

Digital Transformation Of Maritime Transport Documents: A Juridical Analysis Of Electronic Bill Of Lading Implementation Based On The UNCITRAL Model Law On Electronic Transferable Records (MLETR)

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Abstract

This study aims to analyze the legal status and validity of the Electronic Bill of Lading (E-B/L) within the Indonesian legal system, identify regulatory gaps between national law and the UNCITRAL Model Law on Electronic Transferable Records (MLETR) 2017, and analyze the managerial implications of such legal uncertainty for shipping companies and cargo owners (shippers/consignees). The digitalization of maritime transport documents is increasingly necessary because the Indonesian Commercial Code (Kitab Undang-Undang Hukum Dagang/KUHD) remains oriented toward physical Bills of Lading, while the Electronic Information and Transactions Law (UU ITE) has recognized electronic documents. This study employs a normative and comparative juridical qualitative approach, using primary, secondary, and tertiary legal materials, which are analyzed together with the results of in-depth interviews with a Corporate Legal Associate and a Commercial Associate at a national shipping company. The findings indicate that E/B/L is legally recognized as electronic evidence under the UU ITE but has not yet obtained full legal certainty as a document of title, as the KUHD still requires physical delivery of the document. Significant regulatory gaps were also identified regarding the concepts of electronic transferable records, control as a substitute for possession, the principle of singularity, and document-conversion mechanisms. This legal uncertainty has encouraged shipping companies to implement dual-run systems and risk-mitigation strategies through international E/B/L platforms, strengthened contractual clauses, and Protection and Indemnity (P&I) Club protection. The study recommends harmonizing the KUHD and UU ITE and adopting the principles of MLETR to strengthen legal certainty and the competitiveness of Indonesia's maritime transportation sector.

403

Keywords: Electronic Bill of Lading, Model Law on Electronic Transferable Records, Electronic Information and Transactions Law, Regulatory Gaps, Maritime Transportation Management.

INTRODUCTION

Maritime transportation serves as the backbone of global trade, carrying more than 80% of the world's trade volume, and therefore requires the simultaneous integration of operational, economic, technological, and legal aspects in its management (UNCTAD, 2021). One of the most fundamental instruments in maritime transportation is the Bill of Lading (B/L), which simultaneously functions as a receipt of goods, evidence of the contract of carriage, and document of title. The third function makes the B/L a negotiable instrument that enables goods still in transit to be traded or used as collateral for international trade financing.

The development of information technology has driven the transition from paper-based Bills of Lading to Electronic Bills of Lading (E-B/Ls). The World Economic Forum and Bain & Company (2021) noted that reliance on paper-based documentation creates significant transaction costs and slows international trade cash-flow processes. On the other hand, digitally replicating the functions of the B/L—particularly its function as a document of title—presents significant legal challenges because property law (Zakenrecht) under Indonesian civil law has historically required physical delivery (levering) as a symbol of the transfer of rights over goods.

In Indonesia, the legal status of the E-B/L lies at the intersection of two legal regimes. The Indonesian Commercial Code (Kitab Undang-Undang Hukum Dagang/KUHD), particularly Articles 504 and 506, regulates the Bill of Lading within the framework of a physical document bearing a handwritten signature. In contrast, Law No. 11 of 2008 on Electronic Information and Transactions (UU ITE), as subsequently amended, recognizes electronic information as valid legal evidence under Article 5 and provides that electronic documents may satisfy written-form requirements provided that they meet standards of authenticity, integrity, and accessibility under Article 6. The normative tension between these two legal regimes raises a fundamental question: can the transfer of digital data within an E-B/L system satisfy the requirements of leveraging under Indonesian civil law, and does the holder of an E-B/L have a legal position equivalent to that of a paper B/L holder in the event of a dispute?

The urgency of legal certainty becomes even more apparent when considered in light of international precedent. In *MSC Mediterranean Shipping Co SA v Glencore International AG* [2017], before the English Court of Appeal, the delivery of cargo without adequate physical documentation—even though carried out through an electronic code system—was deemed not to have the same legal effect as the physical delivery of a B/L,

404



resulting in the carrier being held liable for misdelivery. This case serves as a warning to the global shipping industry, including Indonesia, that digital innovation without a legal framework recognizing the functional equivalence of electronic documents carries significant commercial risks. In the domestic context, the disparity between vessel transit times—approximately 2–3 days for short-sea trade routes—and the movement of physical documents through banking channels—approximately 7–14 working days—can generate significant demurrage and storage costs at major ports.

