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LEGAL FRAMEWORK FOR SINGLE WINDOW SYSTEM IMPLEMENTATION:

A STUDY BASED ON ANALYSIS OF INTERNATIONAL LEGAL STANDARDS

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Foreword

It is my great privilege to introduce this publication, *Legal Framework for Single Window System Implementation: A Study Based on Analysis of International Legal Standards.*

In an era where international trade is rapidly evolving and digital transformation is essential; the establishment of efficient Single Window (SW) systems is of critical importance for governments and border agencies worldwide. This publication illustrates the commitment of the World Customs Organization Asia/Pacific Regional Office for Capacity Building (ROCB A/P) to supporting Members in strengthening their readiness for digital trade facilitation.

This paper offers a comprehensive examination of the legal foundations required to develop and operate Single Window systems at both the national and international levels. By systematically analysing the relevant standards, recommendations, and instruments of major international organizations, the author provides an exceptionally clear and structured overview of the legal issues that policymakers must address.

What makes this publication particularly valuable is its practical orientation. It explains complex legal issues into actionable insights, offering a clear reference for policymakers, Customs administrations, and cross-border regulatory agencies in the Asia/Pacific Region. As the author stresses, the legal foundation is critically important to move the efforts forward. By his presenting a structured overview of international standards and their implications, this study supports Members in assessing legal gaps in a coordinated manner.

Mr. Jaemin Cho, the author, has been working in the ROCB A/P for the last three years and is about to finish his term to return to his home Administration. Taking this opportunity, I would like to thank Korea Customs Service for sending such capable official to our office. This publication is one of his many accomplishments during his tenure and will be remembered as a masterpiece of the topic. I would like to commend the author for contributing an important resource that will reinforce the collaborative efforts of ROCB A/P and provide Members with a foundation for developing trusted Single Window systems. It is my sincere hope that this publication will serve as a catalyst for further advancement across our Region.

Together, we advance!

田島 潤

Jun TAJIMA
Head, ROCB A/P
1 December, 2025

Author's Note

Dear Readers,

It is my pleasure to introduce this study on the legal framework for Single Window systems.

The Single Window system is a key initiative not only of the World Customs Organization but also of the United Nations and other international organizations.

The main purpose of this study is to summarize and analyze the legal issues arising from the establishment of Single Window systems. To achieve this, the author reviews the initiatives and documents of major international organizations, as well as relevant trade agreements, to examine the legal framework in detail.

Through this study, WCO Members can explore the various legal issues related to Single Window systems and gain a comprehensive understanding of the current global landscape. Specifically, the paper analyzes the legal frameworks required for the implementation and operation of Single Window systems in customs and cross-border trade.

Drawing on major international agreements and documents from organizations such as the WCO, UN/CEFACT, ADB, IMO, and IPPC, this study identifies key legal requirements, including the functional equivalence of electronic documents, user identification and authentication, technological neutrality, data quality and security, record management, and cross-border interoperability. It also examines how regional trade agreements address Single Window provisions within the broader context of global trade.

As a Program Manager who recently organized several workshops on Single Window for WCO Members, I felt it was timely to summarize the legal issues currently being discussed by individual international organizations.

I hope that this paper will be a useful resource for WCO Members in addressing the legal challenges associated with establishing Single Window systems.

조 재 민

Jaemin Cho

Program Manager of the ROCB AP

25th November 2025

Contents

Acronyms

ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
ADR	Alternative Dispute Resolution
ASEAN	Association of Southeast Asian Nations
CBRA	Cross-Border Regulatory Agencies
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPTA	Framework Agreement on Facilitation of Cross-Border Paperless Trade in Asia Pacific
DPA	Digital Partnership Agreement
EDI	Electronic Data Interchange
eB/L	Electronic Bill of Lading
ePhytos	Electronic Phytosanitary Certificates
FTA	Free Trade Agreements
GATS	General Agreement on Trade in Services
GeNS	Generic ePhyto National System
GNC	Globally Networked Customs
IMO	International Maritime Organization
IPPC	International Plant Protection Convention
IPR	Intellectual property rights
ISA	Interconnect Security Agreement
ISPM	International Standards for Phytosanitary Measures
ISO	International Organization for Standardization
ISW	international Single Window
LPCO	licenses, permits, certificates, and other
MLEC	UNCITRAL Model Law on Electronic Commerce
MLES	UNCITRAL Model Law on Electronic Signatures
MLETR	UNCITRAL Model Law on Electronic Transferable Records
MOUs	Memoranda of Understanding
NPPO	National Plant Protection Organization
PPP	Public-Private Partnership
RTA	Regional Trade Agreements
SLA	Service Level Agreement
SW	Single Window
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UNCITRAL	UN Commission on International Trade Law
UNECE	UN Economic Commission for Europe
UNECC	UN Convention on the Use of Electronic Communications in International Contracts
UN	United Nations
UN/CEFACT	UN Centre for Trade Facilitation and Electronic Business
UN/EDIFACT	UN Electronic Data Interchange for Administration, Commerce and Transport
UN ESCAP	UN Economic and Social Commission for Asia and the Pacific
UN/LOCODE	UN Code for Trade and Transport Locations
UNICC	UN International Computing Centre
WCO	World Customs Organization
WTO	World Trade Organization

1. Introduction

As international trade accelerates, the movement of goods across borders has become increasingly burdened by overlapping and complex procedures. Within this context, Single Window (SW) has emerged as a promising solution. According to a recent analysis by the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP), member states are actively engaged in the implementation of SW, which serves as strong evidence supporting this trend (UN ESCAP, 2023). By providing a single access point for all trade-related procedures, SW enables traders, Customs officials, and other Cross-Border Regulatory Agencies (CBRAs) to exchange data seamlessly through an integrated electronic platform. This centralized and automated approach not only simplifies clearance procedures, but also reduces trade costs, improves administrative efficiency, and strengthens regulatory compliance.

