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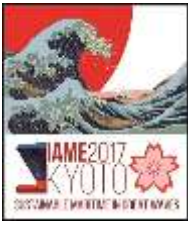
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On Introducing Electronic Information Systems for Port Administrative Procedures in Developing Countries

Abstract

In recent years, computerization of port administrative procedures has been rapidly implemented throughout the world. In April 2016, the Facilitation Committee of the International Maritime Organization (IMO) adopted the amendments to the annex of the Convention on Facilitation of International Maritime Traffic 1965. The amendments state that the public authorities shall take all necessary measures to establish systems for the electronic exchange of information. Concurrently, the Association of Southeast Asian Nations (ASEAN) has been promoting a policy to develop an ASEAN single window, which connects and integrates the national single windows (NSWs) of the member states. In conjunction with the development of NSWs, ASEAN countries are expected to develop information systems for port administrative procedures. This paper summarizes the international trends for establishing information systems for processing the port administrative procedures, known as a port-EDI (Electronic Data Interchange). This summary will focus mainly on the activities of the IMO and Asian countries. The paper also compares the existing port-EDIs of Japan, the Republic of Korea, and the Republic of Singapore. Finally, the authors discuss the future prospects of introducing port-EDIs in developing countries that have not yet introduced the system.

Keywords: *port-EDI, FAL convention, port administrative procedures, ASEAN Single Window.*

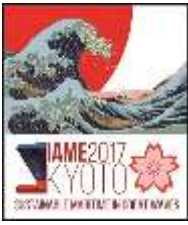


1. Introduction

The information system that processes port administrative procedures, such as port entry/departure declaration, berthing requests, and other related information between private sectors and public sectors, is called a port-EDI*¹. The port-EDI provides a one-stop service for port administrative procedures. In other words, the port-EDI is a single window (SW) system in the scope of maritime shipping.*²

From the private sector perspective, the purpose of introducing a port-EDI is to reduce costs by reducing the time spent filling out application forms and the time spent traveling to public sector facilities to submit the applications. Additionally, from the public sector perspective, the purpose of introducing a port-EDI is to shorten the time needed to check whether mistakes were made in the formal application forms and to confirm that mandatory items have been properly entered. Port-EDIs are also useful for analyzing statistical data and collecting fees related to facility usage.

The Facilitation Committee (FAL) of the International Maritime Organization (IMO) adopted the amendments to the annex of the Convention on Facilitation of International Maritime Traffic 1965 (FAL Convention) at its 40th session (FAL40) on April 2016. In order to reduce administrative burdens on shipping companies and public authorities, the amendments provide that the public authorities must take all necessary measures to establish systems for the electronic exchange of information by April 8, 2019 (IMO, 2016). This means that all countries that have ratified the FAL Convention must introduce the electronic information system for processing port administrative procedures, namely port-EDIs. Countries that have not introduced port-EDIs (hereinafter called “countries without port-EDIs”) are mainly developing countries. Some of these countries do not have the technical capability to develop complex information systems. Therefore, it is assumed that requests for assistance in developing port-EDIs from these countries will increase. Also, the Association of Southeast Asian Nations (ASEAN) is promoting the ASEAN Single Window (ASW) system, which is a unique regional initiative that connects and integrates the National Single Windows (NSWs) of the member states (ASEAN Secretariat, 2013). The NSW that is described above is a system that enables a single submission of data, a single and synchronous processing of data submitted, and a single decision-making system for customs release and clearance (ASEAN, 2005). This means that the NSW focuses on customs procedures. However, from a logistics perspective, the reduction of burdensome customs procedures along with the reduction of burdensome port procedures, like port entry/departure declaration, are important and necessary steps to improve the supply chain management (SCM). To this end, some ASEAN countries even developed port-EDIs in conjunction with NSW development as shown in section 4.



The trends above show that the computerization of port administrative procedures is being accelerated internationally. Also, requests for support in developing port-EDIs from countries without port-EDIs to countries that have introduced port-EDIs (hereinafter called “countries with port-EDIs”) are expected to increase. Therefore, in this paper, the authors focus on the international trends and future prospects of introducing port-EDIs to countries without port-EDI.

The relationship between the port-EDI and other information systems in maritime shipping such as SW and the Port Community System (PCS) is summarized in Figure 1.

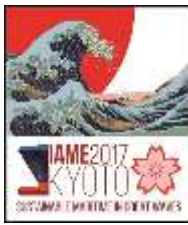
SW is an information system that provides a one-stop service and shares the related data of all port-related procedures, such as customs clearance and other port administrative procedures.

According to the International Port Community System Association (IPCSA), the PCS is a system that enables the exchange of electronic information between public and private or private and private sectors to increase efficiency in port logistics. Some European ports have introduced this system in recent years. However, the International Association of Ports and Harbors (IAPH, 2011) has stated that the features of PCSs differ in each system. Major features of PCSs are gate-in/gate-out procedures at container yards and container status reporting. In addition, the current PCS usually covers only a single port.

As shown in Figure 1, the port-EDI is part of SW and the PCS. Thus, SW and the PCS are regarded as the systems that improve and support the port-EDI in order to facilitate other port-related administrative procedures through collaboration or integration.

