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Developing a single window integrated platform for multimodal transport management and logistics

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Abstract

This paper will focus on the implementation of National Single Window (NSW) telematic applications allowing the integration of inland and maritime waterway transport with other modes of transport and also with Port Community Management applications. The NSW concept refers to the implementation of a national system that will act as a single point of contact for the electronic submission and exchange (especially) of freight related information between public and private stakeholders from different transport modes. The main objective of the paper is to propose a solution and an implementation roadmap for the correlation and harmonization of the currently isolated and partly un-coordinated initiatives related to SW. NSW should build on existing telematic applications and systems like SafeSeaNet, River Information Services or Intelligent Transport Systems for Road Transport. In this way, the authors propose a possible approach in developing integrated NSW.

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1. Introduction

In general, the transport sector represents a vital element of the economy of the European Union, in particular for its member states. The need for seamless mobility and fast, efficient and on-time delivery of goods is a very important part of every European citizen's life. However, the transport sector faces many challenges that threaten its development. These range from congestion and high operating costs to pollution and major problems related to safety and security.

Recognizing the need to take action, the Commission has prepared a "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system" – COM(2011)0144, which proposes a number of measures to be taken for a sustainable transport in the future in line with the following objectives:

- Improving the energy efficiency performance of vehicles across all modes. Developing and deploying sustainable fuels and propulsion systems;
- Optimising the performance of multimodal logistic chains, including by making greater use of inherently more resource-efficient modes, where other technological innovations may be insufficient (e.g. long distance freight);
- Using transport and infrastructure more efficiently through use of improved traffic management and information systems (e.g., ITS, SESAR, ERTMS, SafeSeaNet, RIS), advanced logistic and market measures

The concept of NSW is a new initiative in the field of transport telematics which has emerged especially as a result of several policy regulations for maritime transport like for example the Blue Belt concept and Directive 2010/65/EU. The NSW concept refers to the implementation of a national system that will act as a single point of contact for the electronic submission and exchange of (especially) freight related information between public and private stakeholders from different transport modes. NSW should build on existing telematic applications and systems like SafeSeaNet, River Information Services or Intelligent Transport Systems for Road Transport. Currently the implementation of Single Windows focuses mostly on Maritime Single Windows as required by Directive 2010/65/EU which came into force on 1st of June 2015. Although several projects have addressed the issue of NSW, there are still no implementations at European level. This paper takes into account the results of previous projects related to implementation of Single Windows like RISING, IRIS Europe I, II and III, PLATINA, AnNa Maritime Single Window and especially European e-Freight Capabilities for Co-modal Transport (e-Freight). Also some of the findings and solutions in terms of supply chain requirements developed in projects like CASSANDRA and CORE have been studied.

The paper is structured as following: firstly, the current state of the art, European and national regulations and ongoing or finalised projects in the field are presented. Case studies are also being performed for countries where systems similar to NSW have been implemented. Particular attention is given to implementations where potential Single Windows are interconnected with Port Community Management applications. This is because the authors believe that NSW can have a great impact especially if it firstly contributes to the information exchange between port operators/managers and all other stakeholders involved in the transport chain. Secondly, an analysis of the technological and political requirements for the implementation of NSW telematic applications, which would allow for the integration of at least two transport modes and Port Community Management applications, will be carried out. Finally, based on these investigations, a generic architecture for NSW and an indicative roadmap for their implementation will be proposed.