If SW is to be developed, it should first be established at national level by integrating domestic regulatory agencies and the private sector. In the longer term, this could evolve into an international SW (ISW) through international interoperability with participating countries. However, building a National SW itself requires more than just technical and procedural coordination. A robust legal framework—one that aligns with domestic laws and international agreements or standards—is essential. This paper explores the legal aspects that must be considered when operating SW and examines what kind of legal frameworks are needed to ensure its effective functioning.

This study seeks to answer the following key questions. What are the legal foundations for SW? What major legal challenges do countries face when implementing SW? By addressing these questions, this paper aims to identify the core legal frameworks necessary for the operation of SW.

The structure of this paper is as follows. Chapter 2 addresses the key elements of the international legal framework for SW from multilateral agreements. Chapter 3 analyzes key documents published by international organizations and delves into how they address the legal frameworks related to SW. Chapter 4 examines recent legal trends reflected in trade agreements from the perspective of regionalism, thereby exploring the implications of regionalism on SW beyond the multilateral context discussed in Chapter 2. Chapter 5 organizes all potential legal issues that may arise during the operation of SW into categorized types. Chapter 6 then concludes with this paper.

2. Concept of Single Window

2.1 Definition of Single Window

SW refers to an integrated platform that allows traders and CBRAs to submit and process trade and transport-related data through a single-entry point. *Protocol of Amendment to the International Convention on the Simplification and Harmonization of Customs Procedures (Revised Kyoto Convention)*, a multilateral agreement led by WCO that regulates the simplification of customs procedures, does not explicitly use the term 'Single Window'. However, it stipulates that 'if the goods must be inspected by other competent authorities and Customs also schedules an examination, Customs shall ensure that the inspections are coordinated and, if possible, carried out at the same time' (2006, General Annex, Standard 3.35). While this provision does not directly mean SW, it can be considered to embody an important characteristic of SW concept.

A more specific concept of SW can be found in the *Annex to the Protocol Amending the Marrakesh Agreement Establishing the World Trade Organization*, *Agreement on Trade Facilitation* (*WTO Trade Facilitation Agreement*). According to this agreement, SW must meet several requirements (2017, article 10.4). That is, 1) traders must be able to submit documentation and data through a single entry point; 2) notifications regarding the examination results must be communicated to applicants through SW; 3) participating authorities or agencies shall not request the same information again once it has been submitted, except in urgent or publicly notified limited exceptions; and 4) SW should be implemented using information technology as much as possible and practicable.

In addition, the *Framework Agreement on Facilitation of Cross-Border Paperless Trade in Asia and the Pacific* (*CPTA*), adopted under the auspices of UN with the aim of promoting the exchange and mutual recognition of trade data in electronic form as well as facilitating interoperability among national SWs (2021, article 1) also provides a definition of SW. According to *CPTA*, SW is defined as 'a facility that allows parties involved in a trade transaction to electronically lodge data and documents with a single entry point to fulfil all import, export and transit-related regulatory requirements' (2021, article 3.(h)).

2.2 Legal elements for Single Window

The elements of SW can be summarized as follows. First, it must be a legally established system that clearly permits and guarantees the electronic submission of all import, export, and transit-related documentation and data by regulatory authorities through a single-entry point. Second, once data has been submitted through SW, participating authorities must not require the same information again, except in cases of emergency or other limited exceptions that have been publicly disclosed. Third, the results of the review or examination conducted by the participating authorities must be communicated to the applicant through SW in a timely manner. SW should, to the extent possible, be operated using information technology; the legal validity of electronic data must be clearly recognized. Furthermore, where multiple authorities are involved, SW must be supported by administrative measures that allow for integration of inspection procedures to minimize redundancy.

3. Analysis of legal issues and frameworks by international organization on Single Window

The legal and institutional issues surrounding the establishment and operation of SW have been addressed by a range of international organizations, including WCO, UN, the Asian Development Bank (ADB), the International Maritime Organization (IMO), and the *International Plant Protection Convention* (*IPPC*). Each of these organizations has published key documents and recommendations that provide practical guidance and legal frameworks for SW implementation, reflecting the diverse needs of customs, trade facilitation, maritime transport, and plant protection sectors.

Synthesizing the insights from these international instruments is essential for understanding the legal challenges and best practices in SW development. Therefore, this section first reviews and summarizes the principal legal issues and frameworks identified in the key documents of WCO, UN, ADB, IMO, and *IPPC*, providing a comprehensive foundation for the subsequent analysis.

3.1 Overview of World Customs Organization's Single Window Compendium focusing on legal issues

Among WCO's publications, the *Compendium on Building a Single Window Environment 2017* (Compendium) is the most practical resource for supporting Members in developing SW. Compendium, structured into Volume 1 and Volume 2, offers comprehensive guidance on all stages of SW implementation. Notably, Volume 1, Part VII of Compendium specifically addresses key legal issues. It covers the legal status and operational framework of national SW, the principle of functional equivalence between electronic and paper-based documents, and legal aspects related to user identification, including authentication and authorization procedures.

