-Supp/5-2021/Published/20210312?DocDate=20210312, accessed on 11 March 2024.
[645] Transferable documents or instruments
16H — (1) Where a rule of law requires a transferable document or instrument, that requirement is met by an electronic record if —
(a) the electronic record contains the information that would be required to be contained in the transferable document or instrument; and
(b) a reliable method is used —
(i) to identify that electronic record as the authoritative electronic record constituting the electronic transferable record;
(ii) to render that electronic record capable of being subject to control from its creation until it ceases to have any effect or validity; and
(iii) to retain the integrity of that electronic record.
(2) For the purposes of subsection (1)(b)(iii), the criterion for assessing integrity is whether information contained in the electronic record, including any authorised change that arises from its creation until it ceases to have any effect or validity, has remained complete and unaltered apart from any change that arises in the normal course of communication, storage or display.

equivalence principle set out in the MLETR.[646] By outlining the conditions and requirements for the electronic records, it enables electronic bills of lading to operate under the same substantive rules as paper bills of lading. However, the legislation does not address the proprietary rights of electronic records. This gap arises because the Electronic Transactions Act substantially mirrors the MLETR, which deliberately confines itself to recognizing electronic records on the functional equivalence rather than attributing proprietary status to them. As a result, questions remain as to whether electronic bills of lading under Singapore law can fully replicate the proprietary functions of their paper counterparts.

In contrast, regarding the platforms/systems, Singapore has advanced further than the UK: Division 6 of the Electronic Transactions (Amendment) Act 2021 Act is entitled "Accreditation, etc., of provider of electronic transferable records management system" and delegates authority for making regulations to the responsible Minister.[647] This focus on system providers is crucial, but it does not inherently resolve the question of whether the electronic bill of lading itself, as a digital object managed by such a system, can be the object of proprietary rights.

The US otherwise lacks extensive laws on whether digital assets can be recognized as personal property rights. However, laws in certain US states are at the forefront of acknowledging technological advancements. Wyoming (2019) recognized digital assets as property but excluded electronic bills of lading.[648] Idaho (2022) expanded digital assets to include controllable electronic records.[649] The 2022 UCC Amendments modernized the Code but still excluded electronic documents of title.[650]

It is evident that whether it is the UK ETDA, the Singapore Electronic Transactions Act, or the approach of the US, the proprietary right pertaining to electronic bills of lading and the

---

[646] Singapore Electronic Transactions Act 2010 (2020 Rev Ed), https://sso.agc.gov.sg/Act/ETA2010 accessed 25 October 2023.
[647] Singapore Electronic Transactions (Amendment) Act 2021, Division 6, https://sso.agc.gov.sg/Acts-Supp/5-2021/Published/20210312?DocDate=20210312, accessed on 11 March 2024.
[648] SF0125 - Digital assets-existing law, https://wyoleg.gov/Legislation/2019/sf0125, accessed on 8 March 2024.
[649] Legislature of the State of Idaho, House of Bill, NO. 585, https://legislature.idaho.gov/wp-content/uploads/sessioninfo/2024/legislation/H0585.pdf, accessed on 11 March 2024.
[650] UNIF. COM. CODE & EMERGING TECHS. (UNIF. L. COMM'N & AM. L. INST. 2022), https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=67fe571b-e8ad-caf8-4530-d8b59bdca805&forceDialog=1; ULC Wraps Up 131st Annual Meeting: Five New Acts Approved, https://www.uniformlaws.org/discussion/ulc-wraps, 12-102(a)(1), accessed 30 July 2023.

approach to processing systems/platforms have both been overlooked. Imagine a scenario where an electronic bill of lading is created and stored within a specific system: what legal rights can be asserted in relation to an electronic bill of lading, as information? If the system, acting as the actual controller, denies the lawful holder access to this information, how can the lawful holder seek remedy?

This question arises from two main concerns: first, in the context of digitisation bills of lading, the electronic information is typically stored in a title registry system offered by the bill of lading platform. In the Singapore case: *Dirak Asia Pte Ltd and another v Chew Hua Kok and another*,[651] the judge considered that emails stored in the 'cloud', unlike physical printouts or soft copies of emails saved on computers, cannot be directly possessed by the user; instead, one can only possess the username and password to access the emails in the possession of the email provider. In this case, the lawful holder and the actual holder of the email are, in fact, separated, meaning the two types of holders have different powers over the information. So where is the boundary of this power? Secondly, with digitalisation bills of lading, the document is generated directly within the system, with control over the electronic record being exercised through the system. In cases of disputes, then, can the real owner claim a proprietary remedy? This points to a broader question of proprietary rights within electronic bills of lading and the power boundaries of the platforms.

It is also noticeable that reliable systems received criticism from the academic community.[652] As we know, electronic bills of lading must meet a series of conditions to be considered equivalent to paper bills of lading. There are many factors to determine whether a system is reliable. However, to solve the issue of reliability, the boundaries of the platform's power need to be clarified. The theoretical foundation for electronic bills of lading to become an object of proprietary rights will be focused on this part.

[651] *Dirak Asia Pte Ltd and another v Chew Hua Kok and another* [2013] SGHCR 1 ("*Dirak Asia*"), para. 12.
[652] See examples: Liang Zhao, 'UK Electronic Trade Documents Act 2023: a legal solution for digital trade?' (2023) 23 *Lloyd's Shipping & Trade Law* 1; José Angelo Estrella Faria, 'Electronic Transferable Records under MLETR' (2017) 22 *Uniform Law Review* 285.

5.4.2.2 Theoretical foundation: five-layer model

Having reviewed the practices of other jurisdictions, we now turn to the bill of lading itself to assess whether an electronic bill of lading can be treated as an object of property law, and how this might be achieved.

In answering this question, we believe it is necessary to consider the model of the property rights of digital files from the research of John David Michels and Christopher Millard.[653] Their research model is based on Benkler's three-layer description of information work:

> "(1) The first, or lowest, layer of a network is the physical infrastructure layer, consisting of cables, spectrum, and hardware such as computers and routers.
>
> (2) The second, or middle, layer is the logical infrastructure layer, consisting of the software components that carry, store, and deliver content, such as the TCIP/IP protocol.
>
> (3) The third, or highest, layer is the content layer, encompassing all materials stored, transmitted, and accessed on the network."[654]

This model of cyberspace aims to clarify if the network is between equal users or dominated by producers providing a set of predefined information products to consumers. Additionally, the second layer integrates the 10-layer model suggested by Gleason and Friedman.[655]

---

[653] Michels, J.D. and Millard, C. (2022) 'THE NEW THINGS: PROPERTY RIGHTS IN DIGITAL FILES?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 329-330.

[654] Michels, J.D. and Millard, C. (2022) 'THE NEW THINGS: PROPERTY RIGHTS IN DIGITAL FILES?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 329-330. See Y. Benkler, "From Consumers to Users: Shifting the Deeper Structures of Regulation toward Sustainable Commons and User Access" (2000) 52 F.C.L.J. 561, 561–62. The original text is as follows: "As the digitally networked environment matures, regulatory choices abound that implicate whether the network will be one of peer users or one of active producers who serve a menu of prepackaged information goods to consumers whose role is limited to selecting from this menu. These choices occur at all levels of the information environment: the physical infrastructure layer-wires, cable, radio frequency spectrum-the logical infrastructure layer-software-and the content layer."

[655] D. Gleason and L. Friedman, "Proposal for an Accessible Conception of Cyberspace" (2005) 3 J. Inf. Commun. Ethics Soc. 15: "The 7-layer OSI model, a structure developed by and for engineers, explains how ICT can take information from an intelligible form down to electrical signals, and then back up to presentation.

The model is structured as follows: The 7-layer OSI model

Layer	Description
1. Physical	Mechanical and electrical structure of the system
2. Data Link	Blocks of data (frames); error and flow control

Michels and Millard apply the above model to digital files, starting with the first layer: At the physical infrastructure level, a digital file is saved on a hardware device (or 'carrier') in the form of binary code, represented by a sequence of ones and zeros.[656] At the second logical layer, they argue that digital files are virtual objects created and managed by software applications and the operating system (OS), enabling users to interact with and perceive these files.[657] At the content layer, a digital file holds information like pictures or music for human understanding, such as this manuscript's text and figures.[658] They assert that there is no controversy regarding the first and third layers of digital files, but at the logical layer, each digital file has set boundaries and can be identified through file management software.[659] Since it can be identified, users can exclude others from access by using password protection or encryption, gaining exclusive control, which makes digital files more suitable as objects of property law than mere information. Currently, the ownership status of the file as a virtual object in the logical layer is not clear.[660]

Inspired by the discussions of these scholars, I attempt to analyse the electronic bill of lading from the three levels mentioned above, particularly combining the functions and characteristics of electronic bills of lading, to outline a five-layer research model. By integrating theories of property law, this is to determine whether electronic bills of lading can be considered as objects under property law.

---

3. Network Making and managing connections between network nodes
4. Transport Transfer of complete data sets between end-points
5. Session Communications between applications
6. Presentation Producing the user-interface from underlying data syntax
7. Application User-access to the network environment

For our purposes, we suggest that three layers should be added to the model to elucidate the human side of the equation:

8. Interpretation User understanding of system presentation
9. Impact The effects that systems have on stakeholders (including society)
10. Ontological The user experience of "being in" cyberspace."

[656] Michels, J.D. and Millard, C. (2022) 'The New Things: Property Rights in Digital Files?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 330.

[657] Gleason, David H. and Lawrence Friedman. "Proposal for an accessible conception of cyberspace." J. Inf. Commun. Ethics Soc. 3 (2005): 15-23.

[658] Ibid.

[659] Michels, J.D. and Millard, C. (2022) 'The New Things: Property Rights in Digital Files?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 330.

[660] Gleason, David H. and Lawrence Friedman. "Proposal for an accessible conception of cyberspace." J. Inf. Commun. Ethics Soc. 3 (2005): 15-23.

Below is an analysis of the electronic bill of lading at different layers on the basis that electronic bills of lading cannot be properly understood without recognising their multi-layer nature:

First, the physical infrastructure layer is no different from digital files. Both operate on servers, databases, and other hardware devices.

Secondly, the logical infrastructure layer is key to electronic bills of lading. The two types of electronic bills of lading are different precisely because of the different software components used at the logical layer, such as blockchain employing encryption and distributed ledger technology to ensure data security and integrity. However, whether it is a digitisation bill of lading or a digitalisation bill of lading, technologies in the logical infrastructure layer provide the data structure and associated verification and transmission protocols, enabling secure storage, validation, and transmission of data across the network.

Thirdly, the application layer involves platforms for electronic bills of lading and pertains to the platform's user interface and user interactions. At the application layer, users can perform certain actions on the platform (such as uploading data, editing content, or setting permissions).

Fourthly, the content layer pertains to the specific content of the electronic bill of lading, similar to the front and back information and articles of the paper bill of lading.

Lastly, the function layer is different from the previous models and based on the functions of the electronic bill of lading. It is well known that bills of lading serve three functions: as a receipt of goods, as evidence of the contract of carriage, and as a document of title.[661] Unlike digital files, such as emails or photographs, an electronic bill of lading is not just an electronic record or digital file itself. The information it contains also represents the goods, stemming from the third function of a paper bill of lading: whoever is the lawful holder of the bill of lading is deemed to have lawful possession of the goods.[662] This function undoubtedly adds complexity to the study of proprietary rights in electronic bills of lading, as the property rights of the goods behind its functions are also tied to bills of lading. Therefore, this layer involves two property rights: one

[661] Aikens, S.R., Lord QC, R., Bools QC, M., Bolding, M., & Toh SC, K.S. (2020). Bills of Lading (3rd ed.). Informa Law from Routledge. https://doi-org.soton.idm.oclc.org/10.4324/9780429026478.
[662] Guenter Treitel and Francis Reynolds, Carver on Bills of Lading (5th edn, Sweet & Maxwell 2022) ch 6.

is the proprietary right of the electronic bill of lading as an electronic record, and the other is the property rights of the goods represented by the function of the document of title.

The function layer is related to the characteristic of documentary intangibles.[663] Electronic bills of lading, just like paper bills of lading, are documentary intangibles, shared common functions and characteristics. Sir Roy Goode divided intangibles into two types: pure intangibles and documentary intangibles.[664] He further split the latter into three: documents of title to payment of money, documents of title to negotiable securities, and documents of title to goods.[665] Bills of lading, as documents of title to goods, "do not embody ownership rights themselves, but only provide control leading to successive possession, and it is this control that can be transferred by delivery, along with any required endorsement."[666]

Many scholars actively seek to equate the two, aiming to fit the legal framework of paper bills into electronic ones.[667] This thesis instead highlights significant differences between them, such as the logical layer of cyberspace and the involvement of platforms. The functional arrangements of electronic bills of lading also differ in how they execute the document of title function of a paper bill of lading: for instance, electronic bills of lading like essDOCS have a title registry system to manage the rights to goods. In contrast, blockchain electronic bills of lading may not have a similar system, but how they implement the document of title function is equally worthy of study.

Therefore, focusing solely on differences only tells part of the story. To provide a more comprehensive argument for the justification of the proprietary right of electronic bills of lading, this part will elaborate in more detail from the functional perspective of both.

As some scholars have mentioned, "over and above the potential difficulties in replicating paper documentary intangibles in electronic form, precise replication is probably

---

[663] McKendrick, Ewan, Royston Miles Goode, Royston Miles Goode, and Royston Miles Goode. 2021. Goode and Mckendrick on Commercial Law Sixth edition/ed. London UK: Penguin Books, paras 2.56-2.60.
[664] Ibid., para. 2.53.
[665] Ibid., para. 2.56.
[666] Ibid.
[667] *See* eg José Angelo Estrella Faria, 'Uniform Law for Electronic Transferable Records: Legislative Guide' (2011) 16 *Uniform Law Review* 147; Miriam Goldby, *Electronic Documents in Maritime Trade: Law and Practice* (OUP 2019); Sarah Green and Louise Gullifer, 'Functional Equivalence and Electronic Trade Documents' (2021) *Law Quarterly Review* 610; Ling Zhu, 'The Legal Nature of Electronic Bills of Lading' (2017) 22 *Journal of International Maritime Law* 213.

undesirable."[668] This analysis also relates to legal approaches, as the Jack Report 1989 proposed a two-stage transition from paper to electronic documents.[669] Initially, electronic documents would replicate paper ones, but later, this approach would be abandoned in favor of dematerialized instruments, requiring new legal frameworks. However, contemporary legal research and regulatory practice remain largely situated in this initial stage: electronic documents neither fully replicate the paper-based framework nor have they given rise to a new system of proprietary rights. As a result, the first stage never happened, leading users to either jump directly to the second stage or continue using paper documents.

The five-layer model is the starting point for consideration of the proprietary rights in electronic bills of lading. Besides, another reason for this consideration is that their systems seem to actually frustrate property law. As Prof. Fox observed in the context of cryptocurrency systems: "Systems designed to obscure the claims of strangers to payment transactions, to eliminate the need for adjudication in payment transactions, and to hide the real-world identity of the people behind them are not an easy object for traditional rules of property law."[670] The case of electronic bills of lading arguably mirrors this scenario. In such systems, electronic signatures or passwords are employed to achieve exclusive control over the digital records. Take the example of blockchain electronic bills of lading, which utilize an encryption method known as 'zero-knowledge proof'.[671] This technique permits one party (the prover) to prove to another (the verifier) that a certain statement is true, all without disclosing any information beyond the truth of that statement. In essence, zero-knowledge proofs allow the prover to confirm they hold specific information without having to reveal the information itself.[672] While these measures are highly beneficial for enhancing privacy and security, they inevitably blur the boundaries of liability within systems and platforms. Similarly, electronic bills of lading are not an easy object to fit into traditional rules of property law.

---

[668] Smith, M. and Leslie, N. (2018) *The law of assignment*. Third edn. Oxford, United Kingdom: Oxford University Press, para. 9.45.
[669] Committee of Inquiry into Shipping Documentation, Bills of Lading: A Report by the Committee of Inquiry into Shipping Documentation (HMSO 1989) ("Jack Report").
[670] David Fox and Sarah Green (eds), '*Cryptocurrencies in Public and Private Law*' (1st edn, Oxford University Press 2019), para. 6.04.
[671] Ibid.
[672] Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, '*Bitcoin and Cryptocurrency Technologies*' (Princeton University Press 2016).

5.4.2.3 Legal argument for proprietary status

Now, to explore whether electronic bills of lading can become an object of property law, we will start with the logical layer and argue within the frameworks of whether electronic bills of lading as electronic records can be treated as an object of property law.

Case law initially seeks to be analysed to investigate the property rights of digital files or digital assets under common law. As noted above under 4.4.2.2, in *Colonial Bank v Whinney* Fry LJ in his dissenting speech attempted to define property, stating that "all personal things are either in possession or in action. The law knows no tertium quid between the two."[673] This influential opinion splits all known property rights into two distinct groups: things in action and things in possession. However, when applying this classification rigorously to electronic bills of lading, they fit neither category - not as things in action, nor as things in possession. While the UK Law Commission has posited that under certain conditions, electronic trade documents could fall under the category of possession, this stance does not resolve the long-term issue of categorizing electronic records. Arguably, in terms of classification, one cannot simply rely on a dichotomy to determine whether something can be an object of property. This is evidenced by many cases that have moved beyond a mechanical application of these categories to blur the lines, instead focusing on the inherent nature of property. For instance, in *Cryptopia*, the judge avoids the rigid approach of defining property by merely determining whether an item fits within these two categories.[674]

As previously mentioned, it incorporates the classic statement of the characteristics of 'property' outlined by Lord Wilberforce in *Ainsworth*, expounding from the following four aspects whether digital assets are property: "(a) Identifiable subject matter; (b) Identifiable by third parties; (c) Capable of assumption by third parties; (d) Some degree of permanence or stability."[675] The judges concluded that it meets the criteria to be considered a species of 'property'.[676] Regarding the evaluation of this method, it has been noted that while many cases

[673] *Colonial Bank v Whinney* (1885) 30 Ch 261 (CA) at 285. See also *Your Response Ltd v Datateam Business Media Ltd* [2014] EWCA Civ 281, [2015] QB 41 at [26].
[674] See above in Section 4.4.2.2: *Ruscoe v Cryptopia Ltd (in liq)* [2020] NZHC 728, para. 124.
[675] *Ruscoe v Cryptopia Ltd (in Liquidation)* [2020] NZHC 728, para. 104-119.
[676] Ibid., para. 120.

have followed this standard,[677] many scholars have offered their distinct insights. Some contend that this approach risks falling into circular.[678] Others argue that the existing criteria are insufficient. For example, Michels and Millard propose adding a fifth criterion, that of applying erga omnes, to distinguish between personal rights and property rights among these criteria.[679] Additionally, Gray has argued that a resource can only be considered property if it is excludable.[680] Cutts suggests that digital assets must meet the condition of being rivalrous to qualify as property.[681]

Similarly, based on the principles established by Lord Wilberforce, New Zealand judges have articulated their perspectives on whether digital files are considered property in particular cases. Arnold J emphasized the identifiability and transferability aspects of property: in *Dixon v R*, he seems applied four criteria to conclude that digital files were not mere information but actually qualified as 'property': they could be identified, had a value, were capable of being transferred and had a physical presence, albeit one that could not be detected by means of the unaided senses.[682] In *Henderson v Walker*, Thomas J focused more on the principles of excludability (the ability to prevent others from controlling the property) and exhaustibility (the ability to deprive others of the property's value), highlighting the importance of exclusive control over property.[683]

Integrating the above different standards, to make the argument more comprehensive, we will analyse electronic bills of lading using all these standards. Overall, standards (a), (b), (c), and

---

[677] *Vorotyntseva v Money-4 Ltd (t/a Nebeus.com)* [2018] EWHC 2596 (Ch); *Robertson v Persons Unknown* (ComCt, 15 July 2019); *B2C2 Ltd v Quoine Pte Ltd* [2019] SCHC(I) 3; *Ruscoe v Cryptoppia Ltd* [2020] NZHC 728, [2020] 2 NZLR 809; *Ion Sciences Ltd v Persons Unknown* (Com Ct, 21 December 2020); *Fetch.ai Ltd v Persons Unknown* [2021] EWHC 2254 (Comm); *Lavinia Deborah Osbourne v Persons Unknown and Ozone Networks* [2022] EWHC 1021 (Comm).