To address these challenges, the United Nations Commission on International Trade Law (UNCITRAL) issued the Model Law on Electronic Transferable Records (MLETR) in 2017 as an international legal instrument specifically governing electronic transferable records. The MLETR includes the replacement of the concept of possession with control, application of the principle of singularity, and mechanisms for conversion between physical and electronic documents. Several of Indonesia's trading partners, such as Singapore, have incorporated MLETR principles into their Electronic Transactions Act in 2021, while Indonesia has not yet undertaken similar harmonization.

Previous studies on E-B/Ls in Indonesia have tended to limit their analysis to the UU ITE framework (Ramadhan, 2021) or use the Rotterdam Rules as a comparative framework (Saputro, 2023), while international studies have focused more extensively on technical readiness and legal challenges in common-law jurisdictions (Goldby, 2020; Goldby & Bailey, 2021; Al-Khaled, 2020). Research specifically employing MLETR 2017 as the sole benchmark for regulatory gap analysis within the Indonesian maritime transportation law context, while simultaneously integrating managerial implications at the shipping-company level, remains limited. The novelty of this study lies in three dimensions: (1) the use of MLETR 2017 as the primary benchmark for regulatory gap analysis, including an examination of the sole-control principle as a substitute for possession; (2) the explicit integration of legal analysis with maritime transportation management by examining the relationship between regulatory gaps and increased contractual risks and operational logistics costs, including demurrage/detention; and (3) the prescriptive nature of the research findings, which formulates detailed legal-policy recommendations rather than merely providing a descriptive analysis.

Based on the foregoing discussion, this study is formulated to address three research questions: (1) what is the legal status and validity of E/B/Ls within the hierarchy of Indonesian legislation, particularly concerning the interaction between the KUHD and UU ITE; (2) what are the significant regulatory gaps between Indonesian national law and MLETR 2017; and (3) what are the managerial implications of such legal uncertainty for the operational decision-making and risk management of shipping companies and cargo owners (shippers/consignees) in Indonesia? The objective of this study is to analyze the gaps in national regulations concerning E/B/L adoption through a comparative



examination of Indonesian positive law and MLETR 2017, with the aim of formulating legal and managerial recommendations that support legal certainty and the digitalization of the maritime transportation sector.

LITERATURE REVIEW

Maritime Transportation Management and the Functions of Transport Documents

Maritime transportation management is understood as a systematic process encompassing planning, organizing, actuating, and controlling all activities related to the transportation of goods by sea, with the objectives of achieving operational efficiency, maritime safety, legal certainty, and protection of the parties involved (UNCTAD, 2021). Notteboom, Pallis, and Rodrigue (2022) emphasize that the effectiveness of modern maritime transportation management is largely determined by the system's ability to manage transportation information and documents accurately, rapidly, and securely. Within this framework, the planning function includes strategic decisions regarding the use of electronic documents to improve time efficiency and reduce transaction costs; the organizing function requires the integration of electronic systems among stakeholders and clear authority over document control; the actuating function depends on the reliability of documentation systems as a basis for cargo delivery (Goldby, 2020); while the controlling function requires a clear legal framework to ensure that digital traceability and transparency can operate effectively (World Bank, 2020).

The Bill of Lading (B/L) occupies a strategic position in maritime transportation management because it bridges operational and legal aspects through three primary functions: receipt of goods, evidence of the contract of carriage, and document of title. The third function is negotiable and enables goods that are still in transit to be traded or used as collateral for international trade financing. These three functions must be replicated digitally for the Electronic Bill of Lading (E-B/L) to fully replace the conventional B/L, while the document of title function represents the greatest legal challenge because of its connection to the concept of physical possession under property law (Zakenrecht).