Regarding the legal status of SW, Compendium recommends that SW be established based on a clear legal definition, enabling it to bear legal responsibilities for its actions (WCO, 2017a, pt VII, p.4). Concerning SW operator, it emphasizes the importance of independence from CBRAs, as well as the necessity of a distinct legal personality. In other words, SW operator should have the capacity to enter contracts with third parties. Naturally, the type of legal personality may vary depending on the circumstances of each country (WCO, 2017a, pt VII, pp.5-6).

With respect to functional equivalence, this concept primarily denotes that there should be no legal disparity in terms of legal effect between paper-based and electronic documents. National laws should not mandate the submission of paper-based documents, handwritten signatures. Functional equivalence extends to encompass electronic communications and record-keeping as well (WCO, 2017a, pt VII, pp.6-7).

In the area of identity management, it highlights the roles of identification, authentication, and authorization, particularly in addressing data protection, confidentiality, and digital evidence such as probative or evidentiary value. It requires reconciling the conflicting interests between the protection of data and commercial confidentiality on the one hand, and the authority of SW operator or government to handle such information on the other. However, the use of such information must remain within the scope authorized by CBRAs (WCO, 2017a, pt VII, pp.7-9).

Additionally, it also outlines the legislative frameworks that must be established at each step of the business process when setting up SW, particularly in relation to clearance procedures. It addresses the harmonization of regulatory processes and the clear definition of the authorities and obligations

of SW operator and CBRAs. However, these issues are not specific to SW but are more broadly applicable to the legislative requirements governing general customs procedures.

Another topic addressed in Compendium is data quality. The unified technical standards ensure data quality by using international standards like the Harmonized Commodity Description and Coding System, the International Standard for country codes and codes for their subdivisions (ISO 3166), the International Standard for currency codes (ISO 4217), the United Nations Code for Trade and Transport Locations (UN/LOCODE). To improve the data quality submitted by stakeholders, Compendium suggests several approaches, including imposing penalties for submitting incorrect data to SW (WCO, 2017a, pt VIII, p.9). It recommends introducing incentive benefits to encourage declarants to establish internal control systems. For example, if declarants implement such systems, Customs offers benefits by allowing them to meet eased requirements in customs procedures and enjoy expedited renewal procedures (WCO, 2017a, pt VIII, p.10). Furthermore, it recommends that each country establish a Service Level Agreement (SLA), an Interconnect Security Agreement (ISA), or amend the Customs Mutual Assistance Agreement (CMAA) to facilitate the acceptance of lodged data from other countries (WCO, 2017a, pt VIII, p.14).

Regarding the record-keeping of CBRAs, it stresses the uniformity to avoid burdening businesses with varying policies from different CBRAs. It mentions data archiving and retention, focusing on ensuring that data cannot be altered. Concerning data retention, it also addresses the safeguard of data protection and that data should be destroyed once there is no longer a legitimate need to retain it. To ensure the admissibility of electronic evidence in legal proceedings, it addresses the role of Audit-Logs in maintaining data integrity and supporting the validity of electronic evidence in court. Audit logs are records that capture system activities and data access, helping to track each action.

The concept of ISW is briefly mentioned within Compendium *Volume2* (WCO, 2017b, pt IV, p.10), which links it to WCO Globally Networked Customs (GNC), and the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) *Recommendation No. 36*. GNC is a systematic approach to the exchange of information between WCO members, built upon agreed protocols (WCO, n.d.). Additionally, it mentions the issue of dematerializing all documents from CBRAs, such as licenses, permits, certificates, and other related documents (LPCO) involved in

customs clearance. It exemplifies the Electronic Phytosanitary Certificates (ePhytos) and Electronic CITES Permits (WCO, 2017b, pt VI, pp.12-13).

Table 1. Legal contents in '*Building a Single Window Environment volume 1*'.

Table of Contents	Legal Aspects
1. Understanding the Single Window Environment	Basic legal frameworks such as *WTO Trade Facilitation Agreement*
2. From Cross-border Regulatory Functions to Single Window services	N/A
3. Single Window as part of Customs Modernization	N/A
4. Creating Policy Momentum	N/A
5. Establishing Formal Structures	SW Operator's legal personality, mandate, governance
6. Designing Single Window Services	Standardizing CBRA's control, Transparency of system, Audit mechanism on System, SLAs
7. Dealing with Legal Issues	Legal Authority, Legal Entity, Functional Equivalence, Identification/Authentication/Authorization, Responsibility of SW Operator, Registration process, Application and Issuance of LPCO, Collection of Advanced Information, Electronic Processes in declaration and report
8. Data: Ensuring quality, security and privacy	Data integrity, Record-Keeping, Data Security
9. Managing transition to a single window	N/A

Source: Author
Note: All contents are based on WCO Compendium on *Building a Single Window Environment, vol. 1* (2017).

Table 2. Legal contents in '*Building a Single Window Environment volume 2*'.

Table of Contents	Legal Aspects
1. Writing a business case for single window	N/A
2. Introducing public-private partnerships	Public-Private Partnership (PPP), Defining SW Services, Risk Distribution

3. Functional assessment	Regulations granting the CBRAs to collect and provide trade data as well as issue LPCOs
4. Innovation in business processes and e-payments in single window	Registration process, Application and Issuance of LPCO, Collection of Advanced Information, Electronic Processes in declaration and report, Electronic Payment
5. Data Harmonization	N/A
6. Dematerialization and Paperless Processing	E-Repository, E-Documents, E-Signature regarding the Supporting Documents
7. Architecture for the single window environment	N/A
8. Integrated risk assessment	Integrating Risk Management across all CBRAs
9. Performance management and sustainability	N/A

Source: Author
Note: All contents are based on WCO Compendium on *Building a Single Window Environment, vol. 2* (2017).

