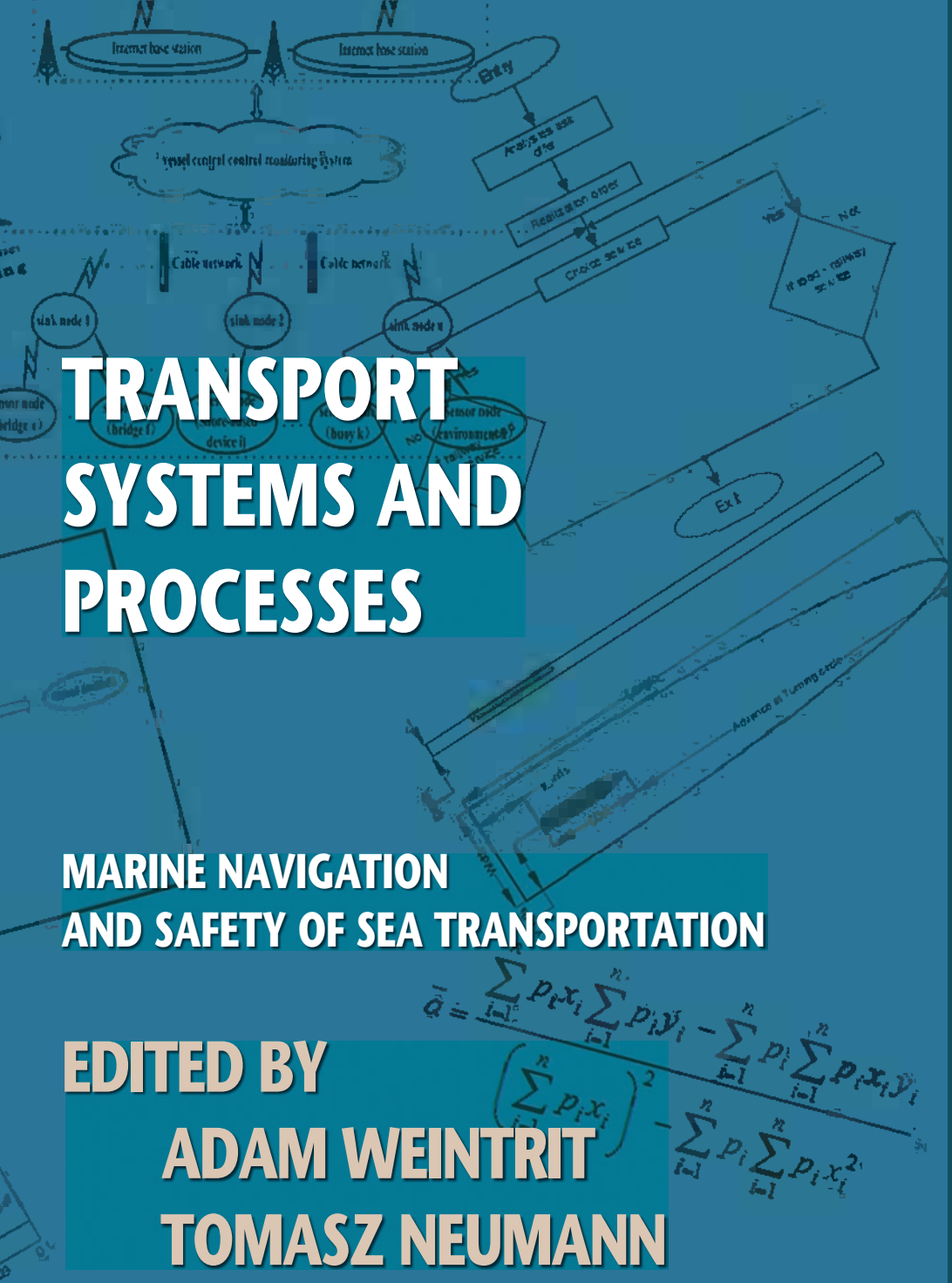

TRANSPORT SYSTEMS AND PROCESSES

MARINE NAVIGATION AND SAFETY OF SEA TRANSPORTATION

EDITED BY
ADAM WEINTRIT
TOMASZ NEUMANN

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Transport Systems and Processes

Marine Navigation and Safety of Sea Transportation

Editors

Adam Weintrit & Tomasz Neumann

Gdynia Maritime University, Gdynia, Poland

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Miscellaneous Problems in Maritime Navigation, Transport & Shipping Introduction

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PREFACE

The contents of the book are partitioned into six parts: transportation (covering the chapters 1 through 4), information and computer systems in transport process (covering the chapters 5 through 11), maritime transport policy (covering the chapters 12 through 14), maritime law (covering the chapters 15 through 18), ships monitoring system; a decision support tool (covering the chapters 19 through 25), inland navigation (covering the chapters 26 through 30). Certainly, the subject relating to transport systems and processes may be seen from different perspectives and different branches.