[678] Kevin Gray and Susan Francis Gray, *Elements of Land Law* (5th ed, Oxford University Press, Oxford, 2009) at [1.5.29]; and Kelvin FK Low 'Bitcoins as Property: Welcome Clarity?' (2020); 136 LQR 345 at 348-349; Gray, Kevin. "Property in Thin Air." *The Cambridge Law Journal*, vol. 50, no. 2, 1991, pp. 252–307. *JSTOR*, http://www.jstor.org/stable/4507540. Accessed 21 Mar. 2024, 293.

[679] Michels, J.D. and Millard, C. (2022) 'The New Things: Property Rights in Digital Files?', The Cambridge Law Journal, 81(2), pp. 323–355. doi:10.1017/S0008197322000228, 326.

[680] Gray, Kevin. "Property in Thin Air." *The Cambridge Law Journal*, vol. 50, no. 2, 1991, pp. 252–307. *JSTOR*, http://www.jstor.org/stable/4507540. Accessed 21 Mar. 2024, 268.

[681] Dancy, Tatiana, Crypto-Property: Response to Public Consultation by the UK Jurisdiction Taskforce of the LawTech Delivery Panel (June 19, 2019). LSE Law - Policy Briefing Paper No. 36, June 2019, Available at SSRN: https://ssrn.com/abstract=3406736 or http://dx.doi.org/10.2139/ssrn.3406736, p2-4.

[682] *Dixon v R* [2015] NZSC 147, [2016] 1 NZLR 678.

[683] *Henderson v Walker* [2019] NZHC 2184, para. 264-266.

(d) are related to the logical layer of the five-tier model of electronic bills of lading, analyzing the inherent characteristics of electronic records to find that they meet the first four criteria. Standards (e), (f), and (g) are not only related to the logical layer but also to the functional layer, especially the transferability criterion, which is associated with the transfer capability of physical bills of lading: transferability and the functional aspect are inseparably linked, thus arguably necessitating a discussion of the relationship between these functions of physical bills and electronic bills of lading. We will first address the initial four criteria at the logical layer. Subsequently, the remaining three criteria will be examined in relation to the functions of paper bills of lading.

(a) Identifiable subject matter

This means that the item in question can be specifically identified or distinguished from other items. It is clear what is being referred to, and there is no ambiguity about its identity. Electronic bills of lading easily meet this criterion. Both digitisation bills of lading and digitalisation bills of lading are identifiable electronic records. The lawful holder of this electronic records can access the content and the information on the electronic bills of lading.

(b) Identifiable by third parties

This suggests that not just the lawful owner, but also other people, can recognize and identify the item as distinct and separate. Electronic bills of lading also meet this requirement. Only those who have obtained the password or similar means can access the system, allowing third parties to clearly identify the electronic bill of lading.

(c) Capable of assumption by third parties

This implies that the rights associated with the item can be assumed or taken on by someone other than the original owner, typically through sale, transfer, or inheritance. Electronic bills of lading can also meet this requirement: when the trade of goods involves third parties, these parties can assume ownership of the electronic bill of lading in the system through the transfer of control.

(d) Some degree of permanence or stability

This indicates that the item is not fleeting or ephemeral and it exists in a form that lasts long enough to be considered property and utilized or transferred as such. Despite being intangible,

electronic bills of lading also satisfy this standard. They cannot be arbitrarily copied or tampered with. Even though blockchain electronic bills of lading possess the potential for technical tamper-resistance, irrespective of the technology employed, electronic bills of lading that have been officially issued and circulated through the system ensure a certain degree of performance and stability.

(e) Transferability

This refers to the ability to legally transfer the item or its rights from one party to another, a fundamental characteristic of property that enables trade, sale, and inheritance. However, we should not hastily conclude that electronic bills of lading fulfill this condition merely because they are transferable. This is because this aligns with the inherent characteristics of standard bills of lading, which serve as the receipt of goods, evidence of a contract of carriage, and the document of title, particularly the third function. In other words, the argument for this standard should not be based solely on analyzing its nature as a virtual object or electronic records from the logical layer, but rather should stem from the relationship between electronic and traditional paper bills of lading in terms of functions. Accordingly, the following analysis is situated at the functional layer, where the proprietary significance of electronic bills of lading is determined by whether and how the document of title function is realised.

The argument involves three specific issues: The first is whether electronic bills of lading can replicate and fulfill the function of the document of title, i.e., evidence of right, at the functional layer. The second issue relates to whether electronic bills of lading can realize the transfer of the right, which is linked to the transferability criterion. The third issue concerns the impact of the evidence of right and the transfer of right on its proprietary right.

Although electronic bills of lading cannot fully replicate the document of title function of standard bills of lading as discussed above, some summary of the third function of the bill of lading is placed here to ensure a clear conceptual background for the subsequent analysis.

Todd summarizes the three effects of the document of title function of the paper bill of lading as follows:

“i. presentation of the bill of lading allows a consignee or holder to take delivery of the goods when the ship arrives, but conversely, the master is entitled to refuse to deliver except against its presentation, and the carrier is also protected from suit if he delivers against presentation of

an original bill; note the importance of the carrier defenses, which are difficult to replicate in an electronic environment;

ii. transfer of the bill of lading will often transfer property in the goods, and conversely, its retention (eg by an unpaid seller) will allow the seller to retain property;

iii. possession of the bill of lading is regarded as possession of the goods; one consequence of this is that pledging the bill of lading is equivalent to pledging the goods themselves, whether or not there is an attornment by the carrier (as bailee of the goods)."[684]

From the discussion above, we can summarize that the function in question must satisfy three conditions: delivery, endorsement for transfer, and possession. Different experts have different views per electronic documents can realize the functions of paper documents: specifically, Lai posits that the tokenisation of documentary intangibles can replicate all the functions of traditional paper documents through functional equivalence, encompassing both evidence of right and transfer of right.[685] Conversely, Fava contends that it is challenging for electronic bills of lading to mirror the functions of their paper counterparts through functional equivalence.[686] Fava reviews the typical attempt to equate the two: electronic bill of lading platforms tried to address this by using contract law, requiring all parties to sign a multi-party contract that includes terms acknowledging the functional equivalence of electronic bills of lading. This was meant to facilitate the transferability of electronic bills and constructive possession of the goods. However, these platform designs and contract systems did not perfectly replicate the three main functions of paper bills, particularly making the relationship between the shipper and other parties more abstract.[687]

Central to this debate is the document of title, which is pivotal in establishing the equivalence between paper and electronic bills of lading. As Fava noted, digitalising the three core functions of a paper bill of lading, especially the document of title function, has been notoriously

---

[684] Paul Todd, 'Electronic Bills of Lading, Blockchains and Smart Contracts', International Journal of Law and Information Technology, Volume 27, Issue 4, Winter 2019, p339–371, https://doi.org/10.1093/ijlit/eaaa002, p344.
[685] Jiabin Lai, 'Tokenisation of Documentary Intangibles', [2023] Lloyd's Maritime and Commercial Law Quarterly 92.
[686] Jake Fava, 'Chip off the Old Block: Acknowledging the Obstacles to Widespread Adoption of Blockchain Bills of Lading' (2021) 7 LSE LR 181.
[687] Ibid., 191.

challenging.[688] As discussed earlier in this thesis, while functional equivalence struggles to justify transferability through the document of title, the substantive approach adopted in this thesis supports transferability by treating electronic bills of lading as controlled electronic records, where rights are transferred through a change of control.

(f) Excludability and exhaustibility

Excludability refers to the ability to prevent others from using or accessing the item, a crucial aspect for maintaining control and ensuring legal protection. This concept is particularly significant for physical goods, though it applies differently to digital or intellectual properties. In the context of electronic bills of lading, they satisfy this criterion through the mechanism of exclusive control. Specifically, the lawful holder of an electronic bill of lading can maintain exclusive control over it, as extensively explained in Section 5.2.2.3.

On the other hand, exhaustibility typically pertains to the fact that an item's use by one individual can diminish its availability for others, a trait more common to physical goods. However, in the case of electronic bills of lading, this concept is relevant in terms of market circulation. According to the operating procedures detailed in various electronic bill of lading systems, exhaustibility is ensured by maintaining only one original set in circulation at any given time. Should there be instances of multiple original sets, the preceding ones are required to be destroyed, thereby upholding the integrity of the single set and avoiding potential disputes.

(g) Rivalrous

In legal and property contexts, 'rivalrous' typically refers to the concept where the use of a resource by one individual reduces the availability of that resource for others. Traditionally, this concept applies to tangible assets like a plot of land or a vehicle; if one person is using it, others cannot use it simultaneously.

When we consider whether electronic bills of lading meet this standard, the situation becomes more nuanced because, like digital files, they can be duplicated without diminishing their availability. However, under specific conditions, electronic bills of lading can still be seen as rivalrous. For instance, the control or access rights to an electronic bill of lading are limited: if this document is encrypted or protected under the title registry system, other individuals

[688] Ibid.

cannot access or use it without proper permission. In this context, the use and control rights of the electronic bill of lading can be exclusive, making it rivalrous in nature, as the control itself limits the number of people who can access these documents simultaneously.

Thus, only if an electronic bill of lading is designed to allow only limited access, or it is protected by legal or technical measures to prevent unrestricted duplication and dissemination, then it can be considered rivalrous. In this sense, it satisfies the criteria for being considered property due to its exclusivity and controlled access, despite its inherently duplicable nature.

From the analysis above, it can be seen that electronic bills of lading can become objects of property law. Additionally, electronic bills of lading comply with the definition of digital assets as outlined in section 3.59 of the UK Law Commission's project on digital assets: (1) be composed of data represented in an electronic medium, including in the form of computer code, electronic, digital, or analogue signals; (2) exist independently of persons and exist independently of the legal system; and (3) be rivalrous.[689]

It is difficult to realize the truly functional equivalence according to Fava:

> "Most importantly, electronic bills of lading were not seen in law or practice as 'functionally equivalent' to paper bills of lading. It has been notoriously difficult to digitalise the three core functions of paper bills of lading, 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 recognize electronic bill of lading as functionally equivalent to paper bills of lading. Former electronic bills of lading platforms attempted to overcome this by 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 bills of lading's functional equivalence. Such contracts relied on the common law concepts of novation and attornment to facilitate electronic bills of lading transferability and constructive possession of the cargo. Nevertheless, the platform designs and contractual system imperfectly replicated the paper bills of

[689] UK Law Commission, Digital assets, https://lawcom.gov.uk/project/digital-assets/, assessed on Jan. 14th, 2024.

> lading's three functions, with the contractual system notably abstracting the relationship between the shippers."[690]

Fava's observation highlights the persistent gap between contractual workarounds and the substantive legal recognition of proprietary functions. While novation and attornment provided temporary solutions, they could not fully replicate the property transfer mechanisms inherent in paper bills of lading, underscoring the limitations of functional equivalence in this context.

In summary, while intangible, electronic bills of lading satisfy the core criteria of property law. Functional equivalence and contractual mechanisms are insufficient to secure their proprietary status. They should instead be recognized as controlled electronic records with independent proprietary attributes, requiring substantive legal acknowledgment.

5.4.3 Evaluation

The whole section explores the relationship between the document of title function and the proprietary right of electronic bills of lading and concludes the electronic bills of lading can be the object of the proprietary right because of its attributes to electronic records. By shedding the document of title function of its paper equivalents, the substantive approach serves as a better framework for the legal issues of the electronic bills.

The core idea of the substantive approach is to treat an electronic bill of lading as an electronic record that is not merely data but is itself endowed with proprietary characteristics, making the record an object of property. This method seeks to establish that the electronic record is the document of title, rather than merely representing or acting as one through functional equivalence.

This path attempts to create a digital native form of property for trade documents, rather than just having digital objects perfectly mimic physical ones. This could have profound implications for the legal definitions of 'asset' and 'possession'. Functional equivalence aims to make electronic bills of lading replicate the functions of paper bills of lading, which is like taking a digital photograph of a key. The UK ETDA, by enabling 'possession' of electronic documents through 'control', moves forward but still frames it in terms of making electronic documents

[690] Jake Fava, 'Chip off the Old Block: Acknowledging the Obstacles to Widespread Adoption of Blockchain Bills of Lading' (2021) 7 LSE LR 181, 191.

similar to paper documents, as if saying this digital photograph can be held like a key. The substantive approach, by viewing the electronic record itself as having proprietary right, implies that the digital record is a new type of key, or perhaps even an inherently digital new locking mechanism. This aligns with the view that technology can enable electronic records to be controlled in a way closely analogous to the control a person can have over a tangible asset, thereby giving them individuated and rivalrous characteristics.

The advantages of this method lie in its potential to provide greater legal certainty, reduce reliance on complex contractual arrangements, and align with the overall trend of the prophetisation of digital assets, thereby potentially better promoting the use of electronic bills of lading as collateral for financing. However, the challenges it faces are also extremely severe, the most prominent of which is the difficulty of cross-border recognition and enforcement. Due to differences in national property laws and the legal status of digital assets, an electronic record granted 'ownership' in one jurisdiction may not receive equivalent recognition in others. Furthermore, the definition of 'reliable systems', allocation of liability, cybersecurity risks, system interoperability, and the transformation of legal concepts are all obstacles that the substantive approach must overcome in practice.

5.5 Custody of electronic bills of lading

The concept of custody in the context of electronic bills of lading refers to the holding, management, and control of the digital record that constitutes the electronic bills of lading. This is very different from physically holding a paper bill of lading.[691] The way custody works depends on the type of platform used to manage the records. These platforms are usually either centralised systems run by well-known service providers (like Bolero or essDOCS), or decentralised systems based on Distributed Ledger Technology (DLT) or blockchain (like CargoX or WaveBL). Since electronic bills of lading are meant to work across borders and systems, it is essential to have a clear and consistent understanding of custody and control.

[691] Electronic bills of lading (eBL) have one more obstacle to overcome – Bilancio https://www.bilancio.io/electronic-bills-of-lading-have-one-more-obstacle-to-overcome/, accessed on 31 May 2025; Bilancio, 'Is Chain of Custody Software the Future of Waste Trading?' (Bilancio, 18 April 2024) https://www.bilancio.io/is-chain-of-custody-software-the-future-of-waste-trading/ accessed 6 June 2025.

This will help build trust in electronic bills of lading, support their wider use, and reduce conflicts over problems like lost documents, wrong deliveries, or unauthorized access.

This Section examines the custody issues of electronic bills of lading and their regulation across two types of platforms: digitisation platforms (centralised systems) and decentralised blockchain-based platforms. By analysing the roles, control boundaries, and legal responsibilities of these platforms. The chapter further explores evolving regulatory frameworks, to assess how liability and oversight for electronic bills of lading platforms can be structured in a digital era. Crucially, it applies the substantive approach developed in this thesis, which is informed by contemporary international efforts such as the UNIDROIT Principles on Digital Assets and Private Law. These principles provide an analytical framework on custody that informs the application of the substantive approach in this chapter.[692]

5.5.1 Legal and practical issues in custody

The legal characterisation of the relationship between an electronic bill of lading holder (such as a shipper, consignee) and the entity providing custody services for the electronic bills of lading (typically the platform operator or a specialized digital asset custodian) is crucial. This relationship sets out what each side is allowed to do, what they're responsible for, and who is liable if something goes wrong – such as if the electronic bill of lading is lost, misdelivery, or unauthorized access. Common law doctrines such as bailment, agency, and trust offer potential frameworks for analysing this relationship, though their application to intangible digital assets like electronic bills of lading is not always straightforward.

5.5.1.1 Defining custodian-holder relationship

The ambiguity in defining the electronic bills of lading custodian-holder relationship under one specific common law doctrine creates legal uncertainty, especially in managing the risks with new digital records like electronic bills of lading. Different legal models, such as bailment, agency, or trust, impose different duties on the custodian, affect who is liable for loss, and determine what remedies the holder has, particularly if the custodian becomes insolvent.

[692] UNIDROIT, *Draft Principles on Digital Assets and Private Law* (Public Consultation, Study LXXXII – PC, January 2023) Principle 10, Commentary 1.

While custody agreements will attempt to define the relationship and allocate risks contractually, these terms may be overridden by mandatory provisions of law or by judicial interpretations based on the functional reality of how control is exercised and how assets are held.[693] This underscores a need for either legislative clarification or the development of clear judicial precedents on the default nature of electronic bills of lading custodial relationships to ensure predictable outcomes for all parties involved.

Bailment, agency, and trust are therefore considered below as possible analytical models.

The bailment will be first discussed. Traditionally, when a shipper delivers goods to a carrier, a bailment relationship is created, and the paper bills of lading serves as evidence of this bailment and the carrier's obligations as bailee.[694] The question arises whether an electronic bill of lading custodian can be considered a bailee of the electronic bills of lading. Bailment typically involves the delivery of tangible personal property for a specific purpose, with an obligation on the bailee to return the property or deal with it as directed.[695] The intangible nature of electronic bills of lading presents a challenge to the direct application of traditional bailment principles.[696] While some legal scholars argue that cloud storage arrangements for digital data could potentially be construed as bailments, the fit is imperfect.[697] However, if the boundaries of platform control are further clarified, an entity exercising such control over an electronic bill of lading on behalf of a holder might be viewed as undertaking obligations analogous to those of a bailee.[698] The custodian, by maintaining the system that enables control, effectively holds the electronic bills of lading for the user.

---

[693] Roy Goode and Ewan McKendrick, Goode and McKendrick on Commercial Law (6th edn, Penguin 2021).
[694] See Norman Palmer, Palmer on Bailment (3rd edn, Sweet & Maxwell 2009) and Document of Title: Document of Title: The Key to Unlocking Bailment Transactions, https://fastercapital.com/content/Document-of-Title--Document-of-Title--The-Key-to-Unlocking-Bailment-Transactions.html, accessed on 6 June 2025.
[695] Ibid.
[696] Promoting Digitalization of Electronic Trade Documents in Nigeria, https://www.cambridge.org/core/product/E62CE8E13B1F0138A8996F7A0338D534/core-reader, accessed on 6 May 2025.
[697] The New Bailments - Washington University Open Scholarship, https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1086&context=law_scholarship, accessed on 6 May 2025.
[698] The Bill of Lading As A Document of Title at Common Law, https://www.scribd.com/document/265178215/The-Bill-of-Lading-as-a-Document-of-Title-at-Common-Law, accessed on 6 May 2025.

Regarding agency, an electronic bill of lading custodian could also arguably be characterized as an agent acting on behalf of the electronic bills of lading holder. In this model, the custodian is authorized to perform specific actions with respect to the electronic bill of lading, such as facilitating its transfer or presentation, based on the instructions of the principal (the holder).[699] The scope of the agent's authority and duties would be primarily defined by the terms of the custody agreement.[700] This characterisation would impose fiduciary duties on the custodian, such as the duty to act in the holder's best interests and avoid conflicts of interest. However, in practice, since platforms tend to adopt a non-interventionist approach toward the actions of the electronic bill of lading holder, it may be difficult to establish such a relationship.[701]

Thirdly, the trust. A trust relationship may be established if the platform operator holds the electronic bills of lading for the benefit of the holder, particularly in scenarios where electronic bills of lading (or the rights they represent) might be commingled, for example, in an omnibus account structure managed by the platform operator. Under a trust, the custodian (as trustee) would hold legal title to, or control over, the electronic bills of lading, while the beneficial interest would remain with the holders (as beneficiaries).[702] This would impose stringent fiduciary duties on the custodian to manage the electronic bills of lading in accordance with the terms of the trust and for the benefit of the holders. Although electronic bills of lading do not arguably perfectly fit this characterisation, if they are regarded as electronic records, this classification might be considered.