The structure of this paper is as follows:

- The Japanese port-EDI is introduced in order to clarify the features of port-EDIs generally;
- Related studies and guidelines are reviewed;
- IMO’s activities to support the introduction of port-EDIs in countries without port-EDIs are summarized;
- The status of port-EDIs in ASEAN countries is also summarized. In addition, the future prospects of introducing port-EDIs in ASEAN countries are analysed;
- A comparison of the port-EDIs in Japan, the Republic of Korea (RoK), and the Republic of Singapore (Singapore) is conducted; and
- Finally, based on the above, the future prospects of introducing port-EDIs to countries without port-EDIs are discussed.



Note that any descriptions in this paper are views and opinions of the authors, and do not represent the views or opinions of any other organization.

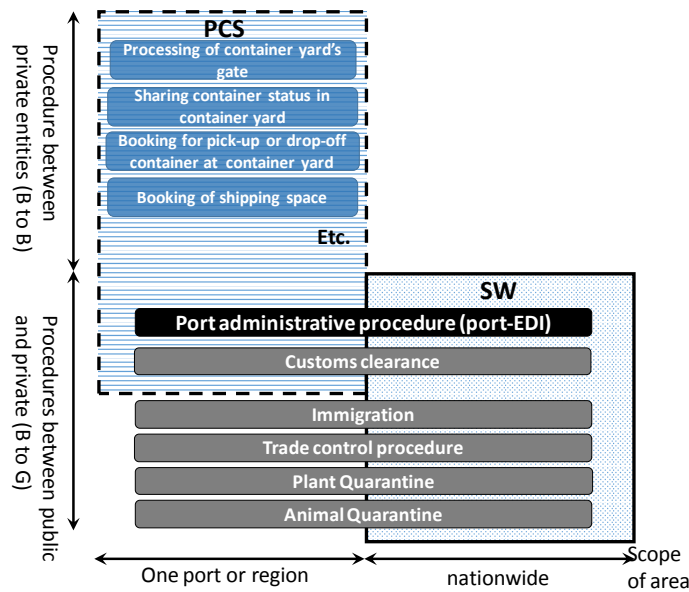


Figure 1. Relation between the port-EDI, SW, and the PCS

Source: the authors

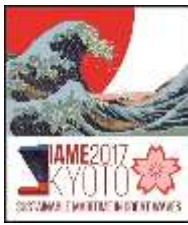
2. Literature Review

2.1 Outline of the Port-EDI in Japan

2.1.1 History of Japan's port-EDI

In 1996, the Kobe Chamber of Commerce & Industry requested that Japanese Prime Minister facilitate the port-related administrative procedures. Based on this request, the Japanese government examined the possibility of establishing port-EDI. The Cabinet of Japan decided to provide a one-stop service for port-related administrative procedures and made those procedures paperless in 1997. Then, the Ministry of Transport established a port-EDI in 1999 (MLIT, 2006).

In the early years of port-EDI implementation, it only handled the features required by harbor masters and port management bodies. However, the government of Japan launched a collaboration effort among the port-EDI, the custom clearance system, and the immigration system in 2003, resulting in one-stop service for port-related procedures, also known as the single window (SW). Through integration, these systems and the import/export restriction systems were unified into a single system in 2008. This integrated system is called the Nippon Automated Cargo and Port Consolidated Systems (NACCS). After the system



integration, the port-EDI became one feature of the NACCS—the NACCS Port Subsystem. The quarantine systems for plants, animals, and food were also integrated into the NACCS in 2013.

2.1.2 Feature of Japan's port-EDI

The feature of the port-EDI in Japan is to process the port administrative procedures as shown in Table 1. Through this process, the private sector can submit electronic application data, such as arrival/departure notices, to multiple public offices by a single input and submission.

Table 1. Scope of port-related procedures of Japan's port-EDI

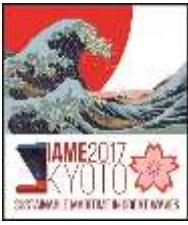
Source: MLIT (2015)

Organization	Scope of port-related procedures
Coast Guard	Arrival/departure declaration, Declaration on use of berthing facilities, Application for permission to handle dangerous goods, Application for permission to carry dangerous goods, Application for anchorage, Application for permission of relocation, Advanced notice, Notice of vessel security information, Advanced report of sea route, Notice of relocation
Port Management Body	Arrival/departure declaration, Application for permission to use berthing facilities, Application for exemption from port entry fee, Application for refund of port entry fee, Notice of vessel relocation, Application for permission to use boarding bridge, Application for permission to use cranes, Application for permission to use port facilities, Application for permission to use water supply facilities for vessels, Application for permission to use tug boat and request for sailing, Application for permission to use facilities of processing waste oil, Application for permission to use power supply
Quarantine	Arrival declaration, Quarantine notice, Arrival notice
Regional Transport Bureau	Notice of information on compensation for oil pollution damage
Customs	Arrival /departure declaration, Crew and passenger list, Application for permission for entry into closed ports, Declaration of payment of tonnage dues
Immigration	Arrival /departure notice, Arrival notice

2.1.3 Characteristics of Japan's port-EDI

The Ministry of Land, Infrastructure, Transport, and Tourism in Japan (MLIT, 2015) describes the characteristics of the port-EDI as follows:

- Users can apply for the port administrative procedures to multiple public authorities by one single input and submission.
- Users can submit the application forms via the internet anytime and anywhere using their NACCS ID and password.



- Users can facilitate the input work by using past input data, which are automatically stored in the system.
- Users can submit the electronic application free of charge.

With regard to introducing port-EDI to countries without port-EDI, Japan's experience of system integration could be useful as it is assumed that countries without port-EDI may introduce multiple administrative systems in the initial stage of development, similar to what Japan did. Drawing on its experience, Japan may be able to assist in developing an integrated system in order to realize a SW.