3.2 Analysis of United Nations' Single Window materials focusing on legal issues

UN has published various documents related to SW. Over the past four decades, the United Nations Economic Commission for Europe (UNECE) has created a set of recommendations focusing on best practices for trade procedures and the handling of data. These recommendations are widely applied to standardize global trade and information exchange. UNECE's recommendations, particularly, underpin the development of SW. These recommendations are categorized into two types: Trade Facilitation Recommendations, which handle best practices in trade procedures, and Code List Recommendations, which focus on the data exchange through the code lists used in business transactions, as outlined in the United Nations Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) standard. Among them, *UN/CEFACT Recommendations No. 14, No. 26, No. 31, No. 33, No. 35, No. 36* and *No. 41* are especially significant in terms of the legal aspects related to SW.

Recommendation 14 (2017b) addresses the authentication practices in trade by advocating for the replacement of handwritten signature with electronic signature. It mentions three functions of signature—identification, evidentiary, and attribution—ensuring the legal validity of electronic

documents. It encourages governments to adopt technology-neutral legislation aligned with the United Nations Commission on International Trade Law (UNCITRAL) model laws.

*Recommendation 26 (*1995) provides a framework for standardizing the Electronic Data Interchange (EDI) in trade. It introduces the Model Interchange Agreement governing EDI according to UN/EDIFACT standards, ensuring legal validity (1995, pp.323-333). It addresses the timing of message receipt, legal effect of acknowledgment responses, evidentiary value of EDI messages, electronic contract timing, force majeure, liability, third-party service provider responsibility, applicable law, and jurisdiction. Additionally, it mentions data security and record retention to safeguard the integrity of transactions.

Recommendation 31 (2000) provides standards for B2B electronic commerce contracts. It presents a model agreement enabling legally binding contracts through electronic communications like email, EDI. It addresses the validity of electronic messages, communication protocols, and contract formation timelines. It specifies requirements for party identification, governing law, jurisdiction, and termination clauses. Designed for flexibility, it supports single or multiple transactions and aligns with the *UNCITRAL Model Law on Electronic Commerce* (*MLEC*). *MLEC* provides a legal framework to recognize the validity of electronic communications and electronic records in commercial activities, aiming to remove legal barriers to the use of electronic means. As a model law, it takes effect in each country when incorporated into national legislation.

Recommendation 33 (2005) is pertinent to establishing SW. It delineates critical legal aspects, including data security and the recognition of electronic signatures. It mentions the authority and responsibility of the lead agency tasked with overseeing data sharing. It stipulates clear allocation of responsibilities among participating CBRAs and the resolution of liability for data errors. It is worth noting that Authority Models for SW are categorized into three types. The scope of authority exercised by Customs will vary depending on the model adopted. Authority Model means the organizational structure used to manage the exchange of data among stakeholders. There are three types: Single Authority Model, Single Automated System Model, and Automated Information Transaction System Model (2005, pp.7-9).

Recommendation 35 (2013b) is a pivotal document addressing the legal aspects of SW. It consolidates various legal issues that have been previously discussed, providing a comprehensive

framework for legal considerations. Particularly, it covers issues such as the functional equivalence, the need for legal provisions governing systems, the authority of SW operators, and the evidentiary value. It also addresses jurisdiction and applicable law in disputes related to operations, data protection, and the identification, authentication, and authorization of the users. It mentions the necessity of ensuring the quality of data processed within SW, the sharing of data between CBRAs, and the dispute settlement mechanisms. It also mentions the legal frameworks for electronic archiving to preserve the stored data, liability issues arising from inaccurate data, intellectual property rights in SW, ownership of data within SW, and competition law concerns related to the exclusive operation of SW.

Recommendation No. 36 (2017b) addresses the legal issues surrounding interoperability among CBRAs and between countries in the context of SW. Based on the framework of *Recommendation No. 35*, it emphasizes that interoperability should be approached within public international law, focusing on technological neutrality. It highlights the frameworks to facilitate data exchange between different systems, including the unification of legal standards for recognizing different authentications. While end users' obligations may be defined contractually, the nature of contractual content should align with national regulation. It mentions that contracts can govern the data ownership of submitted data; however, legislation restricting data use to specific purpose may reduce reliance on contracts. It addresses data protection laws which are identified as issues in cross-border contexts where international frameworks may be required to safeguard personal information during data transfers. Regarding interoperability agreements, it mentions the security measures to maintain data integrity. Regarding Liability, it mentions that general principles are articulated under general civil law including tort law, though user agreements may define specific liability terms. It handles applicable laws and Jurisdiction which encompass not only civil cases but also administrative and criminal matters to prepare scenarios involving extraterritoriality. It underscores data retention, archiving, and audit trailing when formalizing interoperability agreements. Intellectual property rights (IPR) are also addressed, with the *Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization*, *the Agreement on Trade-Related Aspects of Intellectual Property Rights* (*WTO TRIPS*) serving as a reference for compliance with international standards. Finally, a dispute settlement mechanism for potential disputes arising from failure to meet the criteria or other issues is addressed.

Recommendation No. 41 addresses the establishment of SW operators through Public-Private Partnerships (PPP). It provides standardized contractual templates for different PPP types (2017c, p.33). Key content includes the explicit contracting parties, jurisdiction, parent company guarantees and indemnities, pre-agreed dispute resolution, and the ownership of asset and data, risk allocation, audit rights, modification and termination provisions, data protection, governance, and compliance with local privacy laws or commercial confidentiality.