In summary, these models illustrate the limitations of attempting to subsume electronic bill of lading custodial relationships within existing common law categories. While bailment, agency, and trust each illuminate certain aspects of the relationship, none provides a fully satisfactory framework. This reinforces the need for a custody-based analysis grounded in the functional allocation of control, which is adopted in the substantive approach developed in this thesis.

---

[699] §28:7–106. Control of electronic document of title. | D.C. Law Library, https://code.dccouncil.gov/us/dc/council/code/sections/28:7-106, accessed on 6 June 2025.
[700] Corporate Governance Report - EBL, https://www.ebl.com.bd/eblannualreports/areport-24/reports/Corporate_Governance_Report_2024.pdf, accessed on 6 June 2025.
[701] According to the interview with a third-party electronic bills of lading technology platform (21 October 2022).
[702] Corporate Governance Report - EBL, https://www.ebl.com.bd/eblannualreports/areport-24/reports/Corporate_Governance_Report_2024.pdf, accessed on 6 June 2025.

5.5.1.2 Operational and technical challenges

Having examined the custodian–holder relationship in the preceding subsection, this subsection turns to the operational and technical challenges that shape custody in practice. In the context of electronic bills of lading, custody depends not only on legal allocation of rights and responsibilities, but also on the technical conditions under which control is exercised and transferred. In particular, risks arise both within individual platforms and at the interface between different platforms. Accordingly, this subsection addresses two related issues: first, platform security and reliability, which affect the integrity of control within a single system, and secondly, interoperability between platforms, which raises further questions concerning continuity of control and the allocation of responsibility across systems.

5.5.1.2.1 Platform Security and Reliability

This subsection focuses on common cybersecurity risks and the technical measures needed to ensure secure control of electronic bills of lading within a single platform.

i. Cybersecurity Threats

Electronic Bill of Lading platforms, whether they are centralised architectures or based on DLT, are inherently exposed to a spectrum of cybersecurity threats. These include sophisticated hacking attempts aimed at gaining unauthorized access, malware designed to corrupt data or systems, phishing attacks targeting user credentials, and denial-of-service (DoS) attacks intended to disrupt platform availability.[703] A successful breach could lead to the unauthorized alteration or transfer of an electronic bill of lading, the theft of sensitive commercial data, or the complete loss or destruction of the electronic record.

The nature of fraud also evolves in the digital context. While paper bills of lading are susceptible to physical forgery or theft,[704] electronic bills of lading face risks of digital manipulation, forgery of electronic signatures, exploitation of software vulnerabilities within the platform, or identity

[703] Electronic bills of lading: A welcome change but not without potential pitfalls - Dentons, https://www.dentons.com/en/insights/alerts/2025/february/4/electronic-bills-of-lading, accessed on 5 June 2025.
[704] Electronic bills of lading: implications and benefits for maritime, https://commons.wmu.se/cgi/viewcontent.cgi?article=1360&context=all_dissertations, accessed on 5 June 2025.

theft leading to fraudulent control over an electronic bill of lading.[705] The consequences of such breaches can be severe, leading to misdelivery of cargo, financial losses, and significant legal disputes.

ii. Essential Technical Measures

To mitigate these threats and ensure the reliability required by legal frameworks like the UK ETDA, electronic bills of lading platforms must implement a comprehensive suite of technical security measures:

First, robust encryption protocols are essential for protecting electronic bills of lading data both when it is being transmitted (in transit) and when it is stored (at rest). End-to-end encryption helps ensure the confidentiality and integrity of the information contained within the electronic bills of lading, preventing unauthorized parties from reading or modifying it.[706]

For the access controls, strong mechanisms for authentication and authorisation are critical. Authentication verifies the identity of users attempting to access the system, often employing multi-factor authentication, biometric verification, or secure hardware tokens.[707] Authorisation ensures that authenticated users only have access to the functions and data relevant to their roles (role-based access control - RBAC).[708] In DLT-based systems, this extends to the secure management and use of cryptographic private keys, as control of the key often equates to control of the asset.[709]

As for the audit trails, comprehensive, tamper-evident, and immutable audit trails are necessary. These logs should record all significant actions performed on an electronic bill of lading, including its creation, any amendments, transfers of control, and its ultimate surrender

[705] Electronic bills of lading: A welcome change but not without potential pitfalls - Dentons, https://www.dentons.com/en/insights/alerts/2025/february/4/electronic-bills-of-lading, accessed on 5 June 2025.
[706] Revolutionizing Global Trade with Electronic Bills of Lading, https://www.digitaltrade4.eu/revolutionizing-global-trade-with-electronic-bills-of-lading/, accessed on 5 June 2025.
[707] 3 critical responsibilities of digital asset custodians | IBM, https://www.ibm.com/think/insights/3-critical-responsibilities-of-digital-asset-custodians, accessed on 5 June 2025.
[708] Ibid.
[709] What You Need to Know About Digital Asset Custody - ChainUp, https://www.chainup.com/blog/institutional-digital-asset-custody-fundamentals, accessed on 5 June 2025.

or accomplishment.[710] Such trails are vital for traceability, investigating incidents, resolving disputes, and demonstrating compliance with regulatory requirements.

For the user authentication and authorisation processes, beyond technical controls, platforms need secure and reliable business processes for onboarding users, verifying their identities, and assigning appropriate permissions within the system. This includes the management of unique user identifiers and robust procedures to ensure that electronic bill of lading transfers is made only to correctly identified and validated counterparties.[711] Initiatives like the DCSA's Platform Interoperability (PINT) API, which includes receiver validation endpoints, aim to address this by allowing platforms to confirm the recipient's identity before a transfer is executed.[712]

Taken together, these security and reliability measures are essential to ensuring effective control over electronic bills of lading within a single platform. However, secure control within a single platform does not resolve all custody-related risks. In practice, electronic bills of lading often need to be transferred across different platforms, which raises further challenges concerning interoperability. These issues are examined in the following subsection.

5.5.1.2.2 Interoperability Challenges

Interoperability poses distinct custody-related challenges when electronic bills of lading are transferred across platforms. These challenges are examined through an analysis of platform fragmentation and ongoing standardisation initiatives.

i. Platform Fragmentation and Digital Islands

A major impediment to the widespread adoption of electronic bills of lading has been the fragmentation of the market, with numerous specific electronic bills of lading platforms

[710] Revolutionizing Global Trade with Electronic Bills of Lading, https://www.digitaltrade4.eu/revolutionizing-global-trade-with-electronic-bills-of-lading/, accessed on 5 June 2025.
[711] What is Secure Authentication? Methods & Best Practices - Timus Networks, https://www.timusnetworks.com/the-ultimate-guide-to-secure-authentication-best-practices-for-stronger-security/, accessed on 5 June 2025.
[712] eBL Platform Interoperability - Digital Container Shipping Association (DCSA), https://dcsa.org/our-mission/ebl-interoperability-platform, accessed on 5 June 2025.

emerging.[713] Many of these operate as 'club systems' or 'walled gardens', requiring all parties involved in a specific trade transaction (shipper, carrier, consignee, banks) to subscribe to and use the same platform.[714] This lack of interoperability, the ability to seamlessly transfer an electronic bill of lading from one platform to another while retaining its legal validity and functional characteristics, creates 'digital islands' and significantly limits the network effect that would drive broader adoption. If a trading partner is not on the same system, parties often revert to paper bills of lading, negating the benefits.

ii. DCSA Initiatives and Standardisation Efforts

The Digital Container Shipping Association (DCSA), an organisation formed by several major ocean carriers, is at the forefront of industry efforts to achieve electronic bill of lading interoperability.[715] Their framework for interoperability is built on several key components:

Platform Interoperability (PINT) API: A set of standardized Application Programming Interfaces designed to enable the technical transfer of DCSA-compliant electronic billf of lading between different solution providers' platforms.[716]

Legal Framework: The development of a multilateral legal agreement intended to govern the relationships and liabilities between participating electronic bill of lading solution providers and their users in an interoperable environment.[717]

Control Tracking Registry (CTR): A proposed secure, neutral registry designed to log which platform currently has control of a specific electronic bill of lading at any given time. This aims

---

[713] Promoting Digitalization of Electronic Trade Documents in Nigeria, https://www.cambridge.org/core/product/E62CE8E13B1F0138A8996F7A0338D534/core-reader, accessed on 5 June 2025.
[714] See Law Commission, Electronic Trade Documents: Consultation Paper (Law Com No 254, 2021) paras 2.40, describing existing eBL platforms as closed systems; see also DCSA, Striving towards paperless global trade (2023), noting the lack of interoperability across current solutions. For the concept of "walled gardens" in digital ecosystems, see "What is a Digital Walled Garden?", Foreveryard (online) https://foreveryard.com/what-is-a-digital-walled-garden/ accessed 1 December 2025; also Julie E Cohen, 'The Biopolitical Public Domain' (2019) 61 J Law & Soc 165, describing closed digital environments as "walled gardens".
[715] DCSA completes standards-based interoperable eBL transaction - Port Technology, https://www.porttechnology.org/news/dcsa-completes-standards-based-interoperable-ebl-transaction/, accessed on 5 June 2025.
[716] Ibid.
[717] Ibid.

to provide a single source of truth regarding the authoritative location of the electronic bill of lading, thereby building trust in cross-platform transfers.[718]

Successful pilot transactions demonstrating the technical feasibility of transferring electronic bill of lading between different DCSA-compliant platforms have been conducted, marking important milestones.[719] These initiatives signal a move towards a more interconnected electronic bill of lading ecosystem.

However, while technical interoperability is being addressed, achieving true, seamless interoperability presents deeper challenges related to legal and liability frameworks. When an electronic bill of lading, representing significant legal rights and potential liabilities (as a document of title and evidence of the contract of carriage), moves from Platform A to Platform B, complex questions arise.[720] For instance, which platform's terms and conditions will govern the electronic bill of lading post-transfer? Who bears liability if an error, security breach, or loss occurs during or after the transfer, potentially attributable to the specific architecture or security of one of the platforms involved? How will disputes be resolved between users who are on different platforms but party to the same electronic bill of lading transaction? The need for robust inter-platform liability agreements, as highlighted in reports of successful pilots,[721] underscores this complexity. Negotiating and harmonizing such legal agreements, data governance protocols, and dispute resolution mechanisms on an industry-wide scale among competing platform providers is likely to be a protracted and challenging process.

To summarise Sections 5.5.1.1 and 5.5.1.2, the legal and operational aspects of the custody of electronic bills of lading remain uncertain. The following section will examine whether the substantive approach can address these issues.

---

[718] Ibid.
[719] Ibid.
[720] Electronic bills of lading : implications and benefits for maritime, https://commons.wmu.se/cgi/viewcontent.cgi?article=1360&context=all_dissertations, accessed on 5 June 2025.
[721] Goodbye Paper, Hello Digital: Electronic Bill of Lading interoperability is finally here, https://www.shippingandfreightresource.com/electronic-bill-of-lading-interoperability/, accessed on 5 June 2025.

5.5.2 Applying the substantive approach to custody

The sections before have respectively elucidated custody from a general perspective and through the lens of the substantive approach.[722] Rather than addressing each legal issue identified in Section 5.5.1 in isolation, this section adopts a platform-based analysis to examine how those issues arise and interact in practice. In particular, this section addresses the application of these concepts to electronic bills of lading, focusing on four central issues: the specific role of electronic bills of lading platforms; whether the relationship between these platforms and their users constitutes a custodial relationship; if such a relationship exists, how it should be regulated within a custody framework; and, if it does not, how the boundaries of platform power and associated liabilities should be defined and governed.

The nature of electronic bills of lading and their custody intrinsically involves an analysis of the platforms through which they are managed. Two principal types of platforms have emerged: centralised digitisation platforms, often based on a title registry system, and digitalisation platforms, which frequently leverage decentralised blockchain technology.[723] These will be examined sequentially.

5.5.2.1 Centralised systems

The first type is the platform that provides a title registry system used by digitisation bills of lading. Scholars have varied opinions on such platforms.[724] According to Fava, this kind of platform was usually set up as a central registry, managed by third parties to record, store, and oversee the transfer of control over electronic documents. However, this approach created a single point of failure, making platforms vulnerable to cyberattacks and system failures.[725] Pejovic and Lee believe that this 'close to membership' title registry system, if involving third-

[722] See this thesis in Section 4.5
[723] See this thesis in Section 2.2.3.
[724] Rogers, Anthony & Chuah, Jason & Dockray, Martin. (2019). Bills of Lading. 10.4324/9780429059742-5; Miriam Goldby, 'Electronic Bills of Lading and Central Registries: What is Holding Back Progress?' (2008) 17(2) Information & Communications Technology Law 125; Vasileios Ziakas, 'Challenges Regarding the Electronic Bill of Lading (eBoL)' (2018) 3(1) International Journal of Commerce and Finance 40.
[725] Jake Fava, 'Chip off the Old Block: Acknowledging the Obstacles to Widespread Adoption of Blockchain Bills of Lading' (2021) 7 LSE LR 181, 190.

party non-members, would require reissuing bills of lading offline, resulting in inefficient circulation of bills of lading.[726]

For the title registry system, some users directly utilize the system while others choose to integrate their own systems into it.[727] Take Bolero system as an example, in its electronic bill of lading for carriers frequently asked questions, for the Question: Can I integrate to my own bill of lading system? The answer goes to: "a number of Bolero users have integrated their own systems to communicate with Bolero, this is typically achieved through gateway and mapping functionality."[728] For the Question: What documentation do I need to complete to get started? What do I need to get ready to issue eBLs? The answer is "You need to sign a simple agreement with Bolero International. You will also need to enrol to use the Bolero System. Following enrolment you will have your unique digital certificate which will allow you to log on to Bolero. We will show you how to create and issue the eBL."[729] Bolero's Title Registry is explicitly a "control and management system for documents of title that incorporates a database of information drawn from Instructions in Messages sent to Bolero" and from the electronic bills of lading's creation to its termination, "the eBL is controlled by the Title Registry".[730] This operational model clearly indicates a centralised control mechanism where the platform acts as the gatekeeper and authoritative record-keeper.

However, regardless of the approach, arguably the role of the title registry system closely resembles that of a custodian. A substantive custodial relationship often forms between the platform and its users, even in the absence of an explicit custodial agreement.[731] Similar to traditional custodianship, the title registry system takes on the responsibility of recording and safeguarding title information of electronic bills of lading. It provides users with a secure storage space to ensure that information is not tampered with or lost. In other words, the owner of the bill of lading resides with the participants in international trade, while the actual control

---

[726] Caslav Pejovic & Unho Lee, 'Blockchain Bills of Lading: A New Generation of Electronic Transport Documents' (2022) 176 Poredbeno Pomorsko Pravo 31, 35-36.
[727] See Bolero, "Frequently Asked Questions: eBL Creation and System Integration" (2023) https://www.bolero.net/resources/faqs/, accessed 20 January 2025, explaining that users may either interact directly with the Title Registry system or integrate their own internal systems with it.
[728] Bolero, Electronic Bill of Lading for Carriers Frequently Asked Questions (FAQs), p5.
[729] Ibid., p6.
[730] Bolero, 'Bolero Rulebook & Title Registry Record in Trade Transactions' (bolero.net), https://www.bolero.net/rulebook-and-title-registry-record-in-trade-transactions/ accessed 31 May 2024.
[731] See *Dirak Asia Pte Ltd v Chew Hua Kok* [2020] SGHC 58, recognising that a de facto custodial relationship may arise even absent an express agreement.

of the bill of lading resides on the platform, similar to the custody relationship of controlled electronic records.[732]

This assertion finds strong parallels in judicial interpretations of 'control' and 'custody' concerning digital information. For instance, in *Dirak Asia Pte Ltd v Chew Hua Kok*,[733] the court held that an email provider acts as an 'in effect a custodian' because users, possessing only usernames and passwords, do not technically have possession or custody of emails stored on remote servers. Similarly, users of a centralised electronic bill of lading title registry often possess credentials to access and manage their electronic bills of lading, while the platform maintains the authoritative record and the underlying infrastructure, thus exercising a significant degree of control analogous to that of a custodian over digital assets.

The rationale behind this judgment stems from the operational boundaries of these systems' power. These systems are the 'de facto controllers' of the electronic bills of lading. Here, it is necessary to distinguish between the 'de facto controllers' and the 'control'.

This "de facto control" reflects the substantive approach adopted in this thesis, which assesses control by reference to actual factual power rather than formal labels or contractual characterisation. This understanding aligns with the functional conception of "control" under frameworks such as the UNIDROIT Principles on Digital Assets and Private Law. Principle 6 defines "control" based on the factual ability to exclusively direct the use and benefits of the asset.[734] A centralised electronic bills of lading platform, by managing the title registry and the mechanisms for transfer, typically possesses this exclusive ability. Consequently, under Principle 10, such a platform, by maintaining digital assets (electronic bills of lading) for clients in the ordinary course of its business, would likely be classified as a 'custodian', establishing a custodial relationship even without explicit custodial agreements.[735]

---

[732] Digital Assets and Private Law, Public Consultation UNIDROIT 2023, Study LXXXII – PC, January 2023, Draft Principles on Digital Assets and Private Law, Principle 10, Commentary 1.
[733] *Dirak Asia Pte Ltd v Chew Hua Kok* [2013] SGHCR 1.
[734] UNIDROIT, *Principles on Digital Assets and Private Law* (2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf accessed 31 May 2025.
[735] Ibid.

To answer the difference between them, the real question here is whether electronic bills of lading in the possession and custody of the lawful holders are within the platforms' 'power', that is, where the boundaries of the platforms' power lie.

It is necessary here to distinguish this de facto control from the concept of 'power' as articulated in legal precedents such as *Lonrho Ltd v. Shell Petroleum Co Ltd*.[736] The central question is whether electronic bills of lading, while notionally in the possession and custody of lawful holders, are within the platform's 'power', that is, where the precise boundaries of the platform's authority lie. Lord Diplock in *Lonrho* defined "power" in the context of "possession, custody or power" as "a presently enforceable legal right to obtain from whoever actually holds the document inspection of it without the need to obtain the consent of anyone else".[737]

However, the judge in *Dirak* posited that such a concept might constrain the applicability of technology, thus leaning towards the view the legal rights to emails must be determined by the law governing the service terms between the cloud provider and user.[738] In *Dirak*, the judge further opined that Lord Diplock did not set out to prescribe an exhaustive definition of the expression 'power' in Order 24.[739] Moreover, His Lordship also suggested that the understanding of 'power' should be based on the facts of the case at hand.[740]

In other words, subsequent judicial considerations, particularly in the context of electronically stored information, have recognized that Lord Diplock's formulation was not intended as an exhaustive definition of 'power'.[741] Indeed, the judicial approach to 'power' and 'control' over electronically stored information has evolved to consider the practical realities of data management. As highlighted in *Dirak Asia*, the party with technical possession and the ability to

---

[736] *Lonrho Ltd v Shell Petroleum Co Ltd* [1980] 1 WLR 627 (HL).
[737] Regarding the connotation of the concept of "power", the judge cited the often-quoted authority of Lord Diplock in the House of Lords decision in Lonrho Ltd v. Shell Petroleum [1980] 1 WLR 627 (at [635]), known as "Lonrho", where he expounded:
"...in the context of the phrase "possession, custody or power" the expression "power" must, in my view, mean a presently enforceable legal right to obtain from whoever actually holds the document inspection of it without the need to obtain the consent of anyone else. Provided that the right is presently enforceable, the fact that for physical reasons it may not be possible for the person entitled to it to obtain immediate inspection would not prevent the document from being in his power; but in the absence of a presently enforceable right there is, in my view, nothing in Order 24 to compel a party to a cause or matter to take steps that will enable him to acquire one in the future. [emphasis added]."
[738] *Dirak Asia Pte Ltd and another v Chew Hua Kok and another* [2013] SGHCR 1 ("*Dirak Asia*"), [17].
[739] Ibid., [19].
[740] Ibid.
[741] Ibid., [17], [19].

grant or deny access (like an email provider or, analogously, an electronic bill of lading platform) can be seen as a custodian, irrespective of the user' ultimate legal entitlement to the data. This functional view is more aligned with the nature of digital asset platforms than a strict application of *Lonrho*'s 'presently enforceable legal right' in all contexts. The understanding of 'power' should be fact-dependent and contextual.[742]

Regarding the extent to which a cloud user can be said to have 'power' over the electronically stored information in the possession and custody of a cloud provider,[743] in *Dirak Asia Pte Ltd and another v Chew Hua Kok and another*, the judge held that:

> The answer to this question may lie in "the cloud". This is because, in so far as emails accessed using web browsers are concerned (such as Gmail, Yahoo, Hotmail, and web-based/off-site corporate email accounts), the email user does not technically have possession and custody over the emails, as the emails are stored on mail servers and data centres sited in remote locations. In this case, the user may still download and save a copy of the emails in his computer, hard disk, smart phone, tablet device, or some other compound document. However, unless the user has saved his emails in his computer or in similar devices, what the user has in his possession is not the email itself, but the username and password to access the emails in the possession of the email provider. To this end, the email provider is in effect a custodian of the electronically stored information in the user's email account.[744]

Arguably, the same logic applies to the title registry system. With digitisation, users of electronic bills of lading do not technically possess or custody over the bills themselves, as they are stored on mail servers and data centers located at remote locations. Although the digitisation bills of lading system generates original bills of lading through technology, what the users actually possess is not the electronic bill itself, instead, they hold the credentials, usernames and passwords, that allow access to the electronic ones stored within the provider's system. In conclusion, the judge clarified that the email provider is in effect a custodian of the electronically stored information in the user's email account.[745]

---

[742] Ibid., [19].
[743] Ibid., [14].
[744] Ibid., [12].
[745] Ibid.