2.2 Review of research studies

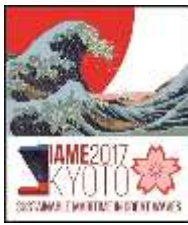
The number of research studies that focus on the development of port-EDIs is quite limited.

Bagchi et al. (2001) pointed out that the RoK's initiative and leadership were key factors in the successful development of Port-MIS, which corresponds to the Japanese port-EDI. Specifically, the successful development and implementation of Port-MIS were attributed to the following factors:

- The government reduced the private sector's financial burden.
- The government established a number of joint taskforces and urged the port users to participate in these special groups.
- During a one year trial period, users were allowed to submit data on paper or electronically. However, after the trial period expired, the government accepted only electronic submissions.
- The government of RoK created a private company, the Korea Logistics Network Corporation (KL-NET), to operate Port-MIS.

Although this study does not discuss the technical aspects of implementing port-EDIs, it is worth noting that involving the private sector to develop the system was an effective measure to successfully implement the port-EDI, so much so that countries without port-EDIs should consider doing the same.

Lee et al. (2000) summarized the key factors for the successful development of the port-related systems: namely, planning with an emphasis on analysis and design; inclusion of customs; sharing of cargo data; providing software to the user; and adopting a global message standard. The Lee study also indicated that government leadership is important. Although the Lee study does not discuss the stages of port-EDI development in its entirety (from a concept



design to a maintenance plan), it would be a useful reference for designing port-EDI software.

Wrigley et al. (1994) provided a framework for the information systems and the technology that enables the electronic data interchange in international trade. This study discusses: technology transfer and diffusion of information systems related to port logistics; corporate competitiveness in international trade; and policy formulation for electronic usage. Similar to Lee et al. (2000), Wrigley et al. (1994) do not touch on the details of the port-EDI development.

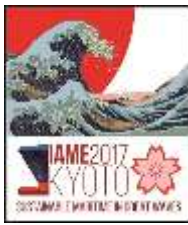
2.3 Review of the port-EDI guidelines

2.3.1 Guidelines for setting up the port-EDI

The IMO (2011) issued the “Guideline for setting up a single window system in maritime transport” (hereinafter “the IMO-SW Guideline”). The single window system is the same as the port-EDI. This guideline sets forth the system implementation process from beginning to end. For example, it covers the following: processes for administrative procedures and stakeholders in maritime shipping; use of legacy systems and processes; design processes; summarizing system users; policy and legislation issues; and messages for electronic data interchange. It also describes, in detail, the electronic interface necessary for collaboration between information systems in maritime shipping as well as the role of the public sector in port-EDI. However, other items, such as the basic concept behind the port-EDI and the operation plan, are only cursorily described.

The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) issued the “Recommendation and guideline on establishing a single window - Recommendation No.33” (hereinafter “the SW Recommendation”) (UN/CEFACT, 2005). It discusses five key steps for planning and implementing an SW. The five key steps are: 1) developing the initial concept for an SW; 2) achieving consensus between all interested parties to examine the feasibility of an SW; 3) undertaking the feasibility study; 4) reviewing the feasibility study report; and 5) implementing the SW. The SW Recommendation also discusses the factors necessary in establishing a successful SW such as political will, strong lead agency, and a working partnership between the government and private sectors. These recommendations are useful for creating a concept or basic plan for the port-EDI development. With its focus on the design of SW, the SW Recommendation does not discuss subsequent SW issues like the maintenance and operation of the system.

The United Nations Economic Commission for Europe (UN/ECE) published the “Single Window Implementation Framework” (hereinafter “the SW Framework”) (UN/ECE, 2011) for use by policy managers who are responsible for preparing SWs. Unlike the IMO-SW



Guideline discussed above, the SW Framework does not discuss methods for establishing each administrative procedural system; instead, it focuses on methods for cooperation between multiple public agencies based on the premise that each agency has the necessary systems in place.

2.3.2 Guidelines for collaboration between the port-EDI and port-related systems

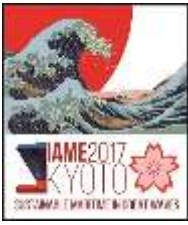
The IMO (2001) issued the “IMO Compendium on Facilitation and Electronic Business” (hereinafter “IMO Compendium”). The aim of the IMO Compendium was to standardize the data format of the electronic data interchange (hereinafter “EDI format”) for FAL Forms 1-7*³ in order to collaborate between the public and private systems in accordance with the United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT).

In addition to the use of the EDI format, even in maritime shipping, use of the Extensible Mark-up Language (XML) format has been recommended for better collaboration since the 2000s. Shih et al. (2008) suggested a data structure for port-EDI applications for the Port of Kobe. Kim et al. (2012) developed and verified the conversion system used in maritime shipping between EDI and XML. Similarly, IMO-SW Guideline, mentioned in subsection 2.3.1, espoused the advantages of using XML for the collaboration. When the IMO-SW Guideline was issued in 2011, there was no international standard for XML message formats or ship clearance. However, the International Organization for Standardization (ISO) issued ISO 28005-1 (ISO, 2011) and ISO 28005-2 (ISO, 2013) in order to manage the exchange of electronic information between ships and shore for coastal transit or port calls.