Nomenclature

EMSA	European Maritime Safety Agency
ESPO	European Sea Ports Organisation
IPCSA	International Port Community Systems Association
NSW/SW	National Single Window/Single Window
SPA	Single Point of Access for traffic and transport infrastructure data
WCO	World Customs Organization

2. State of the art review

2.1. Relevant European legislation

The following legal documents are relevant in the context of implementation of National Single Windows:

- Framework legislation for the transport field
 - Keep Europe Moving – Sustainable mobility for our continent, COM (2006) 314
 - Freight Transport Logistics Action Plan, COM (2007) 607
 - NAIADES II Communication, SWD(2013) 324 final
 - Directive 2005/44/EC of the European Parliament and of the Council on harmonised river information services (RIS) on inland waterway in the Community
 - Framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport, Directive 2010/40/EU
 - The Action Plan for the Deployment of Intelligent Transport Systems (ITS) in Europe, COM(2008)886
- Framework legislation focused on digital single market and single transport area
 - Communication and action plan with a view to establishing a European maritime transport space without barriers, COM (2009) 10/2
 - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011)0144
 - Blue Belt, a Single Transport Area for shipping, COM(2013) 510 final
 - A Digital Single Market Strategy for Europe, COM(2015) 192 final
 - Single Market Act II, COM(2012) 573 final
 - UN/CEFACT Recommendation Number 33 on the Establishment of a Single Window
- Technical legislation for and related to SW
 - Reporting Formalities Directive, 2010/65/EU
 - Directive 2002/59/EC of the European Parliament and of the Council establishing a community vessel traffic monitoring and information system and repealing Directive 93/75/EEC
 - Technical specifications for electronic ship reporting in inland navigation, Commission Regulation No 164/2010
 - COMMISSION DELEGATED REGULATION (EU) No 886/2013 of 15 May 2013 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users
 - COMMISSION DELEGATED REGULATION (EU) No 885/2013 of 15 May 2013 supplementing ITS Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of information services for safe and secure parking places for trucks and commercial vehicles
 - COMMISSION DELEGATED REGULATION (EU) 2015/962 of 18 December 2014 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services

The framework legislation for transport field defines the basic principles that form the foundation for the development of the transport field in the EU. It does not focus on SW and it also does not define any technical specifications at system level. The framework legislation focused on digital single market still operates at the concept level. However it is much more focused towards electronic technologies to facilitate trade, including SW.

The technical legislation actually defines the technical requirements for the implementation of SW (Directive 2010/65/EU), communication technologies (Directive 2002/59/EC for SafeSeaNet) and other related technologies and systems. The Regulations 886, 885 and 962 have been included in this group because all of them require Member States to set up a National Single Point of Access (SPA) where the addressed type of traffic and transport infrastructure data is collected and made available. Therefore the SPA is the equivalent of SW for road transport.

2.2. Current status of NSW implementation

NSW in the sense defined by Directive 2010/65/EU or more advanced systems as proposed in this paper are, according to a recent Commission report [EC report (2014)], not currently implemented at European level. There are, however, several Member States making efforts towards harmonized development of NSW, as it can be seen from the projects described further. Besides that, there are much more countries that have implemented Port Community Management Systems (PCS). A PCS is an electronic platform that enables and facilitates the secure electronic exchange of information between public and private stakeholders involved in the processes necessary for cargo management in ports. According to IPCSA (2015), amongst the first countries to start operating PCS were Germany, France and UK in the late 70s. Then, later in the 1990s Netherlands and Spain also started developing PCS. PCS can be seen as local Single Windows according to ESPO (2014) as they provide the core services associated with SW:

- simple, fast and efficient electronic information exchange and centralisation;
- submission of customs declarations and processing of dangerous goods;
- tracking and tracing;
- electronic generation and handling of maritime and any other type of statistics.

A second important aspect is the implementation of Customs Single Windows. A survey [Choi (2011)] performed by WCO shows that all 58 responding customs administrations have IT systems for cargo clearance. However these systems are rather isolated, as on average only 3 other governmental agencies are connected with the customs' systems. Moreover only 34% of customs administrations implement a single window-type of system.

2.3. Related European projects

2.3.1. e-Freight

The *e-Freight* [Efreight (2014)] is a research and development project co-funded by the European Commission under the 7th Framework Programme. The ambition of the *e-Freight* project was to:

- Provide IT Capabilities supporting EU freight transport stakeholders to have a common, standard framework for freight transport in the European Community and, as far as possible internationally, adhering to EU policy on co-modality;
- Facilitate the use of different transport modes, on their own and in combination, to obtain an optimal and sustainable utilisation of European freight transport resources.