Functional Equivalence Theory and UNCITRAL MLETR as a Digital Legal Standard

To address the legal dilemma arising from the concept of possession in traditional Bills of Lading (B/L), this study employs the Theory of Functional Equivalence as its analytical foundation. This principle constitutes a core concept of commercial cyber law developed by UNCITRAL, which provides that electronic instruments should be recognized as having legal effect equivalent to paper-based documents insofar as they are capable of fulfilling their essential functions. In Indonesia, this principle has been generally adopted through Article 5 of the UU ITE; however, the provision is *lex generalis*



in nature and is considered insufficiently specific to accommodate the particularities (lex specialis) regulated under the KUHD.

The concrete international application of the functional equivalence theory is reflected in the UNCITRAL Model Law on Electronic Transferable Records (MLETR) 2017, which was specifically designed to provide legal validity to electronically transferable commercial documents, including Electronic Bills of Lading (E/B/Ls). A key solution under the MLETR is the concept of sole control: a person is considered the legitimate holder of an E/B/L when that person can demonstrate exclusive control over the authoritative electronic record, secured through a reliable and secure system. The concept of sole control effectively substitutes physical possession with secured digital control, thereby enabling the transfer of rights over goods in an immediate and secure manner. On this basis, the MLETR is used as the primary benchmark for assessing the readiness of Indonesia's national legal framework to provide legal certainty for E/B/Ls.

Regulatory Gap Analysis and Its Relationship to Supply Chain Management

The lack of alignment between national law and MLETR standards is examined through a regulatory gap analysis approach, which distinguishes three levels of gaps: existence gaps, referring to the absence of norms explicitly regulating electronic transferable records; substantive gaps, referring to existing norms, such as the UU ITE, being considered too general to replace the specific functions regulated under the KUHD; and consistency gaps, referring to the conflict between the lex specialis framework oriented toward physical documents and the digitalization principles embodied in international standards. Failure to address these gaps has a direct impact on supply chain management, as the B/L constitutes a vital component of the information flow. Document delays (paper lag) resulting from regulatory gaps can generate significant demurrage and detention charges, thereby becoming non-tariff barriers that undermine the competitiveness of the national logistics sector.

From the perspective of international trade, Ricardo's classical theory of comparative advantage emphasizes production specialization based on the lowest opportunity costs. However, the efficiency of modern trade is also highly dependent on the smooth flow of documents and information. The trade facilitation approach, reinforced by the World Trade Organization (WTO) through the Trade Facilitation Agreement, emphasizes that the digitalization of trade documents, including E/B/Ls, is an important component in reducing administrative barriers and logistics costs. Lee (2020) indicates that the major barriers to the global adoption of E/B/Ls are legal uncertainty and the absence of a uniform legal regime across jurisdictions, while Sun and He (2024) emphasize that these barriers specifically stem from the lack of a legal framework capable of replacing the concept of possession. Adeniran (2025) further argues that the



E/B/L is not merely a technological innovation, but an instrument for transforming the legal framework of maritime carriage contracts, whose successful implementation depends on the regulatory readiness of individual countries.

Position of the Study in Relation to Previous Research

Table 1 summarizes the position of this study in relation to seven relevant previous studies using the compare–contrast–critique–synthesize–summarize framework.

Researcher (Year)	Study Focus	Differences with This Study
Goldby (2020)	The legal functions of B/L and E-B/L as transport documents in international maritime law.	Focusing on international maritime law, not specific to the Indonesian legal context and not reviewing the Criminal Code-ITE Law.
Al-Khaled (2020)	Challenges of E-B/L law in international maritime law.	Lack of discussion of contractual practices and managerial implications at the company level.
Goldby & Bailey (2021)	The legal legitimacy of E-B/L and its development globally.	A global approach, not a national analysis; it has not touched on the managerial implications.
Ramadhan (2021)	Juridical analysis of the use of E-B/L in sea transportation in Indonesia.	Does not use MLETR as a comparator; limited comparative analysis.
Notteboom, Pallis, & Rodrigue (2022)	Economy, management, and port policy.	Focusing on port management and policy, E-B/L is not specifically discussed.
Zhang, Lam, & Qi (2023)	Digital transformation in maritime logistics management.	Pendekatan manajemen, bukan yuridis; tidak membahas validitas hukum E-B/L.
Prasetyo (2023)	Implications of the digitization of transportation documents on maritime legal certainty.	Do not associate analysis with MLETR; limited managerial recommendations.