2.4 Reviewing the introduction of the ASYCUDA customs system in developing countries

Developed countries have usually developed and operated customs information systems by themselves. However, developing countries had not enough abilities to develop customs information systems. Thus, the United Nations Conference on Trade and Development (UNCTAD) has developed a software system for customs clearance called “ASYCUDA” (Automated SYstem for CUstoms DAta) and has been introducing it mainly in developing countries. ASYCUDA is a customs clearance information system that covers most foreign trade procedures such as manifests and customs declarations, accounting procedures, and transit and suspense procedures. In addition, it generates trade data that can be used for statistical economic analysis. The system also takes into account the international codes and standards developed by the ISO, the World Customs Organization (WCO) and the UN (ASYCUDA website).

The development of ASYCUDA goes back to 1981, when the UNCTAD received a request from the secretariat of the Economic Community of Western African States (ECOWAS) to assist in the compilation of foreign trade statistics within their member States. After an initial



evaluation, it quickly became apparent that compiling these statistics would require the involvement of customs clearance offices and the modernization of customs clearance procedures (before the compilation operation even began) in order to achieve quality results.

At present, there are more than 90 countries worldwide that have adopted the ASYCUDA software. Thus, ASYCUDA may be regarded as an international standard software for customs clearance in developing countries.

Basically, ASYCUDA is installed at the request of developing country governments with the assistance of UNCTAD. To inform developing countries of the installation process, the ASYCUDA website explains—step-by-step—how ASYCUDA is implemented. The website describes how to implement ASYCUDA, including not only the software specifications but also instructions on how to set up the organizational structure.

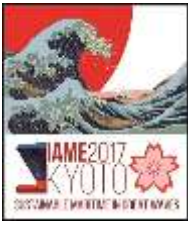
The UNCTAD also explains the implementation benefits of ASYCUDA. For example, because software is provided for free, user-countries could allocate more funds for training, hardware, additional software, and telecoms, etc. It could be said that the recognition of these benefits in developing countries has contributed to the introduction of ASYCUDA.

Based on the reviews discussed above, there are studies and guidelines available that are related to the design and establishment of port-EDIs or SWs, which can be useful for developing port-EDIs. In addition, parties interested in developing port-EDIs could still learn from the process of ASYCUDA used to introduce the systems. However, studies and guidelines of the introducing port-EDIs to other counties have not addressed this. To fill in the instructional gaps that exist within the available literature and research, this paper will focus on international trends and future prospects of introducing port-EDIs to include the technical aspects of such introductions in countries without port-EDIs.

3. IMO Efforts in Supporting Port-EDI Introduction

3.1 Current Status in the IMO

As described in section 1, the IMO/FAL adopted the amendments to the annex of the FAL Convention. One amendment obligated countries to computerize port administrative procedures. Due to this new obligation, requests for assistance with establishing port-EDIs from countries without port-EDIs are expected to increase. In order to respond to the predicted requests, the IMO/FAL plans to design a prototype of a maritime single window (MSW) (IMO, 2016). MSW is an information system—similar to the port-EDI—that processes port administrative procedures. If the prototype MSW is successfully designed, developed, and implemented, it would very likely become the international standard for countries aiming to introduce port-EDIs.



The Technical Cooperation Committee (TC) in the IMO is tasked with developing the prototype MSW project along with the IMO/FAL. According to the IMO/TC, the project is separated into four phases as follows: (1) collecting data on the current status of computerization for port administrative procedures using a user survey; (2) assessing the user requirements and the design criteria; (3) developing the prototype MSW; (4) implementing the prototype MSW in one target country. In April 2015 during the 65th session (TC65) of the IMO/TC, it was reported that the first two phases have already been completed (IMO, 2015a).

The survey results from the first phase show that introduction of MSW (or port-EDI) in developing countries has not progressed significantly. In fact, approximately one fourth of the countries without port-EDIs have not even developed a plan for a port-EDI. On the other hand, from the administrative procedure prospective, many countries report that they use elements of the FAL forms (IMO, 2015b).

The second phase recommends certain system requirements for MSW such as connection and integration between systems, user groups, data items to be collected, interface methods, interface formats, authentication requirements, and hardware and operation requirements (IMO, 2015b). However, each of these system requirements contains only minimal information—leaving out any analysis of business processes or screen transition diagrams. These analyses are necessary when developing the system because port administrative procedures and organizational systems differ by country.

The development costs for the new MSW software are estimated at approximately \$1 million. This estimate may not be reliable, as it is based on information provided by the UN/ECE webpage on single windows and interviews with the implementers of two recent MSWs, rather than calculations of the total amount of time and cost required for developing the prototype MSW.

Due to the fact that the financial aspects of this project are unclear, the third and fourth phase would be difficult to undertake. Even if the project reaches the fourth phase, it would be essential to discuss how to ensure financial sustainability for the operation and maintenance of the prototype MSW.

3.2 Each country's efforts for port-EDI introduction to other countries

In order to support the IMO's efforts to develop the prototype MSW, Norway, the RoK, Chile, and the European Commission have offered their assistance to IMO/FAL (IMO, 2016). Norway has been particularly dedicated to this project. For example, Norway funded the first two phases of the project, and has offered free use of the structure and modules of Norway's single window system, "SafeSeaNet Norway," which is regarded as a port-EDI. RoK has



reportedly tried to introduce their Port-MIS, which is essentially a port-EDI, in other countries. For example, they tried to introduce their system in Kemaman Port in Malaysia (JICA, 2012). Moreover, in the Integrated Technical Cooperation Program (ITCP) under the IMO/TC, RoK and the IMO/TC planned to support implementation of the single window concept in Mauritius; however, this project was postponed (IMO, 2015c). Japan also supports ASEAN countries in establishing port-EDIs (details are described in subsection 4.2).