This perspective is further supported by approaches in other jurisdictions. For example, in the US case *Flagg v. City of Detroit*, the Court found that the City had 'control' over the data through its ties with the third-party provider.[746] A similarly detailed investigative approach was used in *Ice Corp v Hamilton Sundstrand Corp*,[747] where various factors were weighed, including who could access the documents, their use, who created, acquired, or maintained them, and any evidence of the transfer of ownership or document title.[748]

These discussions underscore that determining a platform's power is "necessarily a *fact intensive exercise* which requires a contextual and nuanced appreciation of the relationship between the producing party and the third party in possession and custody of the documents."[749] The need to address this topic underpins the importance of the empirical interviews in this thesis. Furthermore, delineating the boundaries of a platform's power is vital for the regulation of electronic bills of lading, both in the scope of platform liability and within evidence law, assisting in the distribution of evidentiary responsibilities should disputes occur.

The critique focused on the inherent structural weaknesses of centralised systems, whereby the failure of a pivotal component can cause a total system shutdown, is arguably not merely a technical concern; it has direct legal ramifications for a platform's duty of care if it is deemed a custodian. A failure to adequately mitigate this known risk, leading to loss, could constitute a breach of the custodial duty to safeguard assets, as might be implied by frameworks like UNIDROIT Principle 11.[750] Furthermore, while user agreements like Bolero's Rulebook attempt to define roles and limit liability, a de facto custodial relationship established by the platform's operational control may impose certain non-excludable duties, particularly concerning the integrity and security of the electronic bills of lading.

---

[746] 252 F.R.D 346, 353 (E.D. Mich 2008).
[747] 245 F.R.D. 513 (D. Kan 2007).
[748] David D Cross and Emily Kuwahara, 'E-Discovery and Cloud Computing: Control of ESI in the Cloud' (2010) 1(2) EDDE: E-Discovery Digital Evidence Journal 1, 2.
[749] See *Dirak Asia Pte Ltd and another v Chew Hua Kok and another* [2013] SGHCR 1 ("*Dirak Asia*"), para. 34.
[750] UNIDROIT, *Principles on Digital Assets and Private Law* (2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, Principle 11: Duties owed by a custodian to its client, accessed 31 May 2025.

5.5.2.2 Decentralised systems

This subsection examines decentralised electronic bill of lading systems in order to test how the substantive approach to control and custody applies in environments where platform involvement is deliberately minimised. It addresses whether such platforms can truly support self-custody, or whether, in practice, they continue to exercise a degree of control that has legal significance. The second type of platform utilizes decentralised technology, often blockchain, for managing 'digitalisation' electronic bills of lading. As discussed in Section 5.2.2.3 regarding decentralisation, specific questions arise concerning these platforms: What is the precise role of such third-party platforms in electronic bills of lading transactions? Do they act merely as witnesses or as presenters of the technology, or do they establish a form of custody relationship with the lawful electronic bills of lading holder?

The problem can be analogous to Bitcoin or Ether.[751] Technical teams develop and sustain the underlying blockchain. To elaborate, Bitcoin has its own foundation, its own community, comparable to a public interest organisation, and it is a core development team in the community. Although, it is named 'distributed' and 'decentralised', there are actually people who develop it, not out of thin air.[752] The created code is publicly accessible over the Internet. For example, to pass a bill or a standard, the foundation needs to vote on it. The adopted standard is synchronized with each node and cannot be operated in the dark. Each node in a coalition chain is open source, transparent, and public. Therefore, the blockchain can be understood in layers, the technical base is the blockchain, and different platforms like apple stores will 'grow' different applications on top. The electronic bill of lading platform is one of the 'growing' applications, after which electronic contracts, letters of indemnity, letters of credit, and other applications as products will be linked to the blockchain as well.[753]

A key question is whether the platform can access encrypted electronic bill of lading data. The interviewee acknowledged that for the first generation of products, the platform side is accessible for certain data, but the key data is not exposed.[754] The ultimate goal of using blockchain technology is complete data sharing, and mutual verification, thusly achieving

[751] According to the interviewee from a third-party electronic bills of lading technology provider (21 October 2022).
[752] Ibid.
[753] Ibid.
[754] Ibid.

'decentralisation.' As applications continue to be enriched, the platform's role in the future may be simply to provide the platform service, and even user registration is not required. Per the data privacy of the platform, it is completely achievable technically, but it is not yet been realized.[755]

If such full decentralised control cannot be achieved, what relationship exists between the second type of electronic bill platform and users? Does it constitute self-custody, or is it akin to a non-custodial wallet (software-as-a-service)?

Theoretically, self-custody refers to individuals or entities managing and controlling their assets or data themselves, without relying on third parties for management.[756] In the digital asset sphere, this means having complete control over private keys. While blockchain technology provides a secure, decentralised means for managing digital assets, self-custody itself does not strictly require blockchain; it can be achieved through various cryptographic and security techniques like hardware wallets or offline storage.[757]

Regarding the users of the second platform, it is arguable that they do not, in many current implementations, achieve pure self-custody. Although these platforms emphasize the data security inherent in blockchain, and the definition of self-custody might appear to fit, completely eliminating platform influence seems unfeasible in practice. [758]

An interviewee from a third-party blockchain platform provider, when asked about the authority boundary for an encrypted data platform, stated "For the initial products, the platform can access certain data, but the core data remains unseen. As applications become more diverse, the platform's future role might be merely providing the service infrastructure, to the point where not even registration information is needed. Currently, the industry is focused on fulfilling the need for data immutability, which has been met. Regarding the issue of data privacy related

---

[755] Ibid.
[756] Blockchain Student Association from EPFL, 'Cryptocurrency Custody' (Syz Group Blog, 14 December 2022) https://blog.syzgroup.com/crypto-corner/cryptocurrency-custody accessed 27 May 2024.
[757] See NIST, Blockchain Networks: Token Design and Management Overview (NIST IR 8301, 2021) https://nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8301.pdf, accessed 10 December 2025, explaining that users may store private keys themselves, including through offline methods, rather than relying on blockchain-specific custodial structures.
[758] See the previous page: "In the realm of digital assets, self-custody means individuals or entities have complete control over the private keys and storage of their cryptocurrency or digital assets, rather than entrusting them to exchanges or other intermediaries."

to the platform, although it is technically feasible, the implementation has not yet materialized."[759] This admission is significant, as it suggests that even in systems designed for decentralisation, the platform provider may retain a degree of access or control, at least in current iterations.[760] This blurs the lines of true self-custody, where the user should have exclusive control.[761]

This relationship between the platform and the user is similar to Software as a Service (SaaS) model, in which the provider operates the technical system while users retain control over how the service and data are used. SaaS is an internet-based subscription model for software delivery, allowing users to access applications online and pay based on usage, typically via monthly or annual subscriptions.[762] Key characteristics include subscription pricing, multi-tenant architecture (multiple users share one application instance with segregated data), and provider-managed software updates and maintenance.[763] SaaS is widely used for ERP, CRM, and HRM systems, offering users access to software without needing to manage underlying infrastructure.[764]

Arguably, the second type of electronic bill of lading platforms can be classified as SaaS. They provide services based on internet subscriptions, allowing users to utilize the software without purchasing or maintaining it, merely through a subscription. Users can access these platforms over the internet to create, manage, and process electronic bills of lading without worrying about software installation, maintenance, or updates. Hence, these platforms can often be categorized as SaaS because they embody the characteristics of the SaaS model.

They offer services via internet subscription, allowing users to utilize the software without purchasing or maintaining it. Users access these platforms to manage electronic bills of lading

---

[759] According to the interviewee from a third-party electronic bills of lading technology provider (21 October 2022).
[760] Container carrier ONE working with GSBN for electronic bills of lading - Ledger Insights, https://www.ledgerinsights.com/container-carrier-one-working-with-gsbn-for-electronic-bills-of-lading/, accessed on 2 May 2025.
[761] New CFPB rulemaking makes no distinction between custodial and self-custody wallets - Coin Center, https://www.coincenter.org/new-cfpb-rulemaking-makes-no-distinction-between-custodial-and-self-custody-wallets/, accessed on 2 May 2025.
[762] Peter Mell and Timothy Grance, *The NIST Definition of Cloud Computing* (NIST Special Publication 800-145, September 2011) 3.
[763] Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, *Cloud Computing: Concepts, Technology & Architecture* (Prentice Hall 2013).
[764] Barrie Sosinsky, *Cloud Computing Bible* (Wiley 2011).

without dealing with installation or updates. However, the SaaS classification for decentralised electronic bills of lading platforms warrants careful scrutiny, particularly concerning the locus of control and the nature of custody. If a platform merely provides an interface or software tool for users to manage their own private keys and interact with electronic bills of lading tokenized on a public, permissionless blockchain, its role is more akin to a 'software provider' rather than a SaaS custodian in the traditional sense.[765] In such a 'self-custody' model, the user, not the platform, has direct control over the electronic bill of lading as a digital asset.[766] Conversely, if the platform operates a permissioned ledger, manages keys, or if its proprietary system is indispensable for the electronic bills of lading's lifecycle (creation, transfer, surrender), then the SaaS model with significant platform influence and potential custodial responsibilities becomes more accurate. The interviewee's comment about the platform potentially accessing certain data even in blockchain systems, underscores that the 'decentralised' label does not automatically equate to zero platform influence or a pure self-custody scenario for the user.[767]

The term 'decentralised' itself can be misleading. A platform employing blockchain technology is not necessarily fully decentralised in its governance, operational control, or the influence it exerts over user assets or data. The critical determinant for custody is not the underlying database technology (e.g., blockchain) per se, but rather who possesses factual and legal control over the electronic bills of lading. If a blockchain electronic bills of lading platform operates under a SaaS model where the platform retains significant control (e.g., over key management, smart contract deployment, or essential off-chain services), it could paradoxically re-centralise aspects of control that blockchain technology is often intended to distribute. This has implications for systemic risk (e.g., if the SaaS provider becomes insolvent or experiences an outage) and the allocation of liability, potentially mirroring some of the concerns associated with centralised systems.[768] The UNIDROIT Principles' definition of

---

[765] Examining Business Models of Software-as-a-Service Firms - ResearchGate, https://www.researchgate.net/publication/299691742_Examining_Business_Models_of_Software-as-a-Service_Firms, accessed on 2 May 2024.
[766] New CFPB rulemaking makes no distinction between custodial and self-custody wallets - Coin Center, https://www.coincenter.org/new-cfpb-rulemaking-makes-no-distinction-between-custodial-and-self-custody-wallets/, accessed on 2 May 2025.
[767] According to the interviewee from a third-party electronic bills of lading technology provider (21 October 2022).
[768] Blockchain in Financial Services - Competitor Leaderboard Reprint Prepared for Oracle, https://www.oracle.com/a/ocom/docs/blockchain/blockchain-platform-analyst-report.pdf, accessed on 2 May 2025.

'control'[769] and the UNCITRAL MLETR's concept of 'control'[770] become vital analytical tools here. In a genuine self-custody model on a public blockchain, the user holds the private key exercises 'control'. The platform might provide the 'reliable method' or the technical interface but not control itself.[771] However, if the platform's architecture allows it to intervene or is essential for the transfer of electronic bills of lading, then the platform may share or retain elements of 'control', moving it closer to a custodial or quasi-custodial role, even if labeled decentralised.

The preceding discussion has reflected on the applicability of the substantive approach proposed in this thesis to the custody of electronic bills of lading, drawing where appropriate on international principles, including those reflected in UNIDROIT. It has examined the role of the two main types of electronic bill of lading platforms and whether the platform-user relationship constitutes custody. For centralised digitisation platforms, a de facto custodial relationship is often established, requiring detailed analysis of the platform's power over control and custody of user data. For decentralised digitalisation platforms integrating blockchain, the scenario is more intricate. While users of such platforms may not always meet the criteria for pure self-custody, the platforms often exhibit characteristics of a SaaS model. The next critical inquiry is how to regulate the scope of platform power and associated liabilities for both types. The initial question is whether to regulate these platforms at all. Historically, jurisdictions like the EU, [772]and the US,[773] provided significant liability shields for internet platforms to foster their growth.[774] The EU's E-Commerce Directive (ECD), effective since 2000, established regulations

[769] UNIDROIT, *Principles on Digital Assets and Private Law* (2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf, Principle 6, accessed 31 May 2025.
[770] UNCITRAL Model Law on Electronic Transferable Records, Article 11.
[771] MLETR, Article 10, 12.
[772] Tyagi, Kalpana, Anselm Kamperman Sanders, and Caroline Cauffman, ed. Digital Platforms, Competition Law, and Regulation: Comparative Perspectives. Oxford: Hart Publishing, 2024. Bloomsbury Collections. Web. 25 Mar. 2024. http://dx.doi.org/10.5040/9781509969418, p1.
[773] Frosio, Giancarlo and Geiger, Christophe, 'Taking Fundamental Rights Seriously in the Digital Services Act's Platform Liability Regime' (2023) 29 Eur L J 31, p9.
[774] See World Intermediary Liability Map (WILMap) (a project designed and developed by G. Frosio and hosted at Stanford CIS) https://wilmap.law.stanford.edu, accessed on 31 March 2024.

for electronic commerce,[775] with Section 4 Articles 12 to 15 outlining a liability regime for intermediary service providers.[776]

This Directive created liability exemptions for 'mere conduit' services (like Internet Service Providers,[777] solely transmitting data without alteration),[778] 'caching' services (temporary data storage for efficiency, like Content Delivery Network,[779] without modification)[780], and 'hosting' services (providing storage, like website hosting or cloud storage).[781] Under the EU's E-Commerce Directive, electronic bill of lading platforms, by storing and managing electronic documents at the behest of users, could indeed be classified as 'hosting services' under Article 14. This classification would traditionally afford them a conditional liability exemption for the electronic bills of lading they host, provided they lack actual knowledge of illegality and act expeditiously upon obtaining such knowledge. Similarly, in the US, Section 230 of the Communications Decency Act (CDA 230)[782] has historically provided broad immunity to 'interactive computer services' by stipulating they shall not be treated as the publisher or speaker of information provided by third-party users.[783]

[775] Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market (Directive on electronic commerce), https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32000L0031, accessed on 31 Feburary 2024.
[776] Ibid., Article 12-15.
[777] ISP stands for Internet Service Provider, referring to companies or organizations that offer internet access services, enabling individuals, families, and businesses to connect to the internet.
[778] Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market (Directive on electronic commerce), https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32000L0031, accessed on 31 February 2024, Article 12.
[779] CDNs, or Content Delivery Networks, are systems of distributed servers that deliver web content to users based on their geographic location, the origin of the webpage, and the content delivery server. They aim to speed up web page loading times by temporarily storing data, without altering the content itself.
[780] Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market (Directive on electronic commerce), https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32000L0031, accessed on 31 February 2024, Article 13.
[781] Ibid., Article 14.
[782] Communications Decency Act 1996, 47 U.S.C. § 230(c).
[783] Ibid.

However, the proliferation of user-generated content (UGC)[784] and associated issues of intermediary liability have spurred a re-evaluation of these broad immunities.[785] For example, the European Commission published its proposal on Digital Services Act on 15 December 2020, which is intended to create a modern legal framework on a Single Market for Digital Services (Digital Services Act) and amending Directive 2000/31/EC.[786] In 2022, the EU enacted the Digital Services Act, and as of February 17, 2024, the DSA rules apply to all platforms.[787] The DSA overhauls EU laws for online intermediaries dealing with user content, updating the e-Commerce Directive. It applies to various internet services and sets specific legal expectations for each category, like hosting or marketplaces. Extending beyond EU borders, it governs services targeting EU states and can impose fines up to 6% of a company's annual revenue.[788] Additionally, it expands the European Commission's regulatory authority.[789]

Same in US, the wide-ranging immunity was revisited with the introduction of the Fight Online Sex Trafficking Act (FOSTA) in 2018, which significantly amended the original law for the first time since 1996.[790] FOSTA has extended the liability of intermediaries to include sex trafficking and prostitution, a move aimed at countering the use of online platforms for illegal acts that

---

[784] User-generated content (also known as UGC or consumer-generated content) is original, brand-specific content created by social media users and published on social media or other channels. Claire Beveridge, User-Generated Content (UGC): What It Is + Why It Matters, https://blog.hootsuite.com/user-generated-content-ugc/, accessed on 31 March 2024.

[785] Tyagi, Kalpana, Anselm Kamperman Sanders, and Caroline Cauffman, ed. *Digital Platforms, Competition Law, and Regulation: Comparative Perspectives*. Oxford: Hart Publishing, 2024. Bloomsbury Collections. Web. 25 Mar. 2024. http://dx.doi.org/10.5040/9781509969418, p19.

[786] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on a Single Market For Digital Services (Digital Services Act) and amending Directive 2000/31/EC, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020PC0825, accessed on 31 February 2024.

[787] Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market For Digital Services and amending Directive 2000/31/EC, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32022R2065, accessed on 31 March 2024.

[788] Article 52.3: "Member States shall ensure that the maximum amount of fines that may be imposed for a failure to comply with an obligation laid down in this Regulation shall be 6 % of the annual worldwide turnover of the provider of intermediary services concerned in the preceding financial year.
Member States shall ensure that the maximum amount of the fine that may be imposed for the supply of incorrect, incomplete or misleading information, failure to reply or rectify incorrect, incomplete or misleading information and failure to submit to an inspection shall be 1 % of the annual income or worldwide turnover of the provider of intermediary services or person concerned in the preceding financial year."

[789] European Commission, Digital Service Act Overview, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-services-act_en, accessed on 31 March 2024.