Source: Processed from the Literature Review of the Study

Based on this mapping, the novelty of this study lies in three dimensions: first, the use of MLETR 2017 as the sole benchmark for regulatory gap analysis within the context

408

of Indonesian maritime transportation law, including an analysis of the sole-control principle as a substitute for possession; second, the explicit integration of legal analysis and maritime transportation management by examining the causal relationship between regulatory gaps and increased contractual risks and operational logistics costs (demurrage/detention); and third, the prescriptive nature of the research findings, which formulates detailed legal-policy recommendations rather than merely providing a descriptive analysis.

RESEARCH METHODOLOGY

This study employs a qualitative method with a normative and comparative juridical approach. The normative juridical approach is used to examine relevant Indonesian positive-law provisions—namely the Indonesian Commercial Code (Kitab Undang-Undang Hukum Dagang/KUHD) and the Electronic Information and Transactions Law (UU ITE)—and to compare them with the international standards established under the UNCITRAL Model Law on Electronic Transferable Records (MLETR) 2017, with the aim of identifying regulatory gaps in the implementation of Electronic Bills of Lading (E/B/Ls) in Indonesia.

The data used consist of primary legal materials (national legislation and international legal instruments), secondary legal materials (maritime law textbooks, academic journals, and reports from international organizations such as BIMCO, DCSA, and ICC), and tertiary legal materials (legal dictionaries and encyclopedias). These legal materials are complemented by field data obtained through in-depth interviews with two key informants at a national shipping company: a Corporate Legal Associate, who provides a legal perspective on the recognition, validity, and legal risks of E/B/Ls, and a Commercial Associate, who provides a business-practice perspective on the operational efficiency and implementation challenges of E/B/Ls. The research objects encompass two dimensions: the juridical object, consisting of B/L legal norms under the KUHD, Shipping Law, UU ITE, and the principles of electronic transferable records under MLETR; and the managerial object, concerning the impact of legal uncertainty on the efficiency of maritime supply chain management, particularly demurrage and detention.

Data analysis is conducted using descriptive qualitative analysis following the interactive analysis model of Miles, Huberman, and Saldaña (2020), consisting of four stages: (1) data collection through interviews and document analysis; (2) data condensation by reducing and focusing the data on the research questions; (3) data display in the form of descriptive-analytical narratives; and (4) conclusion drawing and verification through comparisons among informants and cross-checking against relevant statutory provisions and literature. In parallel, normative analysis (interpretation and evaluation of national legal norms) and comparative analysis (comparison of the shift



from the concept of possession in conventional B/Ls to control in E/B/Ls under MLETR) are conducted to address the three research questions.

RESULT AND DISCUSSIONS

Legal Status and Validity of the Electronic Bill of Lading within the Indonesian Legal System

The research findings indicate that the legal status of the Electronic Bill of Lading (E/B/L) in Indonesia is currently in a phase of legal paradigm transition, representing an intersection between classical maritime law and telematics law. In principle, the E/B/L has adopted the functional equivalence principle recognized under the UU ITE: insofar as electronic information is accessible, its integrity is guaranteed, and it can be properly accounted for, its functions are considered equivalent to those of a conventional B/L as a receipt of goods and evidence of the contract of carriage. However, the status of the E/B/L as a document of title—namely, its function in enabling the transfer of ownership rights over goods—remains in a grey area. It is commercially recognized by contracting parties, but it does not yet have the same level of legal and operational recognition as a paper B/L in public-law and port operations, because Indonesia's maritime legal administration system remains largely based on physical documentation.

From the perspective of the KUHD, Article 506 historically assumes that the B/L takes the form of a physical document (cognossement) and requires physical delivery as evidence of the transfer of rights over goods. Consequently, the E/B/L faces formal validity constraints from a textual perspective. Conversely, the UU ITE serves as a legal bridge: Article 5 paragraph (1) affirms that electronic information and/or electronic documents constitute valid legal evidence, while Article 6 provides that electronic documents are deemed to satisfy written-form requirements insofar as they meet standards of authenticity, can be stored, and can be accessed. Based on these provisions, under positive Indonesian law, the E/B/L is valid and legally recognized as evidence and as evidence of the contract of carriage, based on the legal force of the UU ITE as *lex posterior*.