Table 3. Legal contents in '*UN/CEFACT Recommendations*'.

Number of Recommendation	Legal Contents
1	Standardizing trade documents as the United Nations Layout Key (UN/CEFACT, 2017a)
13	Transitioning paper-based Customs Procedures to an electronic data-based (UN/CEFACT, 1979)
14	Use of electronic authentication methods including Electronic Signature (UN/CEFACT, 2014a)
14 Addendum	Experiences of 7 countries in establishing electronic authentication systems (UN/CEFACT, 2014b)
18	Simplified and standardized international trade based on Buy-Ship-Pay model (UN/CEFACT, 2002)
26	Model Agreements for Electronic Data Interchange between trading partners (UN/CEFACT, 1995)
31	Standardized Agreement for Business-to-Business Electronic Commerce (UN/CEFACT, 2000)
32	Self-regulatory tools like Trustmark and Codes of Conduct for e-Commerce (UN/CEFACT, 2001)
33	Authority Model, Lead authority, Data exchange & Signature Legislation (UN/CEFACT, 2020)
34	Legal authority for data collection, Legacy system Compatibility (UN/CEFACT, 2013a)
35	Functional Equivalence, legal basis for establishing SW, electronic evidence, applicable law, jurisdiction, legislation on SW facilities, Data protection, Sharing data, Data quality, Liability, Dispute resolution, Electronic Document, Electronic archiving, IPR, Data ownership, competition (UN/CEFACT, 2013b)
36	legal basis for interoperability, Identification, Authentication, Authorization, applicable law, jurisdiction, Data protection, Data Retention, Data quality, Liability, Dispute resolution, IPR, Data ownership, competition (UN/CEFACT, 2017b)
41	Clarifying Legal Relationships in Public-Private Partnerships (UN/CEFACT, 2017c)

Source: Author

3.3 Analysis of Asia Development Bank's materials focusing on legal issues

ADB has conducted research on National SW. That is, it focuses on electronic documents, electronic signatures, authentication, data sharing, retention, and recognition of electronic evidence. Additionally, it underscores the necessity of aligning with international standards to ensure cross-border interoperability and proposes a legal preparedness assessment based on

UN/CEFACT Recommendation No. 35. Signing memoranda of understanding (MOUs) to clarify data protection and exchange is also noted (ADB, 2022, p.22).

Regarding ISW, the working paper published by the Asian Development Bank Institute (ADBI) emphasizes on UNCITRAL's instruments—specifically *United Nations Convention on the Use of Electronic Communications in International Contracts* (*UNECC*), *MLEC*, *UNCITRAL Model Law on Electronic Signatures* (*MLES*), and *UNCITRAL Model Law on Electronic Transferable Records* (*MLETR*). *UNECC* handles the functional equivalence of electronic communications in international contracts. *MLES* provides a legal framework for the functional equivalence of electronic signatures that meet certain criteria. *MLETR* addresses the framework of functional equivalence for electronic transferable records—such as the electronic Bill of Lading (eB/L), bills of exchange, promissory notes, and warehouse receipts. However, there remains a divergence in the implementation of standards such as technological neutrality and functional equivalence, with countries adopting varying approaches (Abhinayan Basu Bal et al., 2017. p.8). Reconciling these divergent approaches presents significant challenges. The author outlines the challenges faced by the ASEAN SW, identifying issues related to varying levels of economic development. For example, some countries haven't even implemented National SW. Furthermore, discrepancies between ASEAN member countries' systems and national laws governing respective National SWs hinders the interoperability (Abhinayan Basu Bal et al., 2017. p.21). The potential for eB/L and the necessity of developing such mechanisms for ISW are noted as well (Abhinayan Basu Bal et al., 2017. pp.23-25).

3.4 Analysis of International Maritime Organization's materials focusing on legal issues

Unlike other international organizations, the International Maritime Organization (IMO) is a specialized international organization focusing on maritime affairs, and as a result, there are documents that study SW with a maritime focus. IMO's primary objectives include streamlining the clearance process for maritime transport, standardizing logistics across the maritime sector (IMO, 2023, p.3). IMO outlines the adoption of electronic signatures, the concept of SW, and a definition of Maritime SW. Maritime SW means a platform that integrates maritime and port administrative functions such as declarations for port arrivals and departures, security report

notifications, and other pertinent data exchanged in the maritime process (IMO, 2023, p.8). It also addresses confidentiality, data integrity, authentication, authorization, non-repudiation, and message traceability (IMO, 2023, p.19). It outlines three business models for SW and proposes three models for information repositories for exchanging data as well as the data privacy regulations (IMO, 2023, pp.20-21, p.33). IMO points out the necessity of the legal validity of cross-border electronic document exchanges to achieve interoperability (IMO, 2023, p.26). It advocates for the contingency reporting framework to maintain continuous operations (IMO, 2023, p.28). It underscores the necessity of well-defined liabilities for the management of SW (IMO, 2023, p.33).

Additionally, IMO researched authentication, data integrity, and confidentiality in data exchanges dealing with the electronic signatures, timestamps, and non-repudiation mechanisms in the context of technology (IMO, 2022, p.5). These measures are designed to validate the authenticity of data as well as prevent the denial of sender responsibility. It appears to be based on *Trusted mobile e-document framework* (ISO 20415), *Securities — Scheme for messages (Data Field Dictionary) Part 1 and Part 2* (ISO 15022), *Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999*/93/EC (*EU eIDAS Regulation*), and *UNECC*.