The *e-Freight* project has defined a reference solution for Next Generation National Single Windows based on an extensive review and analysis of current policies and implementation. The final *e-Freight* Next Generation Single Window concept consists of a multimodal National Single Window (NSW) deployed in each Member State and supported by a number of central EU services. In turn, the NSW system consists of two applications:

- The Common Reporting Gateway provides a common interface for businesses to report all regulatory information in a standardised format, regardless of mode or country;
- The Information Exchange facilitates the distribution and sharing of information between Authorities within and across Member States, and with EU level systems.



Fig. 1. High Level Concept of the e-Freight Next Generation Single Window.

2.3.2. AnNa

The ANNA project (Advanced National Networks for Administrations) [ANNA (2015)] is an EU Member States driven initiative funded by the TEN-T programme to support the effective and sustainable development of national Maritime Single Windows in line with EC Directive 2010/65/EU. It facilitates constant interaction between the various Administrations and Businesses, also cross border.

ANNA fosters a harmonized approach for administrative facilitation:

- to reduce red tape for users;
- to parse IT languages and
- to exchange data between national (Maritime Single Window) networks.

The project involves 14 EU partner countries, 10 EU and non-EU observer countries and 10 observer organisations. The ANNA project runs from 2012 to end of 2015, executing four major activities:

- Master Plan 2015 (2012-2015):
 - Minimum dataset, based on which the requirements of the EU Directive 2010/65/EU can be fulfilled nationally.
 - National scenarios and measures, and a mechanism for gauging national implementation.
- Pilot projects (2012-2015)
- Master Plan Extended Collaboration (2013-2015):
 - A strategy connecting the (national) Maritime Single Windows to national logistics platforms, e-Freight developments and other EU or national initiatives.
- Consultation and co-operation (2013-2015)

2.3.3. National Single Window (NSW) prototype

The NSW prototype [EMSA NSW (2015)] is a project carried out by the European Maritime Safety Agency as part of its mandate from the Commission to ensure the implementation of the Directive 2010/65/EU. The project consists of the implementation of a prototype NSW by the participating countries: Bulgaria, Greece, Italy, Malta, Romania and Norway. The NSW prototype supports the following formalities referred to in Directive 2010/65/EU:

- Notification for ships arriving in and departing from ports of the Member States (Directive 2002/59/EC),
- Border checks on persons (Regulation (EC) No 562/2006),
- Notification of dangerous or polluting goods carried on board (Directive 2002/59/EC),
- Notification of waste and residues (Directive 2000/59/EC),
- Notification of security information (Regulation (EC) No 725/2004),
- Entry Summary Declaration (Regulation (EEC) 2913/92 and Regulation (EC) 450/2008),
- FAL form 1: General Declaration,
- FAL Form 2: Cargo Declaration,
- FAL form 3: Ship's Stores Declaration,
- FAL form 4: Crew's Effects Declaration,
- FAL form 5: Crew List,
- FAL form 6: Passenger List,
- FAL form 7: Dangerous Goods,
- Maritime Declaration of Health,

It also handles the notifications required by Directive 2009/16/EC:

- Pre-arrival notification for ships eligible to expanded inspection;
- Notifications of actual arrival and departure.

Information which shall be provided in accordance with national legislation may also be reported in the NSW prototype:

- Cargo related formalities: Declaration of Temporary Storage, cargo Manifest (tentative);
- Waste delivery receipt;
- Bunkers remaining on board;
- Civil Liability Certificate for Oil Pollution Damage;
- Civil Liability Certificate for Bunker Oil Pollution Damage;
- Ship defects.

The general system architecture for the NSW prototype is depicted in the figure below.