[790] Allow States and Victims to Fight Online Sex Trafficking Act of 2017, Pub. L. No. 115-164, § 4, 132 Stat. 1253, 1254 (2018).

exploit the vulnerable. The law aims to strike a balance between safeguarding free speech on the internet and curtailing the misuse of digital spaces for harmful conduct.[791] The U.S. Department of Justice has also issued a review of Section 230 of the CDA, concluding that "the time is ripe to realign the scope of Section 230 with the realities of the modern internet. Reform is important now more than ever."[792]

This shift in regulatory attitude is mirrored in academic discourse. Lefouili and Madio argue that US's Section 230 of the CDA and the EU's e-Commerce Directive have been outdated.[793] They discussed the economic effects of incentives for self-regulation by online platforms and the introduction of stricter platform liability.[794] Some scholars have also pointed out that the platform's 'dark pattern' does not present content and information neutrally. Their layout leads users to choices and actions that might stray from their real tastes and preferences.[795]

Regarding how to regulate the liability of platforms, some scholars analyse from a fundamental rights perspective the efforts to strike a balance between the free development of platforms and the protection of human rights, believing that the EU's DSA contributes to a balanced and proportionate European legal instrument.[796] Other scholars start with the definition and types of digital platforms, mentioning that there is no uniform definition and that the types are numerous.[797] Furthermore, it is proposed to apply a general legal approach to liability to digital platforms, pointing out that the nature of platform activities and their interaction with consumers implies a predominantly secondary liability.[798] At the same time, a subjective approach is also mentioned as being applied to the allocation of platform liability: the court's

[791] Ibid.
[792] DEPARTMENT OF JUSTICE'S REVIEW OF SECTION 230 OF THE COMMUNICATIONS DECENCY ACT OF 1996, https://www.justice.gov/archives/ag/department-justice-s-review-section-230-communications-decency-act-1996, accessed on 31 March 2024.
[793] Yassine Lefouili & Leonardo Madio, 'The Economics of Platform Liability' (2022) 53 Eur JL & E 319, 320.
[794] Ibid., 347-349.
[795] Tyagi, Kalpana, Anselm Kamperman Sanders, and Caroline Cauffman, ed. Digital Platforms, *Competition Law, and Regulation: Comparative Perspectives*. Oxford: Hart Publishing, 2024. Bloomsbury Collections. Web. 25 Mar. 2024. http://dx.doi.org/10.5040/9781509969418, p9.
[796] Frosio, Giancarlo and Geiger, Christophe, 'Taking Fundamental Rights Seriously in the Digital Services Act's Platform Liability Regime' (2023) 29 Eur L J 31, 18-37.
[797] Dmitriy Kozhemyakin & Svetlana Mironova, 'Legal Approaches to Liability of Digital Platform Operators to Consumers' (2022) 10 IJCLP 22, 25-29.
[798] Ibid., 31.

analysis of the nature of the platform's activities is not as much as the analysis of the consumer's perception of these activities.[799]

The DSA's framework is particularly representative of this new regulatory direction. It builds upon the ECD by introducing a categorical distinction for intermediary services: (a) very large online platforms (VLOPs), (b) online platforms, (c) hosting providers, and (d) other intermediary services.[800] The qualification is based on relevant activities, not on the overall service provider. This means that a service provider may qualify as an online platform with respect to certain activities and as a 'mere conduit' for others. Every intermediary service must set up a contact point as part of their due diligence. Hosting providers should have an easy-to-use notice and action process for others to report illegal content. The draft tightens how online platforms manage complaints and their reporting duties to authorities. It suggests setting up ways to resolve disputes outside of court, using trusted flaggers, and preventing complaint misuse. Small businesses, though, are exempt from these extra rules. The proposal sets extra requirements for VLOPs in risk management, data access, rule compliance, transparency, and conducting independent audits.

For electronic bill of lading platforms, the DSA's implications are profound. Classified likely as 'hosting services' (Art. 3(g)(iii) DSA), they must implement robust 'notice and action' systems (Art. 16 DSA) enabling users and authorities to report 'illegal content'.[801] In the electronic bills of lading context, 'illegal content' extends beyond typical user-generated material to include fraudulent electronic bills of lading, documents facilitating trade in prohibited goods, or those contravening sanctions or financial crime legislation. Platforms would be required to act diligently on such notices and provide clear statements of reasons for any content moderation decisions (e.g., disabling fraudulent electronic bills of lading). Furthermore, if electronic bills of lading platform's functionalities extend to enabling traders to conclude contracts for the sale of goods represented by the electronic bills of lading, it might be classified as an 'online

[799] Ibid., 34.
[800] The Digital Services Act: Practical Implications for Online Services and Platforms - Latham & Watkins LLP, https://www.lw.com/admin/upload/SiteAttachments/Digital-Services-Act-Practical-Implications-for-Online-Services-and-Platforms.pdf, accessed on 2 May 2025.
[801] The impact of the Digital Services Act on digital platforms | Shaping Europe's digital future, https://digital-strategy.ec.europa.eu/en/policies/dsa-impact-platforms, accessed on 2 May 2025.

marketplace', triggering stringent Know Your Business Customer (KYBC) obligations (Art. 30 DSA)[802], requiring verification of traders using the platform.

Electronic bill of lading platforms, which function similarly to hosting services by providing digital storage and document handling, are situated in the application layer of the five-layer model of digital architecture.[803] Owners store their information on these platforms for secure management and processing. Unlike paper bills, electronic version's owners rely on these platforms for document management, processing, and ensuring lawful use. In summary, this creates an interaction akin to a custody relationship, where the platform provides special protection for the document's security and reliability.

The following table provides a comparative overview of regulatory and liability considerations for different types of electronic bills of lading platforms:

Table 1: Comparative Liability Considerations for electronic bills of lading Platforms

Feature/Issue	**Centralised (Digitisation/ Title Registry) Platforms (e.g., Bolero-type)**	**Decentralised (Blockchain-based) Platforms - SaaS Model (Platform-Managed Aspects/Keys)**	**Decentralised (Blockchain-based) Platforms - Software Provider/Self-Custody Interface Model (User-Managed Keys)**	**Key Regulatory/Legal Principles & Instruments Implicated**

[802] The Digital Services Act: Practical Implications for Online Services and Platforms - Latham & Watkins LLP, https://www.lw.com/admin/upload/SiteAttachments/Digital-Services-Act-Practical-Implications-for-Online-Services-and-Platforms.pdf, accessed on 2 May 2025.
[803] See this thesis on page xx.

Nature of Custody / Locus of Control	Platform is de facto custodian; controls central registry.	Platform may retain significant control/access or manage keys; shared or platform-centric control.	User has primary control via private keys; platform provides interface/tools.	UNIDROIT P6 (Control), P10 (Custody); MLETR Art. 11 (Control); *Dirak Asia*.
Platform's Role	Custodian, Central Registrar, Service Provider.	SaaS Provider, potentially with custodial responsibilities, Network Operator/Governor.	Software/Tool Provider, Technology Facilitator.	UNIDROIT P10; DSA (Hosting, Online Platform, Marketplace definitions).
Basis of eBL Singularity/Integrity	Centralised database integrity; platform's operational rules (e.g., Bolero Rulebook).	Blockchain consensus mechanism; smart contract logic; platform's off-chain services.	Blockchain consensus mechanism; user's private key security.	MLETR Art. 10, 12 (Reliable Method); P&I Club approval criteria (reliability).
Liability for Fraudulent eBL (User-Generated/Uploaded)	Potential liability if platform fails in due diligence or	Similar to centralised if platform has control/moderation	Lower direct platform liability for content if	DSA (Illegal Content, Notice & Action); ECD

	notice/action; subject to ECD/DSA hosting safe harbours.	capabilities; subject to ECD/DSA safe harbours.	truly user-controlled; platform provides tools, not content. Still, DSA may apply to underlying infrastructure provision.	Art. 14; CDA 230 (US).
Liability for System Failure/Data Loss/Cybersecurity Breach	Platform liability often limited by user agreement; negligence standard may apply. Potential breach of custodial duty.	SaaS terms likely limit liability; depends on nature of failure (platform vs. blockchain protocol).	Platform (software provider) liability likely limited to software defects; user responsible for key security and interaction with blockchain.	User Agreements; UNIDROIT P11 (Duty to Safeguard); Negligence principles.
Liability for Misdelivery due to Platform Error	High potential platform liability if error	Potential platform liability if SaaS	Low platform liability if	Contract law; Bailment principles (if

	in registry leads to misdelivery.	system error causes misdirection of eBL control.	user error in managing keys/transfers on blockchain.	applicable by analogy).
User Onboarding/KYBC Requirements	Depends on specific services; less likely for pure registry unless facilitating trades.	If deemed online marketplace under DSA, KYBC applies.	Less likely for pure software provider model, unless platform facilitates regulated activities.	DSA Art. 30 (KYBC for Marketplaces).
Notice & Action for Illegal eBLs	DSA hosting provider obligations apply (notice, takedown, reasons).	DSA hosting provider obligations apply if platform stores/manages eBLs.	Platform may have obligations if it provides the 'means' to disseminate, but primary responsibility on user. Complex if platform is just an interface to	DSA Art. 16 (Notice & Action).

			public blockchain.	
Platform Insolvency: User Access to eBLs	User rights depend on segregation of assets and legal status (bailment/trust vs. debtor-creditor). Risk of assets being part of insolvency estate.	If platform is custodian, UNIDROIT P13 applies (assets not part of estate). If SaaS, service continuity is key. Data extraction critical.	If true self-custody on public DLT, user retains access via keys, independent of platform solvency. Platform (software) may cease to function.	UNIDROIT P13 (Insolvency of Custodian); National insolvency laws.
Interoperability Liability	Liability defined by bilateral agreements if interoperating.	DCSA Legal Framework (multilateral agreement) aims to standardize liability allocation in transfers. Contractual bridges between rulebooks.	Depends on how interoperability is achieved at the protocol/user level.	DCSA Interoperability Framework; Contract law.

This section has explored the custodial issues related to electronic bills of lading by examining two types of platforms: digitisation bill of lading platforms and decentralised platforms. The

distinction between these platform architectures, particularly concerning the locus of control as understood through the substantive approach, as well as through frameworks such as the UNIDROIT Principles and MLETR, and the nature of the platform-user relationship, significantly influences how they are, or should be, regulated. Building on this, the next subsection evaluates the effectiveness of the substantive approach in addressing custody challenges of electronic bills of lading.

5.5.3 Evaluation

This section critically evaluates the efficacy of the substantive approach, as explored in Section 5.5.2, in resolving the multifaceted custody challenges inherent in electronic bills of lading. The assessment will consider its impact on legal clarity, operational robustness, and regulatory alignment across both centralised and decentralised electronic bills of lading platforms, drawing upon the legal and practical issues identified in Section 5.5.1 and the application of the substantive approach detailed in Section 5.5.2.

The preceding analysis indicates that while the substantive approach presents considerable advantages for addressing the intricate custody challenges pertinent to electronic bills of lading, it is not devoid of limitations and areas necessitating further scholarly and practical development. This subsection aims to synthesize this evaluation, providing a balanced assessment of the approach's overall efficacy by delineating its principal strengths, inherent weaknesses, and persistent gaps.

Among its principal strengths, by emphasizing factual control, this approach furnishes a more direct and frequently more accurate method for identifying custodial relationships, which consequently can reduce legal ambiguity. The establishment of a clearer basis for custodial status through this approach also strengthens the legal foundation for imposing duties of care upon electronic bills of lading platforms, especially concerning security, system reliability, and the integrity of electronic bills of lading records.[804] Finally, the substantive approach supports and encourages judicial interpretations, exemplified by cases such as *Dirak Asia*, that are more consonant with the realities of digital environments, particularly for issues of power and control over electronically stored information.

[804] See Section 5.5.1.2.A.

Conversely, certain weaknesses and limitations are apparent. The demonstration of factual control within a digital context can be technically complex and resource-intensive, potentially leading to an elevated burden of proof in disputes and demanding considerable technical expertise from legal practitioners and adjudicators. Moreover, while effective in identifying the entity acting as a custodian, the substantive approach may not fully articulate the precise content and scope of all attendant custodial duties, such as specific cybersecurity standards or data protection measures. These often require supplementation through specific regulations or contractual agreements. The application of the concept of singularity, exclusive control can also prove challenging in highly decentralised systems where control functions might be distributed, or within interoperable ecosystems where control is sequentially passed or shared among multiple entities. Additionally, the very concept of control, particularly in relation to novel DLT architectures and smart contract governance, may necessitate continuous refinement and interpretation to maintain its efficacy.

Several gaps also persist in the current application and understanding of the substantive approach. There is a need for clearer legal guidelines and liability allocation models specifically tailored for interoperable electronic bills of lading platform. While industry initiatives, such as the DCSA's proposed legal framework, are emerging, broader legal recognition and support are required.[805] Another major gap is that there are no widely accepted and detailed global standards that clearly define what counts as reasonable protection measures for custodians. Lastly, the application and recognition of the substantive approach can exhibit considerable variation across jurisdictions. Potential conflicts with existing national laws, which may have entrenched, differing definitions or presumptions regarding digital assets, documents of title, or custody, can undermine the harmonizing potential of the substantive approach.

5.6 Conclusion: overall assessment of the substantive approach

This chapter has shown that the substantive approach is fully applicable to electronic bills of lading, especially in relation to definition, control, proprietary rights, and custody. While electronic bills of lading share some functions with paper bills of lading, it is clear that they present unique legal challenges that cannot be fully addressed through the current

[805] See Section 5.5.1.

predominant approaches. The definition and scope of electronic bills of lading, for instance, highlight their distinct nature as digital assets, which complicates their treatment under existing legal frameworks that were primarily designed for paper-based documents.

In terms of control, while paper bills of lading are well-understood in their role as tangible evidence of the transaction, electronic bills of lading involve more complex technological systems that do not lend themselves to the same forms of control. Similarly, issues related to proprietary rights are more complicated for electronic bills of lading, as they involve the digital transfer of ownership, raising questions about the sufficiency of traditional legal approaches. The notion of custody also reveals significant differences, with electronic bills of lading requiring new mechanisms for secure storage and transfer that are not present in the case of paper bills.

These unique legal issues cannot be effectively resolved by merely applying the predominant approach right now. Instead, the methodology outlined in Chapter 5, which advocates for a more flexible and context-specific legal framework, is better suited to address the complexities of electronic bills of lading. This approach provides a more nuanced solution to the challenges posed by electronic bills of lading, offering a pathway to resolve issues that the current predominant approach cannot adequately address.

Chapter 6 Conclusion

This thesis mainly revolves around the approaches of regulating electronic bills of lading. The research questions of this thesis are threefold:

How did the principle of functional equivalence become the predominant method for regulating electronic bills of lading?

What are the limitations of the principle of functional equivalence?

Are there alternative regulatory approaches that can replace the principle of functional equivalence?

To answer the first question, we traced from historical and theoretical perspectives how the principle of functional equivalence entered the legal field from sociology and how it became the predominant principle for regulating electronic bills of lading. For the second question, we used empirical research as much as possible to understand the practice of electronic bills of lading and explored what limitations the principle of functional equivalence would have in practice. On the basis of these limitations, this thesis further puts forward its own contribution, namely the substantive approach. We first introduced the regulatory content of the substantive approach in terms of the definition, control, proprietary rights and custody of electronic bills of lading, and then examined the extent to which this method can be applied to the regulation of electronic bills of lading, and drew a positive conclusion.

6.1 Summary of findings

For the findings and the arguments of this thesis:

The functional equivalence approach has historically played a pivotal role in bridging the transition from paper-based to electronic records. Its emergence in the legal domain and its establishment as the predominant principle governing electronic bills of lading rest on solid theoretical foundations, particularly functionalism and equivalence functionalism, which facilitated its evolution from initial thoughts into a legal doctrine. At the same time, through international instruments such as the Rotterdam Rules and the MLETR, functional equivalence has been formally entrenched as a core regulatory principle in the field of electronic

commercial law. This evolution not only illustrates the adaptive logic of law in responding to technological change but also provides a normative foundation for the legal recognition of electronic bills of lading and the design of related regulatory frameworks.

From its theoretical underpinning and history, it can be seen that the functional equivalence principles provided a workable framework that enabled electronic bills of lading to gain initial legal recognition and legitimacy. In this sense, it has fulfilled an indispensable historical mission. It is also found that although the principle of functional equivalence has a theoretical foundation, its continued dominance in practice stems more from the slow pace of commercial adoption and the lack of viable alternatives. However, as technology continues to evolve and digital trade infrastructures become increasingly sophisticated, the limitations of functional equivalence have become more apparent. What was once a sufficient mechanism for legal adaptation can no longer fully address the complex issues arising in the context of electronic bills of lading. This shift does not diminish its past contribution but rather underscores the need for a substantive approach that can engage with the intrinsic characteristics of electronic records and offer a more coherent regulatory framework for the future.

This thesis further argue that the functional equivalence principle has obvious limitations in dealing with electronic bills of lading: its scope is limited, as some categories of electronic transferable records lack offline counterparts, making complete functional substitution impossible. Secondly, it gives rise to blurred conceptual boundaries, as different international instruments adopt overlapping but inconsistent terminology. Moreover, functional equivalence deliberately restricts itself to formal validity, leaving substantive legal effects, such as evidentiary value, subject to divergent domestic rules. Fourthly, the principle promises flexibility in theory but often results in rigid outcomes in practice, creating inconsistencies across jurisdictions. Fifth, the pursuit of flexibility is itself shaped by varying contextual factors, including technological choices and institutional preferences, which further fragment its application. Finally, functional equivalence is ill-equipped to resolve private international law challenges, as neither international instruments nor domestic legislation adequately address conflicts of law in cross-border digital.

Building on the identified limitations, this thesis proposes the substantive approach as an alternative regulatory approach. Unlike the principle of functional equivalence, the substantive approach emphasizes that regulation should proceed from the inherent attributes of electronic records, recognizing electronic bills of lading not merely as substitutes for paper bills of lading

but as independent legal instruments. Electronic bills of lading are electronic records capable of being controlled and therefore qualify as digital assets. They may also be the subject of proprietary rights.

Through this systematic analysis of the definition, control, proprietary nature, and custody of electronic bills of lading, this thesis argues that the substantive approach is fully applicable to electronic bills of lading and can provide a more coherent and context-sensitive legal framework for their regulation.

6.2 Key contributions

The contributions of this thesis are mainly reflected in three aspects.

First, at the theoretical level, it deepens the academic discussion on the legal status of electronic bills of lading, clarifying the boundaries and connections between the functional equivalence approach and the substantive approach. By situating functional equivalence within its historical and context, the thesis shows both its relevance and its inherent limitations when applied to electronic bills of lading in a more advanced digital environment.

Secondly, at the normative level, this thesis establishes electronic bills of lading as legal instruments with the substantive approach, rather than merely as functional substitutes for paper documents. By focusing on issues such as control, proprietary rights, and custody, the thesis provides doctrinal clarity that may inform legislative development, judicial reasoning, and regulatory design across different jurisdictions.

Thirdly, at the practical level, this thesis offers workable guidance for legislators, regulators, and commercial actors, helping to promote the application and diffusion of electronic trade documents while ensuring legal certainty. This thesis shows that the substantive approach does not depend on the immediate adoption of uniform legislation, nor is its value confined to formal legislative reform. Rather, the substantive approach can be embedded into existing legal and commercial practices in a multi-layered and commercial manner. In the absence of unified or explicit legislation, the substantive approach may first operate through judicial interpretation and the evolution of adjudicative reasoning. When resolving disputes involving electronic bills of lading, courts need not confine their analysis to formal assessments of functional equivalence but may instead focus on substantive elements such as control and proprietary

right, thereby determining the legal effects of electronic bills of lading on a more substantive basis and gradually reshaping regulatory logic at the case level. The substantive approach may also be implemented through industry rules and contractual mechanisms. In practice, shipping companies, platform operators, and trade participants frequently rely on standard terms, platform rules, and multilateral contractual arrangements to define control mechanisms, modes of transfer, and the allocation of responsibilities relating to electronic bills of lading. Although such arrangements do not rely on legislation, they effectively establish an operational framework based on substantive rights, offering foundations for the development. In addition, the substantive approach may be further developed through soft-law instruments. model rules, industry guidelines, and principle-based documents issued by international organisations can provide clarification and guidance on the substantive legal attributes of electronic bills of lading, thereby reducing uncertainty for participants without requiring immediate changes to existing legislative structures.

Taken together, this thesis demonstrates the full applicability of the substantive approach in the regulation of electronic bills of lading. This approach is not only more robust in theory but also more practicable in application, providing a feasible path for the legal recognition and effective regulation of electronic bills of lading in international trade.

Overall, this thesis not only fills a gap in the academic debate on regulatory approaches to electronic bills of lading, but also provides a new approach for future legislation and practice in this field.