3.5 *International Plant Protection Convention*'s materials on e-Phyto Hub

International Plant Protection Convention (IPPC) is a treaty designed to safeguard plants, agricultural goods, and natural ecosystems from harmful pests. With 185 contracting parties, *IPPC* promotes the implementation of International Standards for Phytosanitary Measures (ISPMs) to enhance global food security, enable safe trade, and preserve the environment. Discussions on ePhytos, which is an electronic certificate in import procedures regarding plant quarantine, and data exchange within *IPPC* have made significant progress. Especially, from the perspective of cross-border data exchange, discussions on *IPPC* ePhyto Solution, which is cross-border electronic data exchange plan initiated by *IPPC* to secure the exchange of ePhytos between members, are actively taking place.

This is not directly related to SW itself. However, as SW evolves to ISW by linking respective national SWs, there are relevant aspects to consider regarding cross-border data exchange. In this context, the exchange of ePhytos through ePhyto Hub, which was developed and is managed by United Nations International Computing Centre (UNICC), can serve as a useful reference (IPPC, n.d.).

ePhyto Hub and Generic ePhyto National System (GeNS) are two components of *IPPC* ePhyto Solution. ePhyto Hub is a centralized system designed to facilitate the exchange of ePhytos between National Plant Protection Organizations (NPPOs) by serving as a single point for data exchange. GeNS is a web-based platform developed for members without their own national electronic systems. It enables these members to participate in exchanging ePhytos by connecting to ePhyto Hub.

Regarding GeNS, Digital Signature issue happens. So, *IPPC* handles it so that GeNS uses digital signatures to ensure the integrity of ePhyto, establishing a system where the exporting country signs ePhyto, and the importing country verifies it (UNICC, 2021, p.6). IPPC mentions that a legal assessment is required to determine whether the existing framework addresses issuance and receipt of electronic documents, the exchange of electronic data, the recognition of electronic signatures, the misuse of the system, unauthorized access, encryption mandates, interagency and international data sharing, evidentiary standards for electronic transactions, the mandate of electronic submissions, electronic payments, data ownership, the permissibility of offshore data storage under GeNS, statutory data retention, and accessibility requirements (IPPC, 2021, p.32). Lastly, although ePhyto Hub was developed by UNICC and is operated by IPPC, the issue of how end-user fees are allocated and transferred to IPPC remains unresolved (TDAF Consulting, 2018, p.26).

4. Regional Trade Agreement status regarding Single Window

As SW has become increasingly important in facilitating cross-border trade, their legal underpinnings are no longer confined to national legislation or multilateral frameworks alone. An increasing number of countries have begun to address the legal basis for SW within the context of regional trade agreements (RTAs). RTAs constitute a key exception to WTO's non-discrimination

principle. RTAs include: (i) Free Trade Agreements (FTA), as defined in article 24 of *GATT 1994*; (ii) Customs Union, as defined in the same article; (iii) Economic Integration Agreement, as defined in Article 5 of *GATS*; and (iv) Partial Scope Agreement (WTO, n.d., p.2).

According to a search conducted on the Legal TINA website (https://legal.tina.trade/), 41 RTAs were found to contain explicit references to 'Single Window'. Early agreements, such as *Agreement between New Zealand and Singapore on a Closer Economic Partnership (New Zealand-Singapore FTA)*, focused primarily on establishing basic SW frameworks. In contrast, modern agreements, such as *Digital Partnership Agreement Between the Government of the Republic of Korea and the Government of the Republic of Singapore* (*Korea-Singapore DPA*), emphasize the interoperability of data exchange. Overall, there is a noticeable trend in recent RTAs toward incorporating more provisions related to SW and the broader framework of electronic paperless trade compared to earlier agreements. That is, *Free Trade Agreement Between The Government of The People's Republic of China and The Government of The Republic of Nicaragua* (*China-Nicaragua FTA*) and *Korea-Singapore DPA* go further by addressing functional equivalence of electronic documents, the incorporation of relevant international standards, the mutual recognition of electronic signatures, and the facilitation of electronic payments (China Nicaragua FTA, 2023, article 12.6; Korea-Singapore DPA, 2023, Annex A, article 14.12). Nevertheless, most FTAs do not appear to have a binding force.

Some RTAs specify the types of data that can be exchanged through SW, such as Certificates of Origin and Certificates of Non-Manipulation. Additionally, recent agreements have increasingly included provisions on confidentiality, restriction on use of data beyond agreed purposes, and the development of data exchange systems (Korea-Singapore DPA, 2023, Annex A, article 14.12). Nevertheless, unlike some of the more detailed compendiums issued by international organizations, RTAs usually offer a broad framework for cooperation between governments. They tend not to spell out concrete implementation measures, which is common in other types of treaties. The table below illustrates how 41 RTAs address SW provisions. While some RTAs mandate the implementation of SW as a binding obligation, others adopt a soft law approach.

Table 4. References to Single Window in RTAs.