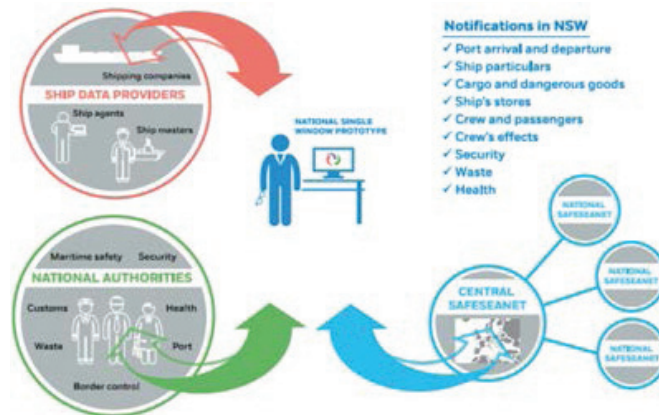


Fig. 2. System architecture for EMSA NSW prototype [source EMSA NSW (2015)].

2.4. Difference at national level between Maritime Single Window and the Customs Single Window developments

The Maritime Single Window (Directive 2010/65/EU) is an initiative supported by DG MOVE in the context of facilitating and simplifying the reporting formalities required in maritime transport. Therefore its primary focus is towards ship related data and not on cargo and trade related information. In terms of communication technologies, it uses the SafeSeaNet system. The key stakeholders for the Maritime Single Window are the European Maritime Safety Agency (EMSA) and national maritime administrations. These are the bodies which should implement and operate the SW, also ensuring the integration into the system of other relevant stakeholders, like for example the customs, border police, emergency services etc.

On the other hand there are also initiatives related to a Customs Single Window which are supported by DG TAXUD, UNECE and WCO. This SW concept is focused primarily on facilitating the exchange of trade related information and documents for all transport modes and processes. The actual communication technologies are not strictly defined, however the preferred message structure is the EDIFACT of the UNECE and the data structure follows the WCO data model.

The Customs SW concept does not imply a certain stakeholder being responsible for the implementation and operation, although the national customs agencies are seen as the most appropriate bodies for this role.

Analysing the two SW concepts and related initiatives it becomes obvious that they should complement and support each other in order to reach the ultimate goal of a single efficient, transparent, digital European market, without barriers for trade and transport. However this will require further efforts for harmonisation both at national level as well as between different directorates of the EU.

3. Proposed multimodal NSW Integrated Platform

3.1. System architecture

The NSW Integrated Platform could be defined as the standalone information system, operating at national level, which provides connectivity to other systems using standard ways of communication, accepting information in strictly defined structure and making it available to various different stakeholders within the country in a harmonized manner. It should be built around the Maritime Single Window in order to allow for the integration and exchange of information with Port Community Systems and telematic applications of other transport modes. Authorized users should benefit from the range of different functionalities of the NSW Platform that should vary depending on the assigned user role. The architecture of the system is needed in order to provide for interoperability and connectivity with other systems in a multimodal approach [Nemtanu and Dumitrescu (2006)]. A general architecture of the proposed system is displayed in the next figure.