After an introducing to intelligent transportation systems (ITS) and monitoring systems, this book describes the contribution of navigation to land-based traffic management comprising, e.g. in-vehicle navigation systems and advisory routing systems. Besides, an overview of maritime, land and inland traffic management is given.

The first part deals with transportation. The contents of the first part are partitioned into four chapters: The land trans-shipping terminal in processes flow stream individuals intermodal transportion, Modelling of traffic incidents in transport, Maritime transport single windows: issues and prospects and Fire Safety Assessment of Some Oxidizers in Sea Transport

The second part deals with information and computer systems in transport process. The principles of information flow in transport are presented. The contents of the second part are partitioned into seven chapters: Development and standardization of intelligent transport systems, Computer systems aided management in logistics, Information in transport processes, Application of fractional calculus in identification of the measuring system, Railroad level crossing – technical and safety trouble, Application of the Polish active geodetic network for the railway track determination, and The advantage of activating the role of the EDI - bill of lading and its role to achieve possible fullest.

The third part deals with maritime transport policy. Different approaches to this subject are presented. The contents of the third part are partitioned into three chapters: Effectiveness of the European maritime policy instruments, Sustainable transport planning and development in the EU at the example of the Polish coastal region Pomorskie, and Development of the Latvian maritime policy; a maritime cluster approach.

The fourth part deals with maritime law. The contents of the fourth part are partitioned into four chapters: European Union's stance on the Rotterdam Rules, Maritime law of salvage and adequacy of laws protecting the salvors' interest, The Hong Kong International Convention for safe and environmentally sound management of the recycling of ships Hong Kong 2009, and Maritime delimitation in the Baltic Sea: status iuris.

The fifth part outlines ships monitoring system; a decision support tool. The contents of the fifth part are partitioned into seven chapters: Ships monitoring system, A decision support tool for VTS centers to detect grounding candidates, On the development of an anchor watch supporting system for small merchant ships, Integrated Vessel Traffic Management System for port security in Malaysia, A Simulation Environment for Modelling and Analysis of the Distribution of Shore Observatory Stations - Preliminary Results, The relation with width of fairway and marine traffic flow, and Integrated vessel traffic control system.

The sixth part deals with inland navigation. The contents of the sixth part are partitioned into five chapters: Navigation data transmission in the RIS system, Sea-river technology in transport of energy products, Novel design of inland shipping management information system based on Wireless sensor networks (WSN) and Internet-of-things, Effectiveness of an Integrated Use of Satellite and GIS Technologies on Ships Mixed "River-Sea" Vessels, and

SC-Method of Adaptation Marine Navigational Simulators for Training River Shipmasters.

Transportation

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1. The Land Trans-Shipping Terminal In Processes Flow Stream Individuals Intermodal Transportion

A. Kuśmińska-Fijałkowska & Z. Łukasik
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ABSTRACT: The influence has the system of the exchange on enlargement of the efficiency of the work trans-shipping land terminal and processing information, which in he will improve the processes of the flow of the individuals of the intermodal transportation which was presented in the figure of algorithms more considerably to the measure. The algorithmization makes possible execution mathematical analyses, as also the influence has on the quality of the executed processes of the flow of the stream of the individuals of intermodal transportation in the trans-shipping land terminal.

1 INTRODUCTION

Correct functioning the whole chain of intermodal transportation depends in the considerable measure on proper functioning land terminals, and in this first of all from their ability infrastructural to the executing the trans-shipments, cost, range of offered services, quality and reliability. Presented algorithms in the article, in the considerable stage will contribute to improvement of the processes of the flow individuals in the land terminal to prevent in the future the situation from Fig. 4 obviously they were created stay on the basis of the observation of the real object in which shortcomings were observed. The algorithmization makes possible in so folded system what the land terminal is to conduct the effective mathematical analysis of drawing ahead processes. Because the modern terminal of intermodal transportation is more the than simple trans-shipping point and develops in the direction of creating the centres of the service of the transport of cargos about the wide range of offered services. (Łukasik Z., Kuśmińska A., Matejek T. 2006-2007)