Agreement Title, Article	Provisions on SW
China - Nicaragua FTA, 2023, art 12.6	Working towards developing SW with international standards and exchanging practices on National SW.
Korea - Singapore DPA, 2023, Annex A, art 14.12	Establishing SW and Data Exchange Systems between the Parties.
United Kingdom - New Zealand FTA, 2023, *art 4.14*	Implementation of SW and e-payment.
United Kingdom – Australia FTA, 2023, art 5.15	Developing SW.
Turkey - UAE CEPA, 2023, art 9.7	Developing SW and Data Exchange Systems between the Parties.
United Kingdom - Singapore DEA, 2022, Annex B, art 6.13	Adopting SW.
Australia-India ECTA, 2022, art 5.7	Providing SW aligned with international standards.
Digital Economy Partnership Agreement, 2021, art 2.2	Establishing SW and Data Exchange Systems, Interconnecting SWs.
United Kingdom - European Union Trade and Cooperation Agreement, 2021, art 118	Establishing SW and Passenger Data SW facility.
United Kingdom – Singapore FTA, 2021, art 6.13	Developing SW.
United Kingdom – Turkey FTA, 2021, art 3.15	Developing SW.
Iceland - Liechtenstein - Norway - UK FTA, 2021, art 2.63	Establishing SW.
United Kingdom - Colombia, Ecuador and Peru Trade Agreement, 2021, art 59	Progressive Establishment of SW and Development of Data Exchange Mechanisms.
United States-Mexico-Canada Agreement, 2020, art 7.10	Enhancing Interoperability and Standardization of SWs.
Australia - Singapore DEA, 2020, art 12	Developing SW and Data Exchange Systems between the Parties.
*Hong Kong, China – Australia FTA, **2020**, art 4.8*	Establishing SW.
EAEU – China Agreement on Economic and Trade Cooperation, 2019, art 6.15	Developing SW and Data Exchange Systems between the Parties.
African Continental Free Trade Agreement, 2019, art 18	Establishing SW.
ASEAN - Hong Kong, China FTA, 2019, art 9	Establishing SW.
EU – Singapore FTA, 2019, art 6.13	Developing SW.
Sri Lanka – Singapore FTA, 2018, art 6.3	Developing SW.

Turkey – Singapore FTA, 2017, Annex 6-A, art 10	Developing SW.
Canada – Ukraine FTA, 2017, art 4.7	Developing SW and Interoperable system.
EU – Canada CETA, 2017, art 6.8	Developing SW and Interoperable system.
Additional Protocol to the Framework Agreement of the Pacific Alliance, 2016, art 5.8-5.9	Implementing Single Commerce Windows; Ensuring Interoperability.
Mexico – Panama FTA, 2015, art 5.8	Implementing Foreign Trade SW.
Singapore - Chinese Taipei EPA, 2014, art 5.8	Establishing SW.
EU - Colombia and Peru Trade Agreement, 2013, art 59	Progressively establishing SW.
Costa Rica – Peru FTA, 2013, art 4.8	Creating and Interconnecting SWs.
Panama – Peru FTA, 2012, art 4.8	Creating and Interconnecting SWs.
Mexico - Central America FTA, 2012, art 6.12	Creating and Interconnecting SWs.
Canada – Colombia FTA, 2011, art 411	Creating and Interconnecting SWs.
ASEAN - Australia - New Zealand FTA, 2010, art 5	Technical assistance for developing SW.
ASEAN Trade in Goods Agreement, 2010, art 49	Establishing National SW and ASEAN SW.
Australia – Chile FTA, 2009, art 16.9	Developing SW.
Canada – Peru FTA, 2009, art 411	Developing interconnected and compatible SWs.
Chile – China FTA, 2006, art 56	Working towards developing SW.
China - Hong Kong, China EPA, 2003, art 68	Establishing SW; Exploring the Interconnectivity of SWs.
China - Macao, China EPA, 2003, art 35, art 68	Establishing SW; Promoting SW Interoperability.
New Zealand – Singapore EPA, 2001, art 4.6	Establishing SW.
Asia Pacific Trade Agreement, 1976, art 5	Working towards establishing SW.

Source: Author

5. Key finding: legal implications of all resources

An analysis of documents published by several international organizations, including WCO, UN/CEFACT, ADB, IMO, and *IPPC*—makes it clear that several legal considerations must be addressed during the implementation of SW.

Primarily, there must be a clear legal basis not only for the operation of SW itself but also for SW Operator responsible for operating it. This legal basis may take the form of national law or, in some cases, non-binding administrative instruments. What matters most is that the legal framework goes beyond merely designating SW Operator—it must also clearly define the operator's authorities and responsibilities. Particularly, SW Operator should have legal personality. This is essential not

only because SW operator must be able to independently enter into contracts with third parties, but also because it must be able to assume legal liability arising from its operations. If SW Operator is designated through a contract rather than legislation, potential antitrust issues from monopolistic operation should be considered. While establishing such a framework may be relatively simpler for national SW, the same cannot be said for ISW. Because the involvement of multiple countries increases both the number of legal stakeholders and the complexity of applicable laws. Therefore, it's natural for countries to agree in advance to avoid legal disputes down the line.

Another important point is that 'functional equivalence' must be comprehensively upheld across the entire regulatory systems. Electronic documents must have the same formal authenticity, substantive authenticity, probative value, admissibility as evidence, and other legal effects as paper-based documents. But this shouldn't be limited to documents, it must extend to electronic signatures and electronic records. Therefore, when SW users submit electronic documents, they should not be required to provide paper copies or handwritten signatures since the documents lack sufficient formal and substantive authenticity or probative value.

Third, SW must be reliable and secure for users to access it. Stakeholders need to submit various legal documents, like import declarations, through SW. It's of importance to know who create the document and who submitted it, Because the result gives rise to legal liability, and it determines who will acquire the rights or benefits conferred by the legal effect. Therefore, there must be clear legal basis for identifying users accessing SW—that is, the processes of identification, authentication, and authorization. These procedures are a must not only to verify who the users are and what access they have but also to protect sensitive data and ensure the integrity of electronic data. Strong identification and authentication mechanisms prevent unauthorized access and misuse, while clearly-defined authorization regulations make sure only qualified users can perform certain actions within SW.