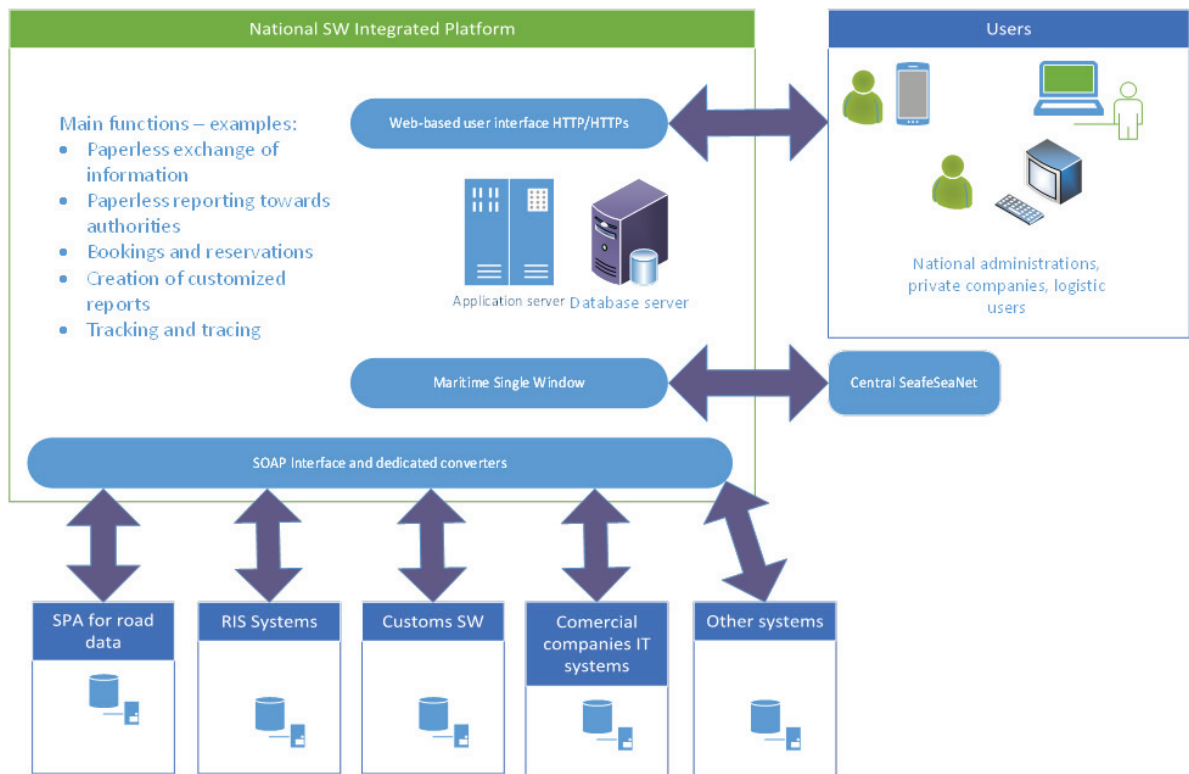


Fig. 3. Proposed general architecture of the NSW Integrated Platform.

The NSW Integrated Platform can provide interfaces with the following types of telematic systems and applications:

- Port Community Management Systems
- SafeSeaNet
- River Information Systems
- Customs Single Window
- Traffic Management ITS Systems/Traffic Management Centres thru National SPA.

The NSW Integrated Platform application should provide single point of service and information to all involved parties and act as information and data hub connecting different systems. It should be used by freight forwarders, shippers, cargo owners, authorities, port operators, etc. to exchange information and documents in electronic form, help planning of the activities and make the operation more efficient. The NSW should be built around the Maritime SW and it should not replace any existing national systems like Customs SW, RIS systems or SPA for road data. Rather it should operate on top of them and exchange information with all. As such it can provide two major roles:

- Facilitating the information exchange and link between administrations and between administrations and users. For example, data from RIS systems can be made available to customs, border police, emergency services etc. Or data from maritime transport can be exchanged with RIS systems which is extremely useful for countries having mixed waterway transport. A further example is the possibility to exchange maritime and inland navigation data with port systems and as such facilitate the efficient planning of port operations and management.
- Being a single digital access point for users requiring multimodal freight and transport services, providing all the information and facilities that are available by each system individually.

The interface with other systems should be built using standardized XML/SOAP messages. This is the standard already in use for example, by RIS systems [Dumitrescu et. all (2011)] and SPA for road transport information. Where necessary, converters will be implemented – for example, from EDIFACT to XML.

The NSW Integrated Platform application should be designed with at least the following modules:

- **Scheduling**

This module should provide dynamic point to point schedules, cut-off/availability and routings for scheduling a shipment. The key functions to be defined are:

- Selecting point to point schedules and routings to schedule a shipment.
- Selecting departure or arrival date to view and select available schedules.
- Viewing pertinent schedule information: departure and arrival dates, mode (road, rail, inland ...), transport number or vessel/voyage number, and transit.
- Viewing cut-off/availability for departure and arrival locations.
- Initiating a booking from the application.