4. Current Status and Future Prospects of Port-EDIs in the ASEAN Region

In the ASEAN region, the gross domestic product (GDP) is growing at a sustainable rate, and further economic development can be expected. Supporting the growth of the ASEAN region and improving logistical efficiency are important issues.

In this section, the authors describe the current status of port-EDIs in the ASEAN region based on an interview survey and discuss the possibility of expanding port-EDIs use in the ASEAN region. Laos and Brunei are not included in this survey, as Laos is an inland country and Brunei has few ports for international trade of ocean containers.

4.1 Status quo of port-EDI in each ASEAN country

4.1.1 Cambodia

Cambodia has not introduced a port-EDI.

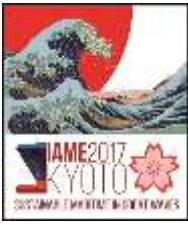
4.1.2 Indonesia

The Directorate General of Sea Transportation (DGST) in the Ministry of Transport has developed INAPORTNET which processes port administrative procedures nationwide. However, the system is not widely operated. This is due to the fact that in order to operate efficiently INAPORTNET must make use of the cargo manifests from the custom systems and, as of yet, this is not possible because the two systems have not completed the necessary collaboration. Thus, users have to input the same cargo manifest data into both systems.

However, to rectify this situation, a Ministerial ordinance aimed at improving the system was issued in 2015. Thus, the system is expected to be used in the future.

4.1.3 Malaysia

Each port-authority, such as Port Klang and Johor Port under the Ministry of Transport, has established a port-EDI. For example, the Port Klang Authority has developed a system for processing the vessel ID and ship call number applications, pre-arrival notices, port ancillary service applications, and dangerous goods applications. Furthermore, the Port Klang Authority has installed Port Klang Net, a Port Community System. Meanwhile, Johor Port Authority has independently developed and operates e-PENS, which processes the security information of ships, port entry/departure declarations, and dangerous goods declarations. It



is predicted that mechanisms to enable collaboration or integration of each authority system are likely to arise.

4.1.4 Myanmar

Myanmar has not introduced a port-EDI. At present, Japan is supporting the establishment of a port-EDI in Myanmar with Japanese grant funding (JICA, 2015). This project is currently in the development phase, which includes detailed design programming, the installation of hardware, and planning operations.

4.1.5 Philippines

The Philippines Ports Authority (PPA) developed the nationwide Port Operations Management System (POMS). POMS processes basic port administrative procedures such as port entry/departure declarations and dangerous goods declarations. However, POMS does not include some procedures that do not have a direct impact on revenue collection. POMS is used in approximately 20 major Philippine ports. However, nearly 100 other ports under the Philippines Ports Authority have not introduced POMS.

4.1.6 Singapore

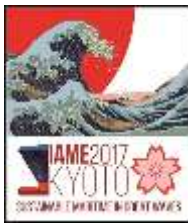
The Maritime and Port Authority of Singapore (MPA) has developed and operates MARINET. MARINET has collaborated with TRADENET, which is the customs system in Singapore. In other words, Singapore has established an SW. In addition, MARINET is connected with PORTNET, which processes port procedures between private companies and is operated by the container terminal operator of the Port of Singapore, PSA International Pte Ltd.

4.1.7 Thailand

Thailand customs has primarily taken the lead in establishing the Thailand National Single Window (TNSW), which can process all import/export-related procedures. Many import/export related procedures for ministries or agencies have already been processed by TNSW. Port administrative procedures are processed by e-Manifest, which is one component of TNSW.

4.1.8 Vietnam

The Vietnam Maritime Administration (VINAMARINE) and the regional maritime administration (MA) in the Ministry of Transport first attempted developing a port-EDI in the Hai Phong Port in 2002. Subsequently, they tried to introduce port-EDIs several times. As of 2016, Vietnam customs has primarily taken the lead in establishing a port-EDI. A Port-EDI is now in operation in ten major ports. Japan customs assisted Vietnam in introducing the customs system NACCS with Japanese grant funding. The Vietnam version of NACCS is currently operating (Tanaka, H., 2014).



A summary of the above survey is shown in Table 2. Table 2 also contains the world rank of “The Networked Readiness Index” (World Economic Forum, 2016), which shows the ICT level of each country and “Logistics Performance Index” (World Bank, 2016). The current status of introducing port-EDIs can be correlated with the world rank of “The Networked Readiness Index” and the “Logistics Performance Index.”

Table 2. Current Status of port-EDIs in each ASEAN country

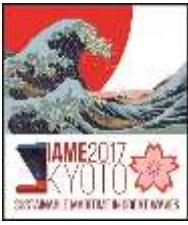
Source: the authors

Country	World rank on “The Networked Readiness Index”	World rank on “Logistics Performance Index”	Current status of port-EDI
Cambodia	109	73	Not established
Indonesia	73	63	DGST developed INAPORTNET in 2012. The system has not been operational; however, a ministry ordinance for promoting its use was announced in 2015.
Malaysia	31	32	Each port authority has developed a system respectively. There is no nationwide system.
Myanmar	133	113	Under development supported by Japan.
Philippines	77	71	PPA has developed POMS, which is operated in 20 ports.
Singapore	1	5	MPA has developed and operates MARINET.
Thailand	62	45	Thai customs has primarily taken the lead in establishing the Thailand National Single Window, which includes features of port-EDIs.
Vietnam	79	64	Vietnamese customs has primarily taken the lead in establishing port-EDIs. The port-EDI is used in the ten major ports.
(Reference) Japan	10	12	NACCS subsystem is in operation.