The interaction between the KUHD and the UU ITE in regulating E/B/Ls can be understood through the substance-over-form doctrine: the KUHD regulates the material or substantive aspects, including the rights, obligations, and carrier's liability, while the UU ITE regulates the formal or medium-related aspects by modifying the manifestation of those rights from a paper-based form into a digital form. However, the harmonization of these two legal regimes has thus far occurred primarily at the level of evidentiary law, while gaps remain in the area of property law (*Zakenrecht*). The KUHD recognizes an endorsement mechanism on physical documents under Article 508 as a means of transferring ownership of cargo, whereas the UU ITE does not yet specifically regulate



how a digital endorsement mechanism can trigger the immediate transfer of proprietary rights without the risk of document duplication or double-spending. Implementation challenges in practice also arise from three ecosystem-related aspects: the readiness of port authorities and customs agencies, which may still require physically signed and stamped documents for clearance purposes; the rigidity of the domestic banking sector in Letter of Credit (L/C)-based trade-finance transactions; and market skepticism regarding the cybersecurity of E/B/L systems.

Regulatory Gaps between Indonesian National Law and the UNCITRAL MLETR 2017

This study identifies three fundamental forms of regulatory gaps between Indonesian national law and the MLETR 2017. First, the absence of the electronic transferable record (ETR) concept: Indonesia's UU ITE currently regulates electronic documents in general (generic electronic records), whereas the MLETR provides specific provisions for commercial documents whose value can be transferred digitally, such as Bills of Lading, bills of exchange, and promissory notes. Second, the absence of the control doctrine as a substitute for possession: Indonesian conventional law establishes ownership of a B/L through physical possession of the document, whereas the MLETR replaces this with a technology-based concept of control (for example, through distributed ledger technology) that ensures the principle of singularity, whereby only one original and valid document/token exists and cannot be duplicated. Such technological control standards have not yet been specifically regulated under the UU ITE. Third, there is currently no legally established mechanism for converting a paper B/L into an E/B/L or vice versa (paper-to-electronic and electronic-to-paper conversion) without disrupting the legal chain of the underlying contract, as provided under the MLETR.

These regulatory gaps generate at least three legal implications for international trade. First, they create legal uncertainty for third parties: correspondent banks involved in Letter of Credit transactions and international maritime insurance companies may be reluctant to use E/B/Ls involving Indonesian jurisdictions because of concerns regarding judicial recognition of rights transferred through digital endorsement. Second, they create legal risks for carriers (carrier's liability): without the adoption of MLETR standards, carriers may face claims from third parties asserting that they hold the physical B/L, because national law does not yet clearly establish when an E/B/L fully replaces the function of a paper B/L. Third, they create obstacles to digital economic competitiveness: compared with neighboring countries such as Singapore, which incorporated MLETR principles into its Electronic Transactions Act in 2021, the implementation of E/B/Ls in Indonesia tends to operate within closed-loop systems—limited to certain private ports or bilateral contractual arrangements—and remains difficult to integrate into global systems.



A summary of the regulatory gaps among the KUHD, UU ITE, and MLETR 2017 is presented in Table 2.

Aspects	KUHD	ITE Law	MLETR 2017
Basis for transfer of rights	Physical possession & endorsement on paper (Articles 506, 508 of the Criminal Code).	It has not regulated the mechanism for the transfer of material rights digitally.	Control over electronic records replaces possession.
Category Electronics Documentation	Not regulating electronic documents.	Manage generic electronic records.	Regulate special electronic transferable records (ETR), including E-B/L.
Single authenticity of the document	It is assumed to be attached to the physical document (one original sheet).	It has not yet set a single principle of authenticity for digital documents.	Singularity principle: only one authoritative electronic record is valid.
Document conversion	Not regulated.	Not set specifically for commercial documents.	Setting up the paper-to-electronic conversion mechanism and vice versa.
Evidentiary power	Depends on a wet signed physical document.	Recognized as valid evidence (Articles 5 and 6).	Recognized as long as it meets system reliability standards.

Source: Processed from a comparative analysis of the KUHD, UU ITE, and MLETR 2017.