2 ANALYSIS OF THE STATISTICAL DATA ARRIVING THE INDIVIDUALS INTERMODAL TRANSPORTATION TO LAND TERMINAL ON TRAIN

Road vehicles arrive on land terminal (Fig. 1) to deliver the individuals on given string of cars, the larger number arrives with the considerable store of the time before string of cars. These attentions are confirmed by conducted investigations. The switching of the branch of road and railway transportation is the aim of applying intermodal transportation in net and their integration within the of the general conception. (Kuśmińska A., Łukasik Z. 2005)

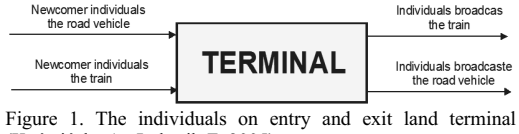

Figure 1. The individuals on entry and exit land terminal (Kuśmińska A., Łukasik Z 2005)

The presented option of arriving the individuals on the land terminal road vehicles (Fig. 2), the arriving the individuals on the terminal represents, a lot of earlier the before string of cars he is prepared to trans-shipping operations, and now he the trans-shipping device has to execute double operations in this case with, what operating costs, the time of the expectation of individuals join obviously.

The solution eliminating the indirect trans-shipment represents the Fig. 3 individual they arrive in such spaces of the time that they are subjected the direct trans-shipment from the road vehicle on the wagon of string of cars.

It was affirmed in the result of the analysis of statistical data gathered from the observation of the real object that individuals arrived the road vehicle to land terminal with considerable temporary superiority on given string of cars. This introduced on the graph in the co-ordinate time became before the string of cars will lower the terminal, and day of arrival of individual (Fig. 4). What the situation from the real object is the very „poor" case he answers the option from graph (Fig. 2).

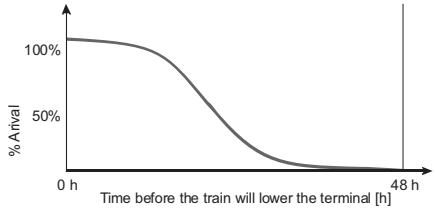

Fig. 2. Proportional arrival of road vehicles with individuals in the function of time (poor option of the arrival) (S.C.2.70 Deliverable 3. 1999)

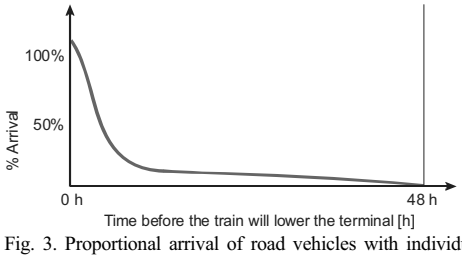

Fig. 3. Proportional arrival of road vehicles with individuals in the function of the time (best option of the arrival) (S.C.2.70 Deliverable 3. 1999)

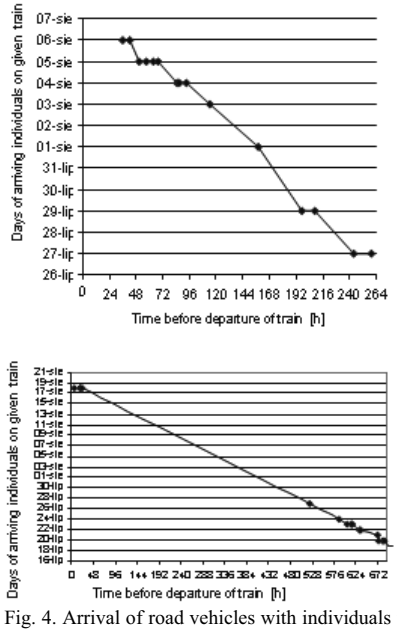

Fig. 4. Arrival of road vehicles with individuals in the function of the time [h] (own study)

Intermodal transportation gained temporary superiority over road transportation in our national conditions, you should improve the processes of arriving the individuals road vehicles to trans-shipping terminal what is visible on the graph in co-ordinates % arriving individuals the road vehicle to land terminal, and the time before the string of cars will lower terminal (Fig. 4), and also improve the flow of individuals in the terminal itself which is the bonding bar of the road and railway piece. (Kuśmińska A., Łukasik Z. 2006)

3 ALGORITHMS OF THE REALIZATION PROCESSES IN THE TRANS-SHIPPING LAND TERMINAL

The influence also has efficiency of realization of processes such on effective functioning land terminal (Fig. 1) how:

- analysis offer ask;
- realization of orders;
- railway- road service;
- road-railway service.