Fourth, countries should incorporate technology neutrality into their domestic laws. Technology neutrality means that when using electronic documents, electronic signatures, and similar tools, SW should not depend on any specific technology. By establishing technology neutrality in legislation, countries can remain flexible in adapting to future technological advancements and avoid hindering overall innovation in SW.

Fifth, data security for SW must be ensured. The integrity and security of SW cannot be achieved by simply restricting user access as mentioned earlier. There needs to be a clear legal framework that protects all the information handled by SW. It's primary to clearly set out in regulation who owns the data or whose information it is, who's allowed to use it, and whether storing that data outside the country is permitted. There should also be legal safeguards to stop the data from being used beyond its original purpose. Clear regulations must also be established to ensure that data is destroyed once its retention period expires. Besides these preventive measures, there should also be penalties and sanctions in place to address data breaches or unauthorized access after they occur. And if data is transferred across borders, it's important to strictly follow international privacy standards to protect confidentiality.

Sixth, there needs to be a legal framework in place to ensure the quality of service provided by SW. SW operator has an obligation to maintain a certain standard of service. To ensure this, laws should be put in place that require back-up operational systems and other related measures to maintain the continuity of import and export clearance, as well as other processes, even when the system experiences downtime. It's also necessary to clearly define legal liabilities beforehand for cases of system errors or other incidents within SW. Moreover, since the quality of service is closely linked to the quality of data, an environment should be fostered where international standards like International Organization for Standardization (ISO) codes are used to improve the accuracy and consistency of data handled by SW. There should also be a legal basis for imposing sanctions or penalties on those who submit inaccurate data to SW or manipulate data already stored in SW. In this regard, providing incentives such as regulatory relaxation or expedited customs clearance to importers and exporters with excellent internal control systems for data submission can encourage voluntary compliance with regulations and enhance the overall reliability of data submitted through SW. For reference, maintaining Audit Logs that track users' activities within SW serves as a measure for managing data integrity, and can be considered a prerequisite for ensuring that the data within SW possesses admissibility and probative value as electronic evidence.

Seventh, it is necessary to clearly establish dispute resolution provisions in advance to prepare for potential legal disputes that may arise during the operation of SW. To this end, it is recommended to introduce legislation or standardized contractual clauses that clearly define the responsibilities

of SW operator. For example, it is desirable to prepare a standard contract that addresses key legal issues such as liability for errors that may occur during the submission of electronic documents, jurisdiction and extraterritoriality, force majeure, the responsibilities of third-party providers delegated by the operator, governing law, and grounds for contract termination. In addition, binding regulations should be established regarding the time of dispatch and receipt of electronic documents, the legal effect of receipt confirmation, and other matters, considering potential civil, administrative, and criminal liabilities that may arise during the submission and transmission of electronic documents. Furthermore, introducing alternative dispute resolution (ADR) procedures, such as arbitration or mediation, in advance can also be an effective way to address future disputes.

Eighth, provisions are needed to ensure interoperability. In the context of National SW, interoperability means the technical integration of various systems operated by different CBRAs, private sector entities, and other stakeholders within a single country. At the regional or international level, interoperability means aligning the different legal systems, data standards, IT infrastructures, and security policies of participating countries to enable the seamless connection of their respective National SWs. Interoperability in National SW can be legally established by including interoperability within the foundational provision of SW. Interoperability in ISW requires the prior legal framework based on international public law. That is, countries should work to harmonize legal norms and establish mutual recognition systems by signing SLAs and ISAs, amending domestic laws in line with *MLEC* and *MLES*, or joining *UNECC*.

Ninth, when the private sector takes part in the implementation of SW under PPP, the relevant contracts or regulations must clearly allocate the legal rights and responsibilities of all parties involved in SW. Specifically, the contract or regulation should define how risks are allocated among the parties and clearly state the scope and nature of the services each party is responsible for. It should also specify the ownership of assets including IPR resulting from SW development, how operational costs and revenues from SW will be shared among each party, procedures for contract modification and termination, and the methods of audits to be conducted on each party.

Tenth, if service fees are charged for using SW, it is necessary to establish a clear legal basis and ensure a transparent mechanism for collecting the fees and distributing the revenues. Contracts should specify in detail how service fees are calculated and collected, and how the revenues are

distributed among the stakeholders. All financial flows should be subject to appropriate oversight and made available for public disclosure.

6. Conclusion

Based on the analysis in this paper, the necessary legal framework for operating SW has been identified. While technological innovation and inter-agency cooperation are important, these efforts must rest upon a legal foundation that clearly defines the roles, legal responsibilities of all stakeholders—including Customs, other CBRAs, private sectors, and SW operators.

International standards issued by international organizations provide a useful foundation for developing national and regional legal frameworks. These standards address various issues, including functional equivalence, technology neutrality, data protection, rules on identification, authentication and authorization, legal status of SW, allocation of liability, data security, dispute resolution, management of public-private partnerships, as well as international issues that must be considered for advancing to ISW.

Recent RTAs increasingly address interoperability, electronic data exchange, and mutual recognition of electronic documents. However, since most provisions remain non-binding, the party of RTAs need to make efforts to develop binding legal frameworks.

Ultimately, the shift toward efficient SW depends on legal frameworks that are clear and internationally harmonized. In other words, policymakers aiming to develop National SW should reference international standards while tailoring their own legal frameworks. Meanwhile, countries seeking to establish ISW should prioritize achieving international legal consensus on legal frameworks focusing on the challenges discussed in this paper.

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