4.2 Prospects for future port-EDIs in the ASEAN region and Japan’s support

Based on the survey results shown in section 4.1, the future prospects for introducing port-EDIs in the ASEAN region are as follows. Cambodia does not have a port-EDI, but is expected to introduce it in the future. Other countries, except for Singapore and Thailand, who have already set up SWs that include port-EDIs, and Myanmar, which is currently developing a port-EDI, have some issues with their port-EDIs. For example, some port-EDIs are not nationwide systems, while some procedures are out of the typical scope of port-EDIs. It was noted that Malaysia has sufficient technical capabilities to develop an IT system; accordingly, it could develop a nationwide system if the central government takes the initiative.

Also, as described in section 1, the ASEAN region is promoting the ASW system, which is a unique regional initiative that connects and integrates NSWs of the member states. The NSW’s feature is to provide a single electronic submission point for applicants such as



customs brokers. Therefore, the concept of NSW does not necessarily contain the port-EDI feature or collaboration with the port-EDI. However, according to our survey, in Thailand and Vietnam, the NSWs contain not only the customs system but also the port-EDI. This implies that a port-EDI can be introduced in the ASEAN region in conjunction with the establishment of the NSW in each country.

Japan has been supporting ASEAN countries in establishing a port-EDI. In order to provide basic ideas and useful information regarding the introduction of a port-EDI, Japan and ASEAN published the “Guideline for Introduction of Port-EDI System on Port-related Procedures.” The port technology group (PTG) under the ASEAN-Japan transport partnership was responsible for this publication. This guideline covers the focal points for introducing port-EDIs: system design, operation, and management. This guideline was endorsed at the 12th ASEAN and Japan Transport Ministers meeting held in 2014 (Mission of Japan to ASEAN, 2014).

In addition, Japan has held international seminars on the port-EDI in Vietnam, Myanmar, and Indonesia. At the seminars, Japan provided an outline of a port-EDI, which included how to facilitate the port administrative procedures, the FAL Convention, and an SW. Furthermore, in order to increase awareness of the importance of introducing port-EDIs, Japan invited not only government officers but also port-related organizations from the private sector.

These efforts and activities might have prompted the ASEAN region to introduce port-EDI. Additionally, Japan is supporting the establishment of a port-EDI in Myanmar; included in this support is assistance in design, development, and maintenance (JICA, 2015).

5. Comparison of port-EDIs of Japan, Korea, and Singapore

The results of an interview survey are used to compare port-EDIs of Japan, RoK, and Singapore and demonstrate how advanced these systems are in Asia. The result of the comparison is summarized in Table 3. Major points are analyzed as follows:

- Establishing and managing body: Each central government has established and manages their port-EDI.
- Operating body: The operating body is different for each of the three countries. Japan and RoK outsource the operation to private companies, which are strongly influenced by the governments. In Japan, the operating body is Nippon Automated Cargo and Port Consolidated System, Inc. (NACCS center). NACCS center was established jointly by the public and private sectors as an authorized corporation in October 1977. It became an incorporated administrative agency in October 2003. After that, NACCS was privatized, becoming a private company in 2008. In RoK, the operating body is KL-Net. KL-Net was

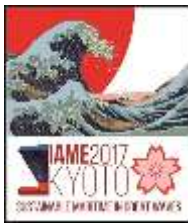


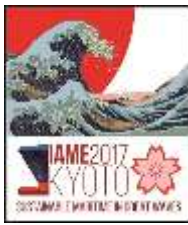
Table 3. Comparison of port-EDIs of Japan, RoK, and Singapore

Source: the authors

	Japan	RoK	Singapore
System Name	NACCS port subsystem (Alias: Port-EDI)	Port-MIS	MARINET
Establishing and management body	Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	Ministry of Oceans and Fisheries (MOF)	The Maritime and Port Authority of Singapore (MPA)
Operating body	NACCS center Inc.	KL-Net Corp.	MPA
Scope of the procedures of the system	The whole port administrative procedures (e.g. Arrival/departure declaration; Application for permission to use berthing facilities; Advanced reporting of sea route; Notice of information on compensation for oil pollution damage; Application for permission to handle dangerous goods, etc.)	The whole port administrative procedures (e.g. Arrival/departure declaration; Pre-arrival notice; Declaration of dangerous goods; Application for using berthing facilities; Ship's security report, etc.)	The whole port administrative procedures (e.g. Arrival/departure declaration; Declaration of dangerous goods; Pre-arrival notice of security; Submission of cargo declaration, etc.)
Establishment of Single Window (SW)	Completed	Completed	Completed
Technical method of establishment of SW	Integration (Japan has also experienced collaboration.)	Collaboration	Collaboration
Collaboration between port-EDI and the system for private related port procedures	The port-EDI is one feature of NACCS. NACCS has also the feature of processing the private related procedures.	Connected to GCTS, which traces the location of containers	Connected to PORTNET, which processes the private related procedures in the Port of Singapore
First year of operation	1999	1992	1999
Rate of utilization of port-EDI	Arrival/Departure Declaration : 65.5% Application for permission to use berthing facilities: 40.1%	100%	100%

jointly established by the government of RoK and major logistics companies in 1994. On the other hand, in Singapore, the government directly operates the system.