The presented algorithm of functioning land terminal (Fig. 5) will make possible to improve processes drawing ahead in the land terminal, how also the chain of intermodal transportation.

Analysis Offer asks (Fig. 6) this the first socket with the customer the party is whose aim as the largest number of orders, the question offer from the customer is delivered in the written mould on the terminal. Directed to the Trade Aggregate the aim of preparing the offer becomes after executing the registration, the party is the priority obviously as the largest number of orders. The Trade Aggregate should check in first order, if he is in the state match the customer during realization to requirements the order, if you should so execute all steps havings on the aim of the receipt of given to the correct calculation costs and prepare the offer. Then after checking and identify, that the offer was prepared well sent to the customer (fax, e-mail) becomes. After dispatch offers, responsible worker for the correct process of offering the services, he contacts with the customer the aim of making sure, what to the regularity of conditions and execution of the interview, what to possible her party. In the case of the settlement of the incompatibility of the conditions of offer from the customer expectation the worker after the consultation with superior makes the corrections of the offer. However, while the introduced offer becomes accepted by the customer the next stage of the process is realized - **the realization of order** (Fig. 7).

The realization of the order which the realization of services is the main aim: railway - road, road- railway in as the shortest time (Fig. 7) the order of the realization of the service is delivering to trans-shipping terminal in the written mould (fax, e-mail). The realization of the order follows after executing the analysis of the agreement of working plan and the identification of the realization of the service. While executing the order the opinion of the regularity of the realization is made. Responsible aggregate for the realization of the order represents the conclusion to the management terminal in the case of incompatibility from the customer expectation. When the customer undertakes reclamation

workings begun then becomes the peaceable conduct with the internal instruction.

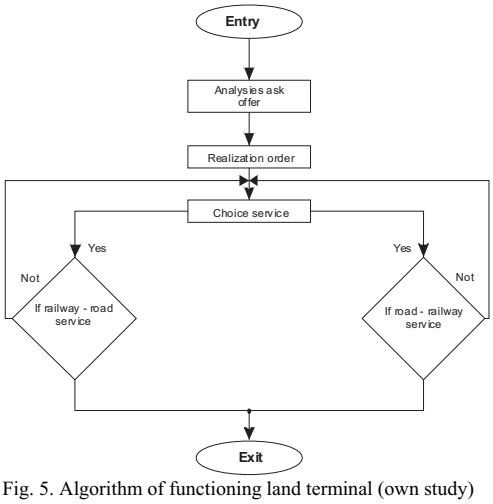

Fig. 5. Algorithm of functioning land terminal (own study)

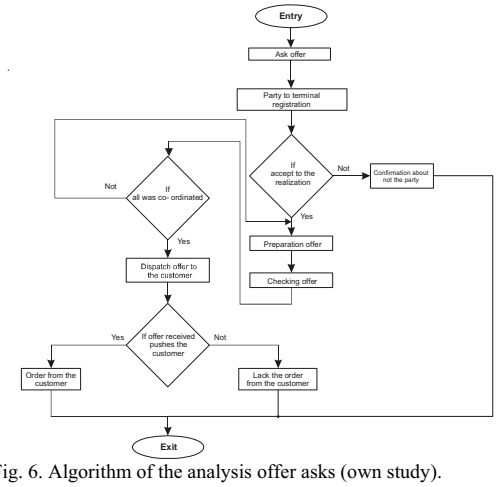

Fig. 6. Algorithm of the analysis offer asks (own study).

During the realization of the order you should haul the kind of the realization of the service:

– railway - road,
– road - railway.

The main aim of the service is the transport of intermodal individuals on near the minimization of the standstill of individuals on the terminal customer order **railway - road** (Fig. 8). While individuals on wagons are on the trans-shipping track he follows identification, agreements with the transports letter (working plan) (technology RFID). The dispatcher prepares them to the landing after affirming agreement and the party of documents (letter transporting-identifying individuals). Individuals subjected the direct trans-shipment become unblocked on wagons.