6.3 Limitations of the research

Based on the summary of the findings and the contributions, this section further reflects on the limitations of this thesis in terms of its theoretical stance, research focus, and methodology. By clarifying these limitations, the thesis seeks to delineate the scope of its findings and to provide a clearer point of reference for future research and institutional development concerning regulatory approaches to electronic bills of lading.

First, although this paper offers a systematic reflection on the limitations of the principle of functional equivalence and argues for the advantages of a substantive approach to regulating electronic bills of lading under their widespread adoption, it does not deny the central role of the principle of functional equivalence at the present stage. In practice, the principle of

functional equivalence remains the predominant approach adopted by jurisdictions in regulating electronic bills of lading. It has played an irreplaceable role in facilitating the legal recognition of electronic bills of lading, particularly by establishing legal equivalence between electronic and paper bills of lading and thereby securing their formal legal validity, a contribution that is both significant and indispensable.

Secondly, this thesis focuses on the legal issues that arise after electronic bills of lading have obtained formal legal recognition and entered a phase of wider commercial use. The analysis places emphasis on the shortcomings of the principle of functional equivalence in addressing substantive legal issues, such as its limited capacity to regulate matters of control, proprietary right, custody. This research orientation also means that the thesis does not fully examine the continuing practical value of the principle of functional equivalence in jurisdictions or industries where electronic bills of lading are still at an early stage of adoption.

Thirdly, although this thesis argues that a substantive approach can provide a more coherent framework for electronic bills of lading, it does not contend that such an approach can fully replace the principle of functional equivalence, especially at the present stage. On the contrary, as discussed above, the principle of functional equivalence continues to play a foundational role in establishing the legal status of electronic bills of lading and facilitating their acceptance within existing legal frameworks.

In this sense, the substantive approach should not be seen as replacing the principle of functional equivalence, but as applying at a different stage. Its value will become clearer as electronic bills of lading gain wider use and digital trade infrastructure matures.

Fourthly, particularly during the transition from paper bills of lading to electronic bills of lading, multiple forms may circulate concurrently in market practice, including paper bills, electronic bills of lading based on functional equivalence (digitisation bills of lading), and electronic bills of lading built on more advanced digital technologies (digitalisation bills of lading). How to achieve legal continuity between different types of bills of lading, how to coordinate competing claims, and how to allocate risks remain issues that existing regulatory frameworks have not yet addressed and that requires further exploration.

Fifthly, this thesis also has limitations at the empirical level. Although the thesis seeks to understand the operational logic and regulatory challenges of electronic bills of lading in real commercial settings through qualitative interviews with different stakeholders, such interviews

are inevitably constrained by the accessibility of interviewees and their willingness to disclose information. In the highly commercialised field of electronic bills of lading, which involves core business models, relevant actors are often restricted by confidentiality obligations and competitive sensitivities when expressing their genuine considerations. As a result, they tend to offer more general or institutionalised responses rather than disclose specific commercial decision-making rationales.

This limitation became apparent when approaching interviewees. For example, although this thesis attempted to contact several key market participants with experience in electronic bills of lading, including senior managers of large shipping companies and electronic bill of lading platforms, not all interviews could be conducted successfully. Some potential interviewees did not continue beyond initial contact, and some key questions did not receive detailed responses because of commercial confidentiality concerns. These constraints inevitably limit the depth of analysis of certain commercial contexts, such as the adjustment or termination of platform cooperation arrangements.

Accordingly, the empirical material in this paper is mainly used to highlight common issues, concerns, and regulatory trends in the practice of electronic bills of lading, rather than to explain the commercial decisions of specific firms in detail. This approach aligns with the overall aim of the thesis, which combines qualitative interviews with doctrinal analysis to identify the structural limits of existing regulatory approaches and to offer broader theoretical and insights into the legal regulation of electronic bills of lading.

Finally, this thesis is limited by the continuing development of technology and regulatory practice. As electronic trade systems, platforms, and international regulatory frameworks evolve, the strengths and weaknesses of different regulatory approaches may also change.

In summary, the limitations of this thesis mainly stem from the current stage of development in the regulation of electronic bills of lading, the continuing evolution of technology and legal frameworks, and the practical constraints of conducting empirical research in commercially sensitive areas. From this perspective, the substantive approach proposed should be seen as a complementary and forward-looking regulatory idea, the scope and effects of which will need to be further examined in future research and practice.

6.4 Final remarks

It is worth emphasizing that the functional equivalence approach is not a transitional tool that can be easily replaced or forgotten. It carries the first response of law in the face of technological change, embodying the adaptability and wisdom of the legal system in unfamiliar circumstances. It laid the foundation for the legal status of electronic bills of lading and created the possibilities for subsequent innovations. In this sense, the substantive approach should be regarded as a continuation and development of functional equivalence, extending its logic into a more context-sensitive regulatory approach.

Last but not least, the functional equivalence approach once led us through an important historical stage, and it deserves to be remembered. Even if it gradually reveals its insufficiency and can no longer solve all problems in the new technological environment, it remains an indispensable starting point for understanding the regulatory logic of electronic bills of lading. In a certain sense, this thesis is not only about comparing and choosing between approaches to electronic bills of lading, but also a tracing and tribute to the ‘past and present’ of the functional equivalence approach.

Bibliography

Cases

UK Cases

AA v Persons Unknown [2019] EWHC 3556, [2020] 4 WLR 35.

Armagas Ltd v Mundogas SA (The Ocean Frost) [1989] QB 14 (CA).

Asset Land Investment plc v Financial Conduct Authority [2018] EWCA Civ 518, [2018] 2 All ER (Comm) 398, [2019] Bus LR 522, [2018] 1 Lloyd's Rep 613.

Banque Bruxelles Lambert SA v Eagle Star Insurance Co Ltd [1998] AC 605 (HL).

Borealis AB v Stargas Ltd (The Berge Sisar) [2001] UKHL 17.

Cartier International AG v British Sky Broadcasting Ltd [2013] EWCA Civ 886, [2014] FSR 8, [2013] 2 CLC 272, [2014] Bus LR D2, [2014] EMLR 12.

Colonial Bank v Whinney (1885) 30 Ch 261 (CA).

East West v DKBS [2003] QB 1509, [2003] 1 Lloyd's Rep 239.

Electrosteel Castings v Scan-Trans Shipping & Chartering Sdn Bhd [2003] 1 Lloyd's Rep 190.

Elena Vorotyntseva v Money-4 Ltd and Others [2018] EWHC 2596 (Ch).

Evans v Andrea Merzario Ltd [1976] 1 WLR 1078.

Fetch.ai Ltd v Persons Unknown [2021] EWHC 2254 (Comm).

FHR European Ventures LLP v Cedar Capital Partners LLC [2014] EWCA Civ 281, [2015] QB 41, [2014] 4 All ER 928, [2014] 3 WLR 887, [2014] WLR(D) 131, [2014] 2 All ER (Comm) 899, [2014] CP Rep 31.

Fimbank plc v Discover Investment Corp (The Nika) [2020] EWHC 254 (Comm), [2021] 1 Lloyd's Rep 109.

Glencore International AG v Metro Trading International Inc (No 2) [2008] EWHC 2755 (Comm), [2009] 1 Lloyd's Rep 81.

Ion Sciences Ltd v Persons Unknown (Com Ct, 21 December 2020).

JI MacWilliam Co Inc v Mediterranean Shipping Co SA (The Rafaela S) [2005] UKHL 43, [2005] 2 AC 423.

Lavinia Deborah Osbourne v Persons Unknown and Ozone Networks [2022] EWHC 1021 (Comm).

Leduc v Ward (1888) 20 QBD 475.

Lickbarrow v Mason (1787) 2 TR 63.

Lonrho Ltd v Shell Petroleum Co Ltd [1980] 1 WLR 627 (HL).

Mayhew Foods Ltd v Overseas Containers Ltd [1984] Lloyd's Rep 370.

MSC Mediterranean Shipping Co SA v Glencore International AG [2017] EWCA Civ 365.

National Provincial Bank Ltd v Ainsworth [1965] AC 1175 (HL).

Pyrene Co Ltd v Scindia Steam Navigation Co Ltd [1954] 2 QB 402; [1954] 1 Lloyd's Rep 321.

Robertson v Persons Unknown (Com Ct, 15 July 2019).

Sanders Brothers v Maclean & Co (1883) 11 QBD 327.

Spiliada Maritime Corp v Cansulex Ltd [1987] AC 460 (HL).

Sze Hai Tong Bank Ltd v Rambler Cycle Co Ltd [1959] AC 576 (PC).

The Ardennes [1951] 1 KB 55; (1950) 84 Ll L Rep 340.

Vorotyntseva v Money-4 Ltd (t/a Nebeus.com) [2018] EWHC 2596 (Ch).

Watkins v Rymill (1883) 10 QBD 178.

Your Response Ltd v Business Media [2014] EWCA Civ 281, [2015] QB 41.

Singapore Cases

BNP Paribas v Bandung Shipping Pte Ltd [2003] SGHC 111, [2003] 3 SLR(R) 611.

B2C2 Ltd v Quoine Pte Ltd [2019] SGHC(I) 03.

Dirak Asia Pte Ltd v Chew Hua Kok [2013] SGHCR 1.

Ocean Projects Inc v Ultratech Pte Ltd [1994] SGCA 64, [1994] 2 SLR(R) 245.

Oversea-Chinese Banking Corp Ltd v Owner and/or Demise Charterer of the Vessel "STI

Orchard" [2022] SGHCR 6; [2023] 1 Lloyd's Rep 22.

Phillips 66 International Trading Pte Ltd v Owner and/or Demise Charterer of the vessel Star Quest (IMO No 9529358) [2016] SGHC 100.

Quoine Pte Ltd v B2C2 Ltd [2020] SGCA(I) 02.

Rapiscan Asia Pte Ltd v Global Container Freight Pte Ltd [2002] SGHC 72; [2002] 1 SLR(R) 701.

Standard Chartered Bank (Singapore) Ltd v Maersk Tankers Singapore Pte Ltd [2022] SGHC 242; [2023] Lloyd's Rep Plus 18.

The Cherry and others [2003] 1 SLR(R) 471.

The "LUNA" v Phillips 66 International Trading Pte Ltd [2021] SGCA 84.

The Luna and Another Appeal [2021] SGHC 84, [2022] 1 Lloyd's Rep 216.

The Neptra Premier [2001] SGHC 223; [2001] 2 SLR(R) 754.

UCO Bank v Golden Shore Transportation Pte Ltd [2005] SGCA 42, [2006] 1 SLR(R) 1.

Vinmar Overseas (Singapore) Pte Ltd v PTT International Trading Pte Ltd [2018] SGCA 65; [2019] Lloyd's Rep Plus 89; [2018] 2 SLR 1271.

New Zealand Cases

Dixon v R [2015] NZSC 147, [2016] 1 NZLR 678.

Emery Air Freight Corp v Nerine Nurseries Ltd [1997] 3 NZLR 723 (CA).

Henderson v Walker [2019] NZHC 2184.

Ruscoe v Cryptopia Ltd (in liq) [2020] NZHC 728, [2020] 2 NZLR 809.

Australia Case

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

Canada Cases

Copytrack Pte Ltd v Wall 2018 BCSC 1709 (CanLII).

Shair.Com Global Digital Services Ltd v Arnold 2018 BCSC 1512 (CanLII).

Shair.com Global Digital Services Inc v Arnold 2019 BCSC 870 (CanLII).

EU Case

Owusu v Jackson [2005] ECR I-1383 (ECJ).

United States Cases

Bank of N.Y. v Meridien BIAO Bank Tanzania Ltd 171 F.R.D. 135 (S.D.N.Y. 1997).

Golden Trade S.r.L. v Lee Apparel Co 143 F.R.D. 514 (S.D.N.Y. 1992).

Goodman v Praxair Servs 632 F Supp 2d 494 (D Md 2009).

Mainland China Case

上海海事法院（2016）沪 72 民初 1006 号民事判决 (*First Instance Civil Judgment on the Maritime and Commercial Dispute over a Letter of Guarantee between Chinaland Shipping Pte Ltd and Anyang Iron & Steel Co., Ltd*).

Hong Kong Cases

Forsa Multimedia Ltd v C&C Logistics (HK) Ltd [2011] HKCU 254.

Vastfame Camera Ltd v Birkhardt Globistics [2005] 4 HKC 117.

International Instruments

UNCITRAL, *Consolidated Official Reports on the Preparation of the United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (The Rotterdam Rules)*.

UNCITRAL, *Model Law on Electronic Commerce* (1996).

UNCITRAL, *Model Law on Electronic Commerce with Guide to Enactment* (1996, United Nations 1999).

UNCITRAL, *Model Law on Electronic Signatures* (2001).

UNCITRAL, *Model Law on Electronic Signatures with Guide to Enactment* (2001, United Nations 2002).

UNCITRAL, *Model Law on Electronic Transferable Records* (2017).

UNCITRAL, *Model Law on the Use and Cross-Border Recognition of Identity*

Management and Trust Services (2022)

UNIDROIT, *Draft Principles on Digital Assets and Private Law* (Study LXXXII – PC, January 2023).

UNIDROIT, *Draft Principles on Digital Assets and Private Law* (Public Consultation 2023).

UNIDROIT, *Draft UNIDROIT Principles on Digital Assets and Private Law* (2021) https://www.unidroit.org/wp-content/uploads/2021/07/Draft-Principles-and-Commentary-Public-Consultation.pdf accessed 31 July 2023.

UNIDROIT, *Principles on Digital Assets and Private Law* (January 2024) https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf accessed 10 January 2025.

UNIDROIT, *Principles on Digital Assets and Private Law* (January 2024).

NIDROIT, *Public Consultation on Digital Assets and Private Law* (2023) Study LXXXII – PC.

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

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

United Nations Convention on the Use of Electronic Communications in International Contracts (2005).

UN / Official Documents

UNCITRAL, Draft Convention on Negotiable Cargo Documents (UN Doc A/CN.9/1205, July 2024).

UNCITRAL, Draft Convention on Negotiable Cargo Documents (UN Doc A/CN.9/1213, July 2024).

UNCITRAL, Draft Model Law on Electronic Transferable Records: Revised Articles (Note by the Secretariat) UN Doc A/CN.9/WG.IV/WP.139.

UNCITRAL, Draft Provisions on Electronic Transferable Records (Note by the Secretariat) UN Doc A/CN.9/WG.IV/WP.115.

UNCITRAL, Explanatory Note to the United Nations Convention on the Use of Electronic Communications in International Contracts (Electronic Communications Convention).

UNCITRAL, Legal Issues Relating to the Use of Electronic Transferable Records (Note by the Secretariat).

UNCITRAL, Model Law on Electronic Transferable Records: Explanatory Note (2017).

UNCITRAL, Note by the Secretariat on Draft Model Law on Electronic Transferable Records: Revised Articles UN Doc A/CN.9/WG.IV/WP.139.

UNCITRAL, Note by the Secretariat on Draft Provisions on Electronic Transferable Records UN Doc A/CN.9/WG.IV/WP.124.

UNCITRAL, Note by the Secretariat on Electronic Commerce: Digital Signatures, Certification Authorities, and Related Legal Issues UN Doc A/CN.9/WG.IV/WP.118.

UNCITRAL, Planning of Future Work on Electronic Commerce: Digital Signatures, Certification Authorities and Related Legal Issues (Note by the Secretariat) UN Doc A/CN.9/WG.IV/WP.71.

UNCITRAL, Promoting Confidence in Electronic Commerce: Legal Issues on International Use of Electronic Authentication and Signature Methods UN Sales No E.09.V.4, ISBN 978-92-1-133663-4.

UNCITRAL, Report of the Working Group on Electronic Commerce on the work of its twenty-ninth session UN Doc A/CN.9/484.

UNCITRAL, Report of the Working Group on Electronic Data Interchange (EDI) on the work of its twenty-ninth session (New York, 10–21 March 1997) UN Doc A/CN.9/437.

UNCITRAL, Report of Working Group IV (Electronic Commerce) on the work of its fiftieth session (Vienna, 10–14 November 2008) UN Doc A/CN.9/797.

UNCITRAL, Report of Working Group IV (Electronic Commerce) on the work of its fifty-fourth session (Vienna, 31 October–4 November 2011) UN Doc A/CN.9/863.

UNCITRAL, Report of Working Group IV (Electronic Commerce) on the work of its fifty-second session (New York, 9–13 May 2011) UN Doc A/CN.9/834.

UNCITRAL, Report of Working Group IV (Electronic Commerce) on the work of its fifty-seventh session (Vienna, 2025) UN Doc A/CN.9/897.

UNCITRAL, Report of Working Group IV (Electronic Commerce) on the work of its forty-eighth session (Vienna, 2008) UN Doc A/CN.9/768.

UNCITRAL, Report of Working Group IV (Electronic Commerce) on the work of its forty-ninth session UN Doc A/CN.9/804.

UNCITRAL, Working Group IV: Report of the thirteenth session UN Doc A/CN.9/WG.IV/WP.13.

UNCITRAL, Working Group IV: Report of the thirty-fifth session UN Doc A/CN.9/WG.IV/WP.135.

Legislation

Bills of Lading Act 1992 (UK, 2020 rev ed).

Carriage of Goods by Sea Act 1992 (UK).

Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market (Directive on electronic commerce) https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32000L0031 accessed 31 February 2024.

Electronically Recorded Monetary Claims Act (Japan).

Electronic Commerce Law of the People's Republic of China 2019.

Electronic Signature Law of the People's Republic of China (adopted 28 August 2004; amended 24 April 2015 and 23 April 2019).

Electronic Trade Documents Act 2023 (UK).

Electronic Transactions Act 2010 (Singapore, Rev Ed 2011).

European Commission, *Digital Service Act Overview* https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-services-act_en.

European Parliament and Council, *Data Act* COM (2022) 68 final.

European Parliament and Council, *Artificial Intelligence Act* COM (2021) 206 final.

European Parliament and Council, *Data Governance Act* (EU) 2022/868.

Handelsgesetzbuch (German Commercial Code).

Maritime Law of the People's Republic of China.

Neb. UCC §12-105: Control of controllable electronic record https://1.next.westlaw.com/Document/NE3BEFBB02BEA11EEB845A1520E18825C/View/FullText.html accessed 1 November 2023.

Property (Digital Assets etc) Bill [HL] 2024–25, Bill 57 https://bills.parliament.uk/bills/3660 accessed 12 August 2025.

Regulation (EU) 2016/679 (General Data Protection Regulation) [2016] OJ L119/1.

Regulation on Implementation of the Provisions of the Commercial Act Regarding Electronic Bills of Lading (South Korea).

UETA §16, Official Comment 3 http://euro.ecom.cmu.edu/program/law/08-732/Transactions/ueta.pdf accessed 26 February 2023.

Uniform Commercial Code (US).

Uniform Commercial Code & Emerging Techs (Uniform Law Commission & American Law Institute 2022) https://www.uniformlaws.org/ accessed 30 July 2023.

Uniform Electronic Transactions Act (US, 1999).

Books

Aikens, Richard; Lord, Richard; and Bools, Michael, *Bills of Lading* (2nd edn, Informa Law from Routledge 2015).

Aikens, Stephen, Richard Lord QC, Michael Bools QC, Michael Bolding and KS Toh SC, *Bills of Lading* (3rd edn, Informa Law from Routledge 2020).

Arizon, Fernando de, and Semark, Daniel, *Maritime Letters of Indemnity* (Informa Law from Routledge 2014) https://doi.org/10.4324/9781315851471.

Austin, JL, *How to Do Things with Words* (Harvard University Press 1962).

Baldwin, Robert; Cave, Martin and Lodge, Martin (eds), *The Oxford Handbook of Regulation* (Oxford University Press 2010).

Basedow, J, 'Rabel, Ernst' in J Basedow and others (eds), *Encyclopedia of Private International Law* (Edward Elgar 2017) 1461 https://doi.org/10.4337/9781782547235.R.1.