- Scope of procedures of system: There are no significant differences with a few exceptions. The minor differences are derived from laws or regulations of the port administrative procedures themselves.
- Establishment of SW: Each country has established a SW.
- Technical method of establishment of SW: The technological approaches to realizing SW were different. Japan has unified port-EDI and customs system into one single system



(integration), after port-EDI and the customs systems collaborated (collaboration).^{*4} On the other hand, a collaboration method was adopted in the case of RoK and Singapore's port-EDI.

- Collaboration between port-EDI and the system for private port-related procedures: Each country has realized the collaboration.
- First year of operation: About 20 years have passed since the start of operations.
- Rate of utilization: In RoK and Singapore, the rate of electronic application of port administrative procedures (rate of utilization) is 100%. On the other hand, in Japan, the rate of arrival/departure notices is 65.5% and application for permission to use berthing facilities is 40.1%. This is because RoK and Singapore require the applicants to use the electronic systems by regulation. On the other hand, Japan permits the applicants to submit documents manually (hand-to-hand) or electronically.

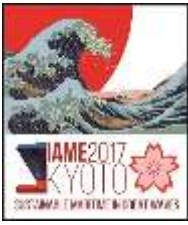
The differences among the three countries are observed from the above findings in the operating body, the technological approach to realizing the SW, and the rate of utilization. The merits and demerits related to the differences are as follows:

- Regarding the operating body, Japan and RoK outsource the operation and maintenance of their system to the private sector. Thus, the two countries might have the ability to draw up rules for outsourcing, such as responsibility demarcation points between the government and private sector and design of the financial scheme. On the other hand, it is difficult for the two countries to accumulate IT expertise to operate the system inside the government.
- Regarding the technological approach to realizing an SW, Japan has experience in developing an SW by both collaboration and integration. On the other hand, RoK and Singapore only have the experience of the collaboration. Thus, if a developing country tries to set up a SW through system integration, only Japan can properly instruct the country on that matter.
- Regarding the rate of utilization of the port-EDI, RoK and Singapore might be better able to assist other countries in making the system use mandatory and reaching a consensus among stakeholders.

6. Future Issues for Port-EDI Introduction in Developing Countries

The authors discuss the future issues for introducing port-EDIs in developing countries, based on the above findings.

6.1 Expected trend in countries that do not have port-EDIs



Countries which have ratified the FAL Convention must establish a port-EDI in order to comply with the amendment of the FAL Convention as described in section 1. Most of countries without port-EDIs are developing countries. Some developing countries likely do not have the technical capacity to establish a port-EDI. Therefore, requests for assistance in establishing port-EDIs from countries without port-EDIs (developing countries) might increase.

Port-EDIs are information systems that use a database management system (DBMS). In other words, there is no special technology for developing port-EDIs from an IT perspective. Thus, as can be seen in case of the ASEAN region, some developing countries whose ICT level are more than intermediate often attempt to establish port-EDIs by themselves. However, even if developing software for port-EDIs is succeeded, some issue will arise, as described in subsection 4.2, such as an inability to implement it nationwide or to address whole port-related procedures. Therefore, countries with port-EDIs can support the improvement or operation of the developed system by such developing countries.

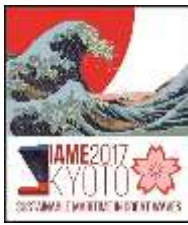
In reality, countries which are not contracted to the FAL Convention*⁵ do not have an obligation to introduce port-EDIs; however, some of these countries try to introduce it—as can be seen in the case of Myanmar. To prompt non-contracted FAL Convention countries to establish port-EDIs, it is necessary for developed countries or regional or international organizations to approach and pressure those countries to establish port-EDIs using dialogue (including the seminars described in subsection 4.2).

6.2 Development policy for port-EDIs

In countries with port-EDIs, the port-EDI has been generally established on-premises; it is installed and runs on computers on the premises (in the building) of the organization using some software, rather than at a remote facility, such as a server farm or cloud. Since Japan, RoK, and Singapore began port-EDI operations in the 1990s as can be seen in section 5, there were no open-source or cloud capabilities. More recently, cloud-based computing and open-source web-systems have become widely available; it is easier to establish port-EDIs now than it was in the past.

In addition, when supporting the countries without port-EDIs, it should consider which type of system is better to introduce, an order-made or ready-made system, since certain port administrative procedures as well as the administrative organizational structures vary among countries. For example, in the case of Myanmar, Japan introduced an order-made port-EDI system because the organizational structure for port-procedures is different from that in other countries.

6.3 Technological approach to realize SW



As mentioned in section 4, the establishment of an SW is currently expected in each ASEAN country. Therefore, from a technical perspective, when introducing a port-EDI, it is necessary to consider establishing an SW at the outset. As mentioned in subsection 2.1.3 and section 5, there are two technological approaches to realizing SWs: collaboration and integration. The method of approach should be decided according to the policies of the countries without port-EDIs.

6.4 Port administrative procedures by FAL Form

With the introduction of port-EDIs, it is necessary to conduct administrative procedures using the FAL form. Contracting governments of the FAL Convention shall adopt FAL forms. In addition, it is beneficial for non-contracting governments to make use of the FAL forms. For example, the authors have clarified that the Myanmar Port Authority permits the use of the FAL forms for applications, although Myanmar is not contracted to the FAL Convention. Also, as mentioned in subsection 3.1, the survey results by the IMO/TC reveal that some countries, which are not contracted to FAL Convention, use elements of FAL forms. For the applicants such as shipping companies or shipping agents, the unified format is obviously desirable.