Managerial Implications for Shipping Companies and Cargo Owners

Legal uncertainty regarding the status of E/B/Ls has encouraged shipping companies to adopt a conservative approach through the implementation of a dual-run system: documentation processes are conducted electronically to facilitate faster communication, while physical documents (hard copies) are still printed for formal legal requirements at ports, customs authorities, and banks—particularly for Letter of Credit (L/C) processing. This dual system creates cost and time inefficiencies because companies must maintain two documentation channels simultaneously, meaning that the potential efficiency benefits of digitalization cannot yet be fully realized.

412

From a risk management perspective, legal uncertainty has significant implications for accountability and insurance coverage. For shipping companies (carriers), the greatest risk is the potential for misdelivery disputes in the event of system failures or cyberattacks affecting the E/B/L platform, given that the KUHD still assumes cargo delivery based on physical documentation, thereby placing carriers in a relatively vulnerable legal position. For shippers and consignees, the primary risk is tied-up capital (cash flow) because banks may reject non-standard E/B/Ls on the grounds that they are perceived as having insufficient evidentiary strength before Indonesian courts in the event of a breach of contract (wanprestasi).

In response to these regulatory gaps, shipping companies have adopted private-agreement-based risk mitigation strategies, including: (1) the use of international E/B/L platforms that have legally binding rulebooks, such as Bolero, essDOCS, or Wave; (2) the inclusion of exclusion clauses in the Contract of Affreightment, stating that the parties agree to recognize electronic data as valid evidence of ownership and release the carrier from liability for failures of third-party systems; and (3) obtaining written confirmation that the E/B/L scheme being used has been approved and co-insured by the company's Protection and Indemnity (P&I) Club.

These findings confirm that the successful implementation of E/B/Ls depends not solely on information-technology readiness but also significantly on the harmonization of national regulations with international trade-law standards. In relation to Pound's theory of law as a tool of social engineering, law should ideally evolve in response to societal needs, including the development of digital technology in international trade. However, the findings indicate that technological development is progressing faster than the development of national regulations, creating a gap between the needs of business practices and the available legal framework. From a risk-management perspective, regulatory uncertainty encourages shipping companies to prioritize contractual risk management over fully realizing the digital efficiencies that E/B/Ls can potentially provide.

CONCLUSION

Based on the findings and discussion, it can be concluded that the legal status of the Electronic Bill of Lading (E/B/L) in Indonesia has received normative recognition under the UU ITE through the application of the functional equivalence principle, thereby granting it legal force and evidentiary value equivalent to conventional documents, provided that the requirements of authenticity, integrity, and accessibility are satisfied. However, from the perspective of the KUHD, the E/B/L has not yet obtained full legal certainty as a document of title, as the KUHD remains oriented toward physical Bills of Lading and the transfer of rights through the delivery of the original document. Thus, the interaction between the KUHD and UU ITE currently provides harmonization primarily at

413



the level of legal evidence, while regulatory gaps remain with regard to property law and the transfer of rights over goods.

This study also identifies significant regulatory gaps between Indonesian national law and the UNCITRAL MLETR 2017, including the absence of specific provisions concerning electronic transferable records, the lack of recognition of control as a substitute for possession, the absence of provisions governing the principle of singularity, and the lack of an established mechanism for converting between physical and electronic Bills of Lading. These conditions create legal uncertainty, particularly in international trade transactions involving banking institutions, insurance companies, and cross-border shipping operations. They also generate managerial implications, including the implementation of dual-run systems and various contractual risk-mitigation strategies by shipping companies and cargo owners.

Based on these conclusions, this study recommends three main courses of action. First, for the government and legislators, harmonization between the KUHD and UU ITE is necessary through the establishment of specific regulations governing E/B/Ls as electronic transferable records, together with consideration of adopting the principles of MLETR 2017. Second, for shipping companies, shippers, and consignees, implementation readiness for E/B/Ls should be strengthened through the use of internationally standardized platforms, enhanced risk-management governance, and closer coordination with banks, insurance companies, and port authorities. Third, for academics and future researchers, further studies on E/B/Ls should be developed from cyber law and information technology perspectives, including the application of blockchain and smart contracts, as well as comparative studies with countries that have adopted MLETR, in order to provide more comprehensive recommendations for the development and modernization of Indonesia's national legal framework.

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