- **Booking**

This should be a secure module for the submission of booking requests. Booking requests should be sent via Internet and it should be confirmed electronically. The key functions to be defined are:

- Submitting bookings on-line opening a booking request form.
- Requesting bookings (including hazardous and oversized cargo).
- Receiving notifications when a new booking request is processed and whenever the status for a booking request changes.
- Submitting change and cancellation requests.
- Submitting request to modify schedule routing and cargo related information.
- Viewing the status of the booking requests and checking the shipment details from the Booking Request List.

To create a new booking request, following information should be introduced:

- Commodity description
- How the commodity would be transported (bulk, container, hazardous ...)
- Where and when would this commodity be transported and by who (carrier)
- Additional information (third parties, shipping instructions ...)
- Reference numbers

- **Shipment Tracking**

This module should allow to trace and view single or multiple shipments by Bill of Lading Number, Booking, or Container Number.

- **Documents Processing**

This module should be used for creating, viewing and printing documents: bill of lading, arrival/departure requests, administrative documents for electronic ship reporting, berthing management and others, to receive notifications and to check documents processing status.

- Reports Creation

Reports should display information from the following categories: Shipment Details, Commodity, Transport/Service, Dates Estimated, Dates Actual, and Container Details.

The upgrade of the port community management systems and their interface to the NSW Integrated Platform is expected to provide the following functionalities:

- Arrival announcement and permission request to Harbour Masters office
- Requests for berthing with estimated time of arrival and cargo information
- Port operations administration (cargo, passengers, costs, ...)
- Port dues invoicing
- Availability of berthing facilities & berth management
- Actual data on vessel's positions and calculated ETA (only for vessels sailing to that port)
- Actual status and position of the vessels in the Port
- RIS reference data.

The interfaces of NSW Integrated Platform with Traffic Management ITS Systems/Traffic Management Centres should be done via the National SPA and should include real time traffic information in the following categories, relevant to road safety and freight logistics:

- Road status: closures and restrictions (weight restrictions, speed / lane restrictions) and roadworks;
- Weather reports – road surface information (wet / ice / snow);
- Flow information – medium speed and occupancy information where available.

3.2. Roadmap for implementation

The development of a National SW Platform is certainly a complex task for any European country. It needs a strong political will, adequate planning and funding. Furthermore, the EU has to set a clear and consistent framework towards that objective. The roadmap we are proposing targets the year 2020 which is a milestone for many European initiatives. It might be rather ambitious, however we believe it can be achievable if the current political support is at least maintained if not increased. Already, in terms of Maritime Single Window, the AnNa and the NSW prototype have produced some significant results. National RIS systems are already implemented in all EU countries [Dumitrescu et. all (2011)] and the core RIS technologies are mature. Also, as presented in this paper, PCS and IT systems for customs are already available in most countries. Finally, SPAs for road transport are starting to be implemented with some of the related Delegated Regulations already entering into force in 2015.

The picture below shows the proposed roadmap for the implementation of National SW Integrated Platforms for multimodal transport and logistics.

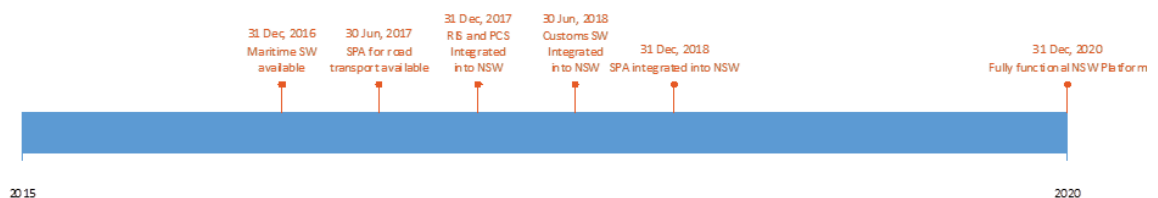


Fig. 4. Proposed roadmap for the implementation of the NSW.