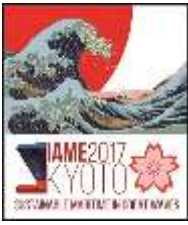
6.5 Interface and protocols for collaboration

In the maritime shipping field, UN/EDIFACT is used as the format for electronic interface for the collaboration. With IT improvements, as mentioned in subsection 2.3, the XML format for electronic interface has appeared in the maritime shipping field as a few examples have been reported (see Iida and Shibasaki, 2016).

Regarding communication protocols, FTP or SMTP/POP (e-mail) are still typically used in the maritime shipping field for the collaboration. However, looking at other fields, other communication protocols such as SOAP over HTTP or REST over HTTP are also adopted. Therefore, in the long run, these current popular interface and communication protocols will be also used in the maritime field for the collaboration.

6.6 Customized operation and management by countries

When countries introduce port-EDIs, each country may adopt the different methods of operation and maintenance as described in section 5. These differences impact cost. Also, when the government does not require that applicants use the system due to some reasons, the government has to deploy staff to deal with those manual applicants. In other words, not mandating system use could increase the labor costs of administering port procedures. Since it is difficult to recommend general countermeasures to each country which faces different issues such as capability of funding, labor unions, and organizational structure, countries with port-EDIs and countries without port-EDIs should well exchange views on the forms of operation and management before the introduction of port-EDIs.



6.7 Influence of a prototype MSW

At present, the IMO is promoting the prototype MSW project. The prototype MSW has a potential to be international standard. However, it is unclear at the present moment whether it is really developed or not, as described in subsection 3.1. In other words, bilateral cooperation that some countries with port-EDIs will support countries without port-EDIs is still effective for the moment. In addition, even if the prototype MSW becomes the standard port-EDIs, it would be necessary to customize it to cover all procedures in the country, since the detailed procedures and the administrative organizational structures vary among countries. Therefore, bilateral cooperation will remain to assist considering the cost and time for necessary customizations.

The above prediction is an analogy in introducing customs system in developing countries. There were two approaches: projects initiated by the UN and projects initiated by bilateral cooperation. At the same time the projects initiated by the UN as described in subsection 2.4, Japan has introduced its NACCS system to Vietnam and Myanmar, while RoK and Singapore have some experience in introducing their customs system to other countries (Kim, 2016; Crimson Logic Pte Ltd, 2014).

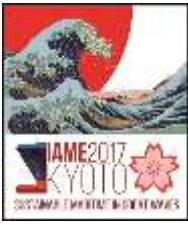
7. Conclusion

This paper focuses on the international trends and future prospects of introducing port-EDIs in countries without port-EDIs. The paper describes 1) literature review including features of Japan's port-EDI as well as related studies and guidelines; 2) the IMO's efforts to support the introduction of port-EDIs in countries without port-EDIs; 3) the current status and future prospects of port-EDI introduction in ASEAN countries; and 4) the comparison of the port-EDI systems of Japan, RoK, and Singapore, which are successful model of port-EDIs. Finally, based on the above descriptions and clarifications, the authors discuss the future prospects of introducing port-EDI in developing countries.

As mentioned in subsection 6.1, special technology is not required to develop port-EDIs. However, total system coordination, including maintenance and operation, in addition to design and development of the port-EDI, is important and difficult to establish. In order to realize total coordination, in implement the best IT capabilities, it is necessary to make regulations, reach a consensus with stakeholders, and secure a budget for sustainable operations. In other words, when supporting developing countries, it is necessary to coordinate various aspects related to design, development, operation and maintenance, and organizational structure.

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Notes

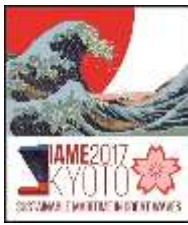
1. At the present, there is no consensus on the name of information systems for port administrative procedures in the world. For example, the IMO uses both “Single Window System in Maritime Transport” and “Maritime Single Window (MSW),” depending on the documents. On the other hand, Japan and other ASEAN countries have adopted the title “port-EDI.” Due to the lack of consensus, in this paper, the authors use “port-EDI” to denote an information system for port administrative procedures. MSW described in section 3.1 is used as a synonym for port-EDI in this paper.
2. Single Window means an information system to provide one-stop service and share the related data of all port-related procedures such as customs clearance and port administrative procedures.
3. FAL Forms are defined by the FAL Convention as follows: IMO General Declaration (FAL form 1); Cargo Declaration (FAL form 2); Ship's Stores Declaration (FAL form 3); Crew's Effects Declaration (FAL form 4); Crew List (FAL form 5); Passenger List (FAL form 6); Dangerous Goods (FAL form 7) .
4. The difference between collaboration and integration is shown in Table 4.

Table 4. Difference between collaboration and integration

Source: the authors

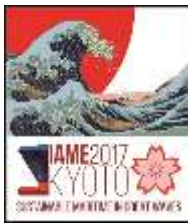
	Collaboration	Integration
Image		
Explanation	<ul style="list-style-type: none"> • Each system is independent. • The systems collaborated through data exchange via an electronic interface. 	<ul style="list-style-type: none"> • The plural systems are integrated into one system (integrated system). • Each system becomes one feature of the integrated system.

5. The number of contracting governments to the Convention is 118 (as of December 2016).



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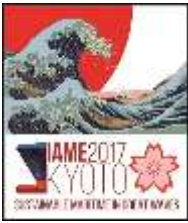
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