Bons, M and others, 'Obstacles for the Development of Open Electronic Commerce' in M Hoogeweegen and B Vermeer (eds), *Academic Research on Electronic Commerce* (Erasmus University 1996) 128.

Bridge, Michael, *The International Sale of Goods* (5th edn, Oxford University Press 2023).

Briggs, A, *The Conflict of Laws* (4th edn, Oxford University Press 2019) 197–201.

Brownstein, Larry, *Talcott Parson's General Action Scheme* (Schenkman 1982).

Carver, T; Treitel, G and BR, *Carver on Bills of Lading* (Sweet & Maxwell 2017).

Chynoweth, P, 'Chapter Three: Legal Research' in M McConville and WH Chui (eds), *Research Methods for Law* (Edinburgh University Press 2008) 28.

Clarke, AC, *Principles of Property Law* (Cambridge University Press 2020).

Delanty, G and Harris, N, 'Critical Theory and the Question of Technology: The Frankfurt School Revisited' (2021) 166(1) *Thesis Eleven* 88.

Dicey, AV; Morris, JHC and Collins, L; *Dicey, Morris & Collins on the Conflict of Laws* (15th edn, Sweet & Maxwell 2012).

Easton, David, *A Systems Analysis of Political Life* (Wiley 1965).

Erl, T, Mahmood Z and Puttini R, *Cloud Computing: Concepts, Technology & Architecture* (Prentice Hall 2013).

Faber, W, 'Scepticism about the Functional Approach from a Unitary Perspective' in W Faber and B Lurger (eds), *Rules for the Transfer of Movables* (De Gruyter 2008) 97.

Fentiman, R, *International Commercial Litigation* (2nd edn, OUP 2015).

Fox, David and Green, Sarah (eds), *Cryptocurrencies in Public and Private Law* (1st edn, Oxford University Press 2019).

Garner, BA and Black, HC, *Black's Law Dictionary* (11th edn, Thomson Reuters 2019) 148.

Goldby, Miriam, *Electronic Documents in Maritime Trade: Law and Practice* (2nd edn, Oxford University Press 2019).

Goode, R; Kronke, Herbert and McKendrick, Ewan, *Transnational Commercial Law: Text, Cases, and Materials* (2nd edn, OUP 2015).

Goode, R and McKendrick, E, *Goode and McKendrick on Commercial Law* (5th edn, Sweet & Maxwell 2010).

Goode, R and McKendrick, E, *Goode and McKendrick on Commercial Law* (6th edn, Penguin Books 2021).

Goode, R, *Proprietary Rights and Insolvency in Sales Transactions* (2nd edn, Sweet &

Maxwell 1989).

Gray, Kevin and Gray, Susan Francis, *Elements of Land Law* (5th edn, Oxford University Press 2009).

Guo, Y, *Legislation on Electronic Transferable Record: Problem and Solution* (Peking University Press 2019).

Guo, Y, The Singularity Problem and Solution of Electronic Transferable Records Legislation (Peking University Press 2019).

Harvey, David John, *Collisions in the Digital Paradigm: Law and Rule Making in the Internet Age* (Bloomsbury Publishing 2019).

Hartley, TC, *International Commercial Litigation: Text, Cases and Materials on Private International Law* (2nd edn, CUP 2015).

Millard C (ed), *Cloud Computing Law* (2nd edn, Oxford University Press 2021).

Mills A, 'Limits on Party Autonomy in Choice of Law' in Basedow J and Rühl G (eds), *Party Autonomy in Private International Law* (Cambridge University Press 2018).

Koops, Bert-Jaap, 'Should ICT Regulation be Technology-Neutral?' in B-J Koops, M Lips, C Prins & M Schellekens (eds), *Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-Liners* (TMC Asser Press 2006) 77.

Lessig, Lawrence, *Code and Other Laws of Cyberspace* (Basic Books 1999).

Mandel, GN, 'Legal Evolution in Response to Technological Change' in Brownsword, R, Scotford, E and Yeung, K (eds), *The Oxford Handbook of Law, Regulation and Technology* (OUP 2017).

Marcuse, Herbert, *One-Dimensional Man* (Routledge & Kegan Paul 1964).

McCrudden, C, 'Judicial Comparativism and Human Rights' in E Orucu and D Nelken (eds), *Comparative Law: A Handbook* (Hart 2007) 371.

Michels, JD and Millard, C, 'Digital Assets in Clouds', in Millard, C (ed), *Cloud Computing Law* (2nd edn, Oxford University Press 2021; online edn Oxford Academic, 17 June 2021).

Michaels, R, 'The Functional Method of Comparative Law' in Reimann, M and Zimmermann, R (eds), *The Oxford Handbook of Comparative Law* (OUP 2006).

Mummery, J, 'Property in the Digital Age' in Barr, W (ed), *Modern Studies in Property Law*

vol 8 (Oxford University Press 2015).

Narayanan, Arvind; Bonneau, Joseph; Felten, Edward; Miller, Andrew and Goldfeder, Steven, *Bitcoin and Cryptocurrency Technologies* (Princeton University Press 2016).

North, P and Fawcett, JJ, *Cheshire, North & Fawcett's Private International Law* (14th edn, OUP 2008).

Palmer, N, *Palmer on Bailment* (3rd edn, Sweet & Maxwell 2009).

Parsons, Talcott, *The Social System* (Routledge 1951).

Pejović, Časlav, *Transport Documents in Carriage of Goods by Sea: International Law and Practice* (1st edn, Informa Law from Routledge 2020).

Pollock, F and Wright, RS, *An Essay on Possession in the Common Law* (Littleton, 1888).

Rabel, Ernst, *The Conflict of Laws: A Comparative Study* (University of Michigan Law School, n.d.).

Rogers, A; Chuah, J and Dockray, M, 'Bills of Lading' in *Bills of Lading* (Routledge 2019).

Schneider, MA, 'Structuralism' in G Ritzer (ed), *Blackwell Encyclopedia of Sociology* (Blackwell 2007) 4856.

Schneier, B, *Applied Cryptography: Protocols, Algorithms, and Source Code in C* (2nd edn, John Wiley & Sons 2015).

Sinclair, T, *Eastern Trade and the Mediterranean in the Middle Ages: Pegolotti's Ayas-Tabriz Itinerary and its Commercial Context* (Routledge 2019).

Smith, Marcus and Nico, Leslie, *The Law of Assignment* (3rd edn, Oxford University Press 2018).

Sosinsky, B, *Cloud Computing Bible* (Wiley 2011).

Stephan, Paul B, *The Futility of Unification and Harmonization in International Commercial Law* (University of Virginia School of Law Legal Studies Working Paper No 99-10, 1999).

Tyagi, K; Sanders, AK and Cauffman C (eds), *Digital Platforms, Competition Law, and Regulation: Comparative Perspectives* (Hart Publishing 2024).

Van der Haar, IM, *The Principle of Technological Neutrality: Connecting EC Network and Content Regulation* (Doctoral Thesis, [s.n.] 2008).

Van Erp, S, 'Comparative Property Law' in M Reimann and R Zimmermann (eds), *The Oxford Handbook of Comparative Law* (2nd edn, Oxford University Press 2019).

Zweigert, Konrad and Kötz, Hein, *An Introduction to Comparative Law* (3rd edn, OUP 1998).

Journal Articles

Aalberts, Bas P and van der Hof, Simone, 'Digital Signature Blindness: Analysis of Legislative Approaches to Electronic Authentication' (2000) 7 *The EDI Law Review* 1.

Akkermans, B, 'The Functional Method in Comparative and European Property Law' (2013) 2 *European Property Law Journal* 1.

Alba, M, 'Electronic Commerce Provisions in the UNCITRAL Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea' (2009) 44 *Texas International Law Journal* 387.

Alba, M, 'The Use of Electronic Records as Collateral in the Rotterdam Rules: Future Solutions for Present Needs' (2009) 14 *Uniform Law Review* 801.

Ali, R, 'Technological Neutrality' (2009) 14(2) *Lex Electronica* 1.

Beecher, S, 'Can the Electronic Bill of Lading Go Paperless' (2006) 40 *International Lawyer* 627.

Benkler, Yochai, 'From Consumers to Users: Shifting the Deeper Structures of Regulation toward Sustainable Commons and User Access' (2000) 52 *Federal Communications Law Journal* 561.

Bosco, AJ, 'Blockchain and the Uniform Electronic Transactions Act' (2018) 74 *Business Lawyer* 243.

Bourreau, Marc and Maxwell, Winston J, 'Technology Neutrality in Internet, Telecoms and Data Protection Regulation' (2014) 35 *Computer Law & Security Review* 407.

Boykin, DD, 'Survey of E-Contracting Cases: Browsewrap, Clickwrap, and Modified Clickwrap Agreements' (2012) 68 *Business Lawyer* 257.

Briedenbach, Stephan and Glatz, Florian, 'Digitalisation of Law' (2021) *German-Georgian Journal of Comparative Law* 1.

Bury DA, 'Electronic Bills of Lading: A Never-Ending Story' (2016) 41 *Tulane Maritime Law Journal* 197.

Cahn, NR, 'Postmortem Life On-Line' (2011) 25(4) *Probate & Property* 36.

Chandler, GF II, 'The Electronic Transmission of Bills of Lading' (1989) 20 J Mar L & Com 571.

Chan, T, 'The Nature of Property in Cryptoassets' (2023) 43 *Legal Studies* 480.

Chetrit, Naomi; Danor, Mayrav; Shavit, Angelic; Yona, Boaz; Greenbaum, Dov, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to Solve a Millennial-Long Problem with Bills of Lading' (2018) 22 *Virginia Journal of Law & Technology* 92.

Chukwuma, Stephen, 'Can the Functions of a Paper Bill of Lading Be Replicated by Electronic Bill of Lading?' (2013) 3(10) *Public Policy and Administration Research* 99.

Cross, DD and Kuwahara, E, 'E-Discovery and Cloud Computing: Control of ESI in the Cloud' (2010) 1(2) *EDDE: E-Discovery Digital Evidence Journal* 1.

Davies, Martin, 'Freight Forwarder's "House Bill of Lading"—Misleading or Deceptive Conduct—Breach of Warranty of Authority' (2018) *Lloyd's Maritime and Commercial Law Quarterly* 234.

Dancy, Tatiana, 'Crypto-Property: Response to Public Consultation by the UK Jurisdiction Taskforce of the LawTech Delivery Panel' (2019) LSE Law – Policy Briefing Paper No 36.

Dickinson, A, 'Electronic Trade Documents and the Conflict of Laws in the United Kingdom' (2024) 55 *Law Quarterly Review* 65.

Dmitriy, K and Mironova, S, 'Legal Approaches to Liability of Digital Platform Operators to Consumers' (2022) 10 *IJCLP* 22.

Faber, W and Martinson, C, 'Can Ownership Limit the Effectiveness of EU Consumer Contract Law Directives? – A Suggestion to Employ a "Functional Approach"' (2019) *Australian Law Journal* 85.

Faria, JAE, 'Uniform Law and Functional Equivalence: Diverting Paths or Stops along the Same Road – Thoughts on a New International Regime for Transport Documents' (2011) 2 *Elon Law Review* 1.

Fava, J, 'Chip off the Old Block: Acknowledging the Obstacles to Widespread Adoption of Blockchain Bills of Lading' (2021) 7 *LSE LR* 181.

Fisher, C; Calderson, SJ; Mougin, J and Radford, MJ, 'Evolution of Clickwrap & Browsewrap Contracts' (2022) 48 *Rutgers Computer & Technology Law Journal* 147.

Frosio, G and Geiger, C, 'Taking Fundamental Rights Seriously in the Digital Services Act's Platform Liability Regime' (2023) 29 *Eur L J* 31.

Furrer, A and Müller, L, 'Funktionale Äquivalenz digitaler Rechtsgeschäfte – Ein tragendes Grundprinzip …' *Jusletter* (18 June 2018).

Gabriel, HD, 'The UNCITRAL Model Law on Electronic Transferable Records' (2019) 24 *Uniform Law Review* 261.

Gagliani, Gabriele, 'Cybersecurity, Technological Neutrality, and International Trade Law' (2020) 23(3) JIEL 723.

Ganne, E, 'Blockchain for Trade: When Code Needs Law' (2021) 115 *AJIL Unbound* 419.

Gleason, David and Friedman, Laura, 'Proposal for an Accessible Conception of Cyberspace' (2005) 3 *J Information, Communication and Ethics in Society* 15.

Goldby, M, 'Electronic Bills of Lading and Central Registries: What Is Holding Back Progress' (2008) 17 *Information & Communications Technology Law* 125.

Goldby, M and Yang, W, 'Solving the Possession Problem: An Examination of the Law Commission's Proposal on Electronic Trade Documents' [2021] *Lloyd's Maritime and Commercial Law Quarterly* 605.

Gray, Kevin, 'Property in Thin Air' (1991) 50(2) *Cambridge Law Journal* 252.

Greenberg, Brad A, 'Rethinking Technology Neutrality' (2016) 100 *Minnesota Law Review* 1495.

Hashmi, S, 'The Rotterdam Rules: A Blessing' (2012) 10 *Loyola Maritime Law Journal* 227.

Haworth, Simon, 'Laying Your Online Self to Rest: Evaluating the Uniform Fiduciary Access to Digital Assets Act' (2014) 68 *University of Miami Law Review* 535.

Herd, Jake, '"Blocks of Lading": Distributed Ledger Technology and the Disruption of Sea Carriage Regulation' (2019) 18 *QUT Law Review* 306.

Heyndels, S, 'Technology and Neutrality' (2023) 36 *Philosophy & Technology* 75.

Hildebrandt, M and Tielemans, L, 'Data protection by design and technology neutral law' (2013) 29(5) *Comput Law & Sec Rev* 509 https://doi.org/10.1016/j.clsr.2013.07.004.

Husa, J, 'Functional Method in Comparative Law – Much Ado about Nothing?' (2013) 2 *European Property Law Journal* 4.

Hwaidi, M and Ferris, G, 'Switching from Paper to Electronic Bills of Lading: Part 2. Fundamental Sociological Structure, Distributed Ledger Technology and Legal Difficulties' (2020) 25(5) *Journal of International Maritime Law* 16.

Johnson, M, 'Lex Situs v Lex Digitalis: Predictions on the Jurisdiction Problem of Digital Asset Transactions' (2023) 6 *De Lege Ferenda* 55.

Kaal, Wulf A and Howe, Hayden, 'Custody of Digital Assets' (2021) University of St. Thomas (Minnesota) Legal Studies Research Paper No 22-05.

Kharitonova, J, 'Digital Assets and Digital Inheritance' (2021) 1(1) *L & Digital Tech* 19 https://doi.org/10.18254/S123456780015732-6.

Krebs, Thomas, 'Electronic Bills of Lading, Transnational and English Law: Blocking the Blockchain?' (2023) 28(3–4) Uniform Law Review 323.

Lai, Jiabin, 'Tokenisation of Documentary Intangibles' [2023] *Lloyd's Maritime and Commercial Law Quarterly* 92.

Lamont-Black, Simone, 'The Freight Forwarder as Carrier: The Purpose of House Bills of Lading' (2024) *Lloyd's Maritime and Commercial Law Quarterly* 72.

Lefouili, Y and Madio, L, 'The Economics of Platform Liability' (2022) 53 *Eur JL & E* 319.

Lenz, David M, 'Death and Downloads: The Evolving Law of Fiduciary Access to Digital Assets' (2012) 23 *Ohio Probate Law Journal Newsletter* 2.

Levina D, 'Jurisdiction at the place of performance of a contract revisited: a case for the theory of characteristic performance in EU civil procedure' (2022) 18 *Journal of Private International Law* 266.

Livermore, J and Euarjai, K, 'Electronic Bills of Lading: A Progress Report' (1997) 28 J Mar L & Com 55.

Low, R, 'Replacing the Paper Bill of Lading with an Electronic Bill of Lading: Problems and Possible Solutions' (2000) 5 *International Trade and Business Law Annual* 159.

Marinotti, J, 'Tangibility as Technology' (2021) 37 *Ga St UL Rev* 671.

Michels, Johan David and Millard, Christopher, 'The New Things: Property Rights in Digital Files?' (2022) 81 *Cambridge Law Journal* 323.

Miller, B, 'Is Technology Value-Neutral?' (2021) 46 *Science, Technology, & Human Values* 53.

Ong, Elson, 'Blockchain Bills of Lading' (2018) CML Working Paper Series, No 18/06.

Pejovic, Caslav and Lee, Unho, 'Blockchain Bills of Lading: A New Generation of Electronic Transport Documents' (2022) 176 *Poredbeno Pomorsko Pravo* 31.

Perrone, M, 'What Happens When We Die: Estate Planning of Digital Assets' (2012) 21 *CommLaw Conspectus* 185.

Pınar, Çağlayan Aksoy, 'The Applicability of Property Law Rules for Crypto Assets: Considerations from Civil Law and Common Law Perspectives' (2023) 15 *Law, Innovation and Technology* 185.

Ramsay, IDC, 'Functionalism and Political Economy in the Comparative Study of Consumer Insolvency: An Unfinished Story from England and Wales' (2006) 7 *Theoretical Inquiries in Law* 625.

Reed, Chris, 'Online and Offline Equivalence: Aspiration and Achievement' (2010) 18 *International Journal of Law and Information Technology* 264.

Reed, Chris, 'Taking Sides on Technology Neutrality' (2007) 4 *SCRIPTed* 263.

Rostill, Luke, 'Relative Title and Deemed Ownership in English Personal Property Law' (2015) 35 *Oxford Journal of Legal Studies* 31.

Savin, A, 'Rule Making in the Digital Economy: Overcoming Functional Equivalence as a Regulatory Principle in the EU' (2019) 22 *Journal of Internet Law* 3.

Shadikhodjaev, Sherzod, 'Technological Neutrality and Regulation of Digital Trade: How Far Can We Go?' (2021) 32(4) *European Journal of International Law* 1221.

Skiba, S and Karas, A, 'The Changing Role of a Freight Forwarder in Modern Supply Chains' (2022) XXV(1) *European Research Studies Journal* 341.

Thayer, AS, 'Possession' (1905) 18 *Harv L Rev* 196.

Tkachenko, AV, 'Functionalism and the Development of Comparative Law Cognition' (2010) 5 *Journal of Comparative Law* 71.

Todd, Paul, 'Electronic Bills of Lading, Blockchains and Smart Contracts' (2019) 27(4) *International Journal of Law and Information Technology* 339.

Veerpalu, A and da Cruz Rodrigues e Silva, Eduardo, 'Hitting the White Ball: The Technology Neutrality Principle and Blockchain-Based Applications' (2019) 15 *Indian Journal of Law & Technology* 300.

Wang, Feng, 'Blockchain Bills of Lading and Their Future Regulation' [2021] *LMCLQ* 503.

Whelchel, RJ, 'Is Technology Neutral?' (1986) 5(4) *IEEE Technology and Society Magazine* 3.

Whytock, CA, 'Legal Origins, Functionalism, and the Future of Comparative Law' (2009) 2009 *BYU Law Review* 1879.

Wu, Tim, 'Network Neutrality, Broadband Discrimination' (2003) 2 *Journal on Telecommunications & High Technology Law* 141.

Yakubov, A, 'Doctrinal Approaches and International Experience in Understanding the Digital Asset' (2022) 4(10) *Am J Polit Sci L & Criminology* 34.

Liew, YK, 'Cross-Border Trust Disputes and Choice of Law in East Asia' (2021) 31(1) *Washington International Law Journal* 126.

Yoo, Christopher S, 'Beyond Network Neutrality' (2005–06) 19 *Harvard Journal of Law & Technology* 1.

Z Chen, 'Jurisdiction and choice of law rules over electronic consumer contracts: The nexus between the concluded contract and the targeting activity' (2022) 29 *Maastricht Journal of European and Comparative Law* 328.

Zech, Herbert, 'Information as Property' (2015) 6 *Journal of Intellectual Property, Information Technology and Electronic Commerce Law* 192.

Zhao, Liang, 'Letter of Indemnity in Carriage of Goods by Sea: Chinese Law and Judicial Practice' (2017) 47 *Hong Kong Law Journal* 265.