The implementation will require the cooperation and support of many national and European stakeholders. They should assume different roles as presented in the table below. Probably the most important should be policy supporters who will have to define the legal and political framework but also to ensure the financing instruments. It is also important to identify the body that will actually implement and operate the SW Platform at the national level.

In most cases it might be a joint undertaking of several governmental administrations (for example customs and maritime/inland waterway administrations) or public-private partnerships between governmental administrations and private stakeholders. In any case, the designated body will need to have the financial as well as regulatory power to operate a system in which a large number of private and public stakeholders are involved. Finally, private end users also have a major role in supporting and contributing to the SW platform by sharing their needs, participating in pilot implementations and providing feedback.

Table 1. Key stakeholders involved in the implementation of National SW Integrated Platform.

Role	European stakeholders	National stakeholders
Policy supporter	European Commission and European Organisations/Agencies (EMSA, ESPO, WCO, IPCSA)	Governments and Ministries
Implementation body	-	Governmental administrations or public-private partnerships
Quality insurance and certification	European Commission	Designated national independent bodies
Data suppliers	European Agencies, e.g. EMSA	National administrations and private fleet operators/owners
Standardisation bodies	ETSI	National standardisation bodies
Logistic users	-	Private companies
Other end users	-	Public administrations, emergency forces, private users

4. Conclusions

The paper presents the current state of the art, European and national regulations and ongoing or finalised projects in the area of Single Windows systems. The main differences between the two major concepts, the Maritime SW and the Customs SW are also analysed.

The authors also present a concept for a National Single Window Integrated Platform that is able to support multimodal transport and logistics operations. It is believed that the implementation of such a Platform could bring major benefits in the field of European trade and transport. The NSW should be built around the Maritime SW and it should not replace any existing national systems like Customs SW, RIS systems, or SPA for road data. It will rather operate on top of them and exchange information with all.

Finally, the development of a National SW Platform appears to be a very complex task for any European country. It will need a strong political will, along with adequate planning and funding. Furthermore, the EU has to set a clear and consistent framework towards those targets. A roadmap for NSW implementation towards 2020 taking into account the current developments has also been presented in the paper. The key national and European actors that have to be involved have been identified and preconditions for implementation have been set up. A constant political and economical determination will be needed to put together all the necessary actions in the future.

References

- ANNA, 2015. <http://www.annamsw.eu/> (accessed December 2015).
- Choi, J. Y., 2011. A Survey of Single Window Implementation. http://www.wcoomd.org/en/topics/facilitation/activities-and-programmes/single-window/-/media/WCO/Public/Global/PDF/Topics/Research/Research%20Paper%20Series/17_SW_Survey%20Analysis_Choi_EN.ashx (accessed December 2015).
- Dumitrescu, D., Minea, M., Gheorghiu, A., Niculescu, M. C., Nemtanu, F., Dumitrescu, S., Camelia Bunea, Severin, A., Robu, O., 2011. Manual RIS. Constanta: Nautica, 2011.
- EC report, 2014. [http://ec.europa.eu/transport/modes/maritime/ports/doc/com\(2014\)320.pdf](http://ec.europa.eu/transport/modes/maritime/ports/doc/com(2014)320.pdf) (accessed December 2015).
- Efreight, 2014. <http://www.efreightproject.eu/> (accessed December 2015).
- EMSA NSW, 2015. <http://emsa.europa.eu/nsw.html> (accessed December 2015).
- ESPO, 2014. http://www.espo.be/images/stories/policy_papers/policy_papers2014/2014.04.07%20espo%20position%20on%20rfd%20final.pdf (accessed December 2015).
- IPCSA, 2015. <http://www.ipcsa.international/pes> (accessed December 2015).
- Nemtanu, F.C., Dumitrescu, D., 2006. The National Architecture of Road Intelligent Transport Systems in Romania, proceedings of the 13th ITS World Congress. London, UK, 8-12 October 2006.