Ziakas, V, 'Challenges Regarding the Electronic Bill of Lading (eBoL)' (2018) 3(1) *International Journal of Commerce and Finance* 40.

Reports

Aalberts BP and van der Hof S, 'Digital Signature Blindness: Analysis of Legislative Approaches toward Electronic Authentication' (Tilburg University, November 1999) http://cwis.kub.nl/~frw/people/hof/ds-fr.htm.

Baker S and Yeo M (with the Secretariat of the International Telecommunication Union), 'Background and Issues Concerning Authentication and the ITU' (Briefing Paper, Experts Meeting on Electronic Signatures and Certification Authorities, Geneva, 9–10 December 1999) http://www.itu.int/osg/spu/ni/esca/meetingdec9-101999/briefingpaper.html accessed 6 June 2008.

Casanova D, Dierker D, Jensen B, Hausmann L and Stoffels J, 'The Multi-Billion-Dollar Paper Jam: Unlocking Trade by Digitalizing Documentation' (*McKinsey & Company*, 4 October 2022) https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/the-multi-billion-dollar-paper-jam-unlocking-trade-by-digitalizing-documentation accessed 1 December 2022.

Chris Hoofnagle, 'Should Regulation Be "Technology Neutral"?' (UC Berkeley, 2018) https://hoofnagle.berkeley.edu/2018/02/02/should-regulation-be-technology-neutral/ accessed May 2024.

Clinton White House, *A Framework for Global Electronic Commerce* (1997) https://clintonwhitehouse4.archives.gov/WH/New/Commerce/read.html accessed 6 May 2024.

European Commission, *Digital Service Act: Practical Implications for Online Services and Platforms* (Latham & Watkins LLP, 2 May 2025) https://www.lw.com/admin/upload/SiteAttachments/Digital-Services-Act-Practical-Implications-for-Online-Services-and-Platforms.pdf.

G7, 'Creating a Modern Digital Trade Ecosystem: Cutting the Cost and Complexity of Trade' https://7703b98d-a40e-40b5-9a19-2340c0e85ea4.filesusr.com/ugd/0b6be5_c8f1719de362441f8277fcdf49240d86.pdf?index=true accessed 2 December 2022.

Goldby Miriam A, 'Managing the Risks of Switch Bills of Lading' (NUS Law Working Paper No 2019/011, NUS Centre for Maritime Law Working Paper 19/03, 2019) SSRN https://ssrn.com/abstract=3384502.

Goldby Miriam A, 'The Electronic Trade Documents Act 2023 and the 2003 Amendments to Article 7 of the Uniform Commercial Code: Do They Do the Same Thing?' (SSRN, 21 July 2023) https://ssrn.com/abstract=4517265.

Ibáñez L-D, Hoffman MR and Choudhr T, *Blockchains and Digital Assets* (2018) EU Blockchain Forum, https://www.eublockchainforum.eu/sites/default/files/research-paper/blockchains_and_digital_assets_june_version.pdf.

Lamont-Black Simone, *Freight Forwarders' House Bills of Lading – Myth, Facts and Hope* (NUS Law Working Paper No 2019/007, NUS Centre for Maritime Law Working Paper 19/01, Edinburgh School of Law Research Paper No 2019/16, 2019) SSRN https://ssrn.com/abstract=3363416.

Mell P and Grance T, *The NIST Definition of Cloud Computing* (NIST Special Publication 800-145, September 2011).

OECD, *Environmental Impact of Digital Assets: Crypto-asset Mining and DLT Consensus Mechanisms* (OECD Business and Finance Policy Papers, OECD Publishing 2022) https://doi.org/10.1787/8d834684-en.

República del Perú, *Decreto Legislativo No 1492* (10 May 2020) https://busquedas.elperuano.pe/dispositivo/NL/1866212-4 accessed 22 May 2024.

Securities and Futures Commission (Hong Kong), 'New Measures to Regulate Virtual Asset Trading Platforms' (31 May 2023) https://apps.sfc.hk/edistributionWeb/gateway/EN/news-and-announcements/news/doc?refNo=23PR5 accessed 14 January 2024.

Sicong Chen, 'The Electronic Bill of Lading – A Problem of Functional or Legal Equivalence?' (ResearchGate, 2021) https://researchgate.net/publication/350192580_The_Electronic_Bill_of_Lading_-_A_Problem_of_Functional_or_Legal_Equivalence accessed 27 May 2025.

Sir Geoffrey Vos, Master of the Rolls, 'The Economic Value of English Law in Relation to DLT and Digital Assets: Digital Assets Symposium' [2022] UKSpeech AJUWY (25 July 2022).

UK Law Commission, *Digital Assets* https://lawcom.gov.uk/project/digital-assets/ accessed 14 January 2024.

UK Law Commission, *Digital Assets and ETDs in Private International Law – Which Court, Which Law?* (Web Project, 2023) https://lawcom.gov.uk/project/digital-assets-and-etds-in-private-international-law-which-court-which-law/ accessed 15 October 2024.

UK Law Commission, *Digital Assets: Consultation Paper and Supplemental Report* (Law Com CP 256, 2023).

UK Law Commission, *Digital Assets: Final Report* (Law Com No 523, 2023).

UK Law Commission, *Digital Assets in Private International Law: FAQs* (January 2025) https://cloud-platform-e218f50a4812967ba1215eaecede923f.s3.amazonaws.com/uploads/sites/30/2025/01/Digital-assets-in-private-international-law-FAQs.pdf accessed 5 February 2025.

UK Law Commission, '*Electronic Trade Documents*' https://www.lawcom.gov.uk/project/electronic-trade-documents/ accessed 25 May 2022.

UK Law Commission, *Electronic Trade Documents: Report and Bill* (Law Com No 401,

2022) https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2022/03/Electronic-Trade-Documents-final-report-ACCESSIblE-1.pdf accessed 25 May 2022.

UK Law Commission, *Electronic Trade Documents: Report and Bill* (Law Com No 405, 2022).

UK Law Commission, *Electronic Trade Documents: Report and Bill*.

UK Law Commission, *Electronic Trade Documents: Summary*.

UK P&I Club, 'Circular 01/23: Electronic (Paperless) Trading' (2023).

Vos G, Master of the Rolls, 'The Economic Value of English Law in Relation to DLT and Digital Assets: Digital Assets Symposium' [2022] UKSpeech AJUWY (25 July 2022), para. 5–6, http://www.bailii.org/uk/other/speeches/2022/AJUWY.html.

World Economic Forum, *Europe Digital Sovereignty* (January 2025) https://www.weforum.org/stories/2025/01/europe-digital-sovereignty/ accessed 15 January 2025.

WTO, *World Trade Report 2015: Speeding up Trade—benefits and challenges of implementing the WTO Trade Facilitation Agreement* https://www.wto.org/english/res_e/publications_e/wtr15_e.htm accessed 31 January 2024.

Websites

Apple Inc, 'iCloud Terms and Conditions' (Apple, updated 2024) https://www.apple.com/legal/internet-services/icloud/cn_si/terms.html accessed 18 March 2025.

A P Møller – Mærsk A/S, 'Cyber Attack Update' (28 June 2017) https://investor.maersk.com/news-releases/news-release-details/cyber-attack-update accessed 22 May 2024.

'Are Electronic Signatures Legal?' (Pipedrive, 22 September 2021) https://www.pipedrive.com/en/blog/are-electronic-signatures-legal accessed 19 May 2024.

Beveridge C, 'User-Generated Content (UGC): What It Is + Why It Matters' (Hootsuite, 31 March 2024) https://blog.hootsuite.com/user-generated-content-ugc/.

Bilancio, 'Electronic Bills of Lading (eBL) Have One More Obstacle to Overcome'

https://www.bilancio.io/electronic-bills-of-lading-have-one-more-obstacle-to-overcome/ accessed 31 May 2025.

Bilancio, 'Is Chain of Custody Software the Future of Waste Trading?' (18 April 2024) https://www.bilancio.io/is-chain-of-custody-software-the-future-of-waste-trading/ accessed 6 June 2025.

BIMCO, 'BIMCO Publishes Electronic Bill of Lading Standard for Bulk Shipping' (14 July 2022) https://www.bimco.org/insights-and-information/contracts/20220714-ebl#:~:text=To%20help%20increase%20adoption%20of%20digital%20trade%20documents,more%20information%20and%20documentation%20for%20the%20new%20standard accessed 28 February 2023.

BIMCO, 'Complete Guide to Electronic Bill of Lading Adoption for the Bulk Trades' (17 January 2024) https://www.bimco.org/insights-and-information/general-information/20230828-ebl-guide accessed 2 February 2024.

BIMCO, 'Conference Recording' https://bimco.cloud.panopto.eu/Panopto/Pages/Viewer.aspx?id=666282da-5a00-4669-afc5-af9600ae7f38 accessed 28 February 2023.

BIMCO, 'Electronic Bills of Lading Clause' (2021).

'COSCO Shipping subsidiary issues first bill of lading on GSBN blockchain' (*Ledger Insights*, 17 January 2023) https://www.ledgerinsights.com/gsbn-ebl-cosco-shipping-bill-of-lading-blockchain/ accessed 28 February 2023.

Blockchain Student Association from EPFL, 'Cryptocurrency Custody' (Syz Group Blog, 14 December 2022) https://blog.syzgroup.com/crypto-corner/cryptocurrency-custody accessed 27 May 2024.

Bolero, 'Bolero Rulebook & Title Registry Record in Trade Transactions' https://www.bolero.net/rulebook-and-title-registry-record-in-trade-transactions/ accessed 31 May 2024.

Bolero, *Digital Trade Finance Platform: The Future of Trade* https://www.bolero.net/ accessed 2 September 2023.

Bolero, 'Electronic Bill of Lading for Carriers: Frequently Asked Questions (FAQs)' https://www.bolero.net/ accessed 2 September 2023.

Bolero, *Rulebook and Title Registry* https://www.bolero.net/rulebook-and-title-registry/index.html.

ChainUp, 'What You Need to Know About Digital Asset Custody' https://www.chainup.com/blog/institutional-digital-asset-custody-fundamentals accessed 5 June 2025.

Container carrier ONE working with GSBN for electronic bills of lading - Ledger Insights https://www.ledgerinsights.com/container-carrier-one-working-with-gsbn-for-electronic-bills-of-lading/ accessed 2 May 2025.

Correa M, 'What Is Legal Technology and How Is It Changing Our Industry?' (*The Lawyer Portal*, 29 January 2019) https://www.thelawyerportal.com/blog/what-is-legal-tech-and-how-is-it-changing-industry/ accessed 18 May 2022.

DCSA, 'DCSA Begins Final Phase of eBL Platform Interoperability Proof of Concept' (12 July 2022) https://dcsa.org/newsroom/dcsa-begins-final-phase-of-ebl-platform-interoperability-proof-of-concept accessed 21 May 2024.

DCSA, 'DCSA Publishes Beta Releases of Standards for the Booking Process 1.0 and the Bill of Lading 2.0' https://dcsa.org/newsroom/resources/beta-releases-of-standards-for-the-booking-process-1-0-and-the-bill-of-lading-2-0/ accessed 18 May 2022.

DCSA, 'eBL Platform Interoperability' https://dcsa.org/our-mission/ebl-interoperability-platform accessed 5 June 2025.

DCSA, 'Major Boost for Electronic Bills of Lading as Liner Companies Pledge 100% Adoption by 2030' (BIMCO, 17 February 2023) https://www.bimco.org/insights-and-information/general-information/20230217-ebl-commitment-dcsa accessed 21 May 2024.

Dentons, 'Electronic Bills of Lading: A Welcome Change but Not without Potential Pitfalls' (4 February 2025) https://www.dentons.com/en/insights/alerts/2025/february/4/electronic-bills-of-lading accessed 5 June 2025.

Dentons, 'Hong Kong's New Licensing Regime for Virtual Asset Trading Providers Takes Effect' (5 June 2023) https://hongkong.dentons.com/en/insights/articles/2023/june/5/hong-kongs-new-licensing-regime-for-virtual-asset-trading-providers-takes-effect accessed 14 January 2024.

Department of Justice, *Department of Justice's Review of Section 230 of the Communications Decency Act of 1996* https://www.justice.gov/archives/ag/department-justice-s-review-section-230-communications-decency-act-1996 accessed 31 March 2024.

Digital Container Shipping Association (DCSA), 'Digital Trade Initiative' https://dcsa.org/100-percent-ebl/ accessed 28 February 2023.

Digital Container Shipping Association, 'About Us' (2023) https://dcsa.org/about-us accessed 22 May 2024.

DigitalTrade4, 'Revolutionizing Global Trade with Electronic Bills of Lading' https://www.digitaltrade4.eu/revolutionizing-global-trade-with-electronic-bills-of-lading/ accessed 5 June 2025.

Dimyadi L, 'What is Legal Technology?' (*Clio*, 9 May 2022) https://www.clio.com/resources/legal-technology/what-is-legal-technology/ accessed 18 May 2022.

'Draft UN Convention on Negotiable Cargo Documents to Modernize and Digitize Global Trade Finalized' (*United Nations Information Service Vienna*, 14 July 2025) https://unis.unvienna.org/unis/en/pressrels/2025/unisl378.html accessed 26 August 2025.

EssDOCS https://www.essdocs.com/ accessed 2 September 2023.

FIT Alliance, 'FIT Alliance: Electronic Bill of Lading' (2023) https://www.fit-alliance.org/ accessed 22 May 2024.

FIT Alliance, 'Joint Statement on Driving Standards for Electronic Bills of Lading' (2022).

FIT Alliance, 'The Complete Guide to Electronic Bill of Lading Adoption for the Bulk Trades' (n.d.) https://www.bimco.org/media/wkzp3cjl/fit-alliance-complete-guide-to-bulk-ebl-adoption.pdf accessed 3 September 2025.

FIT Alliance, 'Uniting behind the Mission to Standardise the Digitalisation of International Trade' (DCSA, BIMCO, FIATA, ICC and SWIFT, 2022) https://dcsa.org/newsroom/resources/future-international-trade-alliance/ accessed 28 February 2023.

FIT Alliance, 'What is Interoperability?' (FIT Alliance eBL Guides) https://www.fit-alliance.org/electronicbilloflading accessed 3 September 2025.

Google LLC, 'Terms of Service' (22 May 2024) https://policies.google.com/terms accessed 18 March 2025.

'IA Electronic Transactions Law: General Principles' (Online Readiness Assessment Guide for Cross-Border Paperless Trade) https://readiness.digitalizetrade.org/legal-guide/ia-general-principles accessed 19 May 2024.

IBM, '3 Critical Responsibilities of Digital Asset Custodians' https://www.ibm.com/think/insights/3-critical-responsibilities-of-digital-asset-custodians accessed 5 June 2025.

Khaitan & Co, 'E-Bills of Lading: The Smart Choice Going Forward?' (Legal Era, 2021) https://www.khaitanco.com/sites/default/files/2021-12/E-bills%20of%20lading%20-%20Article%20Legal%20Era.pdf accessed 9 May 2023.

KT Hanna, 'Definition: Digitization' *TechTarget: WhatIs.com* <www.techtarget.com/whatis/definition/digitization> accessed 15 August 2023.

Loongle, 'Backdated Bill of Lading' (2024) https://www.loongle.com/backdated-bill-of-lading/.

Mayer Brown, 'Use of Electronic Signature for Commercial Transactions in Mexico' (30 June 2020) https://www.mayerbrown.com/en/insights/publications/2020/06/use-of-electronic-signature-for-commercial-transactions-in-mexico accessed 19 May 2024.

Meta Platforms Inc, 'Terms of Service' (1 January 2025) https://www.facebook.com/legal/terms accessed 18 March 2025.

Norton Rose Fulbright, 'House v Ocean – The Complexities of Bills of Lading' (1 October 2018) https://www.nortonrosefulbright.com/en-sg/knowledge/publications/af4149e0/emhouse-v-oceanem--the-complexities-of-bills-of-lading accessed 3 June 2024.

Port Technology, 'DCSA Completes Standards-Based Interoperable eBL Transaction' https://www.porttechnology.org/news/dcsa-completes-standards-based-interoperable-ebl-transaction/ accessed 5 June 2025.

Port Technology, 'DCSA Publishes Data Standards for Electronic Bill of Lading' (Port Technology International, 2020) https://www.porttechnology.org/news/dcsa-publishes-data-standards-for-electronic-bill-of-lading/ accessed 22 May 2024.

Probert S, 'Analysis: A New Dawn for Electronic Bills of Lading' (The Loadstar, 2023) https://theloadstar.com/analysis-a-new-dawn-for-electronic-bills-of-lading/ accessed 22 May 2024.

Scribd, 'The Bill of Lading As A Document of Title at Common Law' https://www.scribd.com/document/265178215/The-Bill-of-Lading-as-a-Document-of-Title-at-Common-Law accessed 6 May 2025.

StayinBusiness, 'Digital Property and Assets' https://www.stayinbusiness.com/resource/digital-property-and-assets/ accessed 17

March 2025.

Ship Inspection, 'Backdated Bill of Lading' (2024) https://shipinspection.eu/backdated-bill-of-lading/.

Shipping & Freight Resource, 'Goodbye Paper, Hello Digital: Electronic Bill of Lading Interoperability Is Finally Here' https://www.shippingandfreightresource.com/electronic-bill-of-lading-interoperability/ accessed 5 June 2025.

Stanford CIS, *World Intermediary Liability Map (WILMap)* https://wilmap.law.stanford.edu accessed 31 March 2024.

SuperMoney, Silas Bamigbola, 'Letter of Indemnity (LOI): Definition, Uses, and Real-life Examples' (23 October 2023) https://www.supermoney.com/encyclopedia/letter-of-indemnity accessed 5 June 2024.

Szakiel P, 'What Is Legal Tech? (+How It's Changing the Legal Industry)' (*G2*, 11 June 2019) https://www.g2.com/articles/legal-tech accessed 18 May 2022.

Timus Networks, 'What Is Secure Authentication? Methods & Best Practices' https://www.timusnetworks.com/the-ultimate-guide-to-secure-authentication-best-practices-for-stronger-security/ accessed 5 June 2025.

Trade Finance Global, 'Electronic Bills of Lading: Are We There Yet?' (17 May 2023) https://www.tradefinanceglobal.com/posts/electronic-bills-lading-are-we-there-yet/ accessed 25 May 2024.

TradeGo, *Electronic (Paperless) Trading* https://www.chinapandi.com/index.php/en/?option=com_attachments&task=download&id=499 accessed 3 February 2023.

TradeGo, *Electronic (Paperless) Trading* (Japan P&I Club) https://www.piclub.or.jp/en/news/36720 accessed 3 February 2023.

TRADELENS, 'eBL' https://tradelens.zendesk.com/hc/en-us/categories/4404615692177-eBL.

'Uniform Electronic Transactions Act (UETA): Glossary' (*Practical Law*) https://uk.practicallaw.thomsonreuters.com/3-578-4607 accessed 24 May 2022.

Washington University Open Scholarship, 'The New Bailments' https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1086&context=law_scholarship accessed 6 May 2025.

WaveBL, ‘Mimics Traditional Bill of Lading Process’ (2023) https://wavebl.com/overview/.

WaveBL, ‘WaveBL Mimics Traditional Bill of Lading Process’ https://wavebl.com/overview/ accessed 2 September 2023.

Wolff J, ‘How the NotPetya Attack is Reshaping Cyber Insurance’ (Brookings, 1 December 2021) https://www.brookings.edu/blog/techtank/2021/12/01/how-the-notpetya-attack-is-reshaping-cyber-insurance/ accessed 22 May 2024.

WTO, ‘Trade Facilitation’ https://www.wto.org/english/tradop_e/tradfa_e/tradfa_e.htm accessed 31 January 2024.

Zhou Chen Shipbuilding Group Co Ltd v Singapore Dreymoor Fertilizers Overseas Pte Ltd (Shanghai Maritime Court, 25 May 2017) https://shhsfy.gov.cn/hsfyytwx/ accessed 21 January 2024.