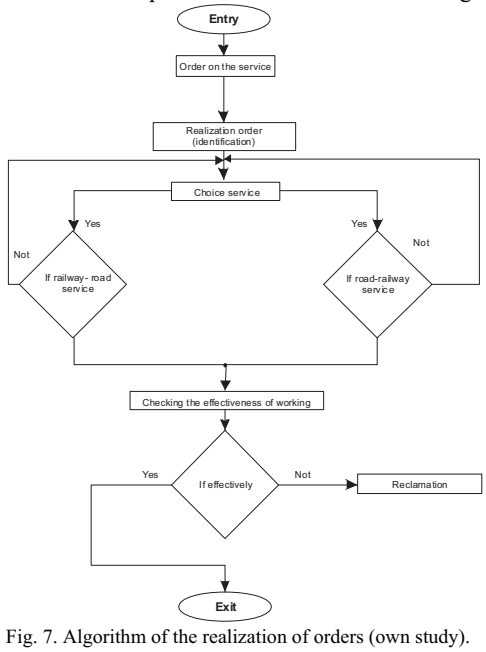

Fig. 7. Algorithm of the realization of orders (own study).

The choice of the technology of the trans-shipment follows in dependence from: the condition of the individual: or vain, if capacious, the type: container 20', replaceable body etc. and also her technical state. He next is considered the decision, which to use the device during the trans-shipment, if the gantry, if the jacks cart, and to accelerate two simultaneously maybe trans-shipping works. Already possessing information the operator of the device places them if the given individual is subjected the direct trans-shipment on the fix to the trans-shipment after executing the choice i.e. he can be charged on the waiting on her wagon or on the road vehicle. He follows the identification of wagon or road vehicle and direct trans-shipment, the protection of the individual and documentary evidence the realization of the service.

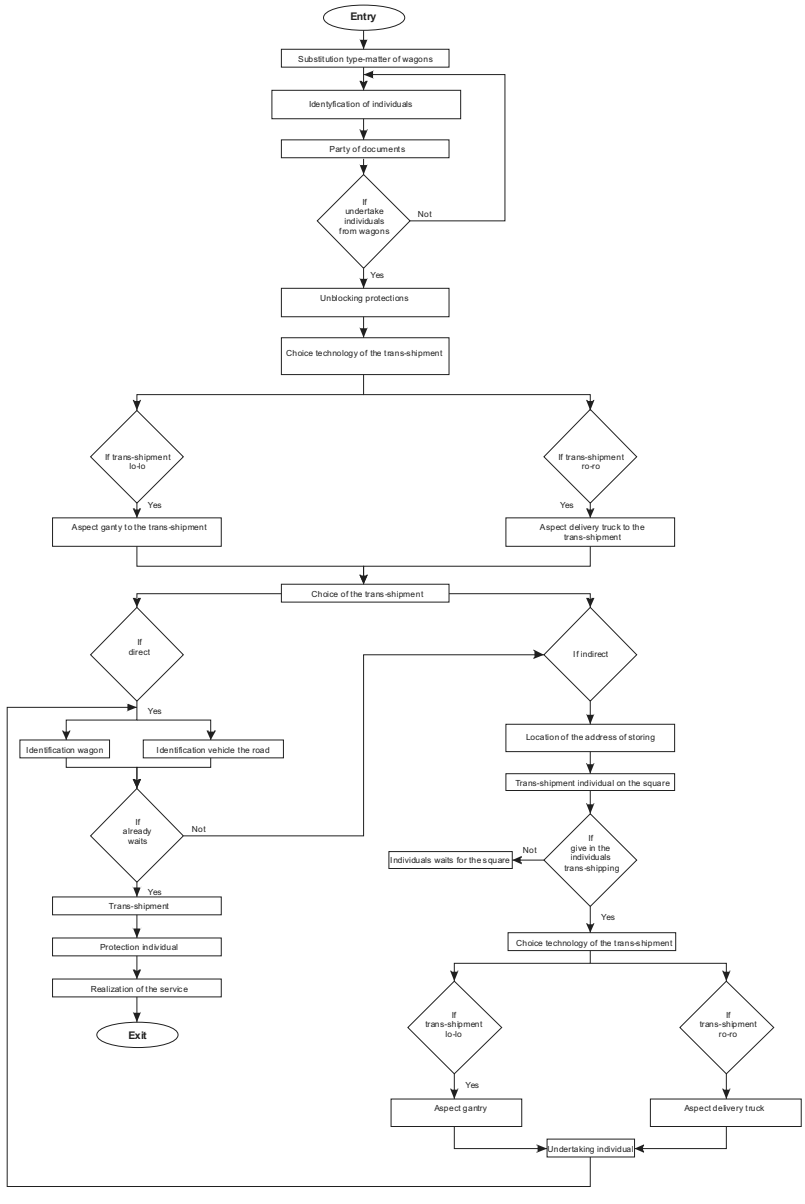

Fig. 8. Railway-road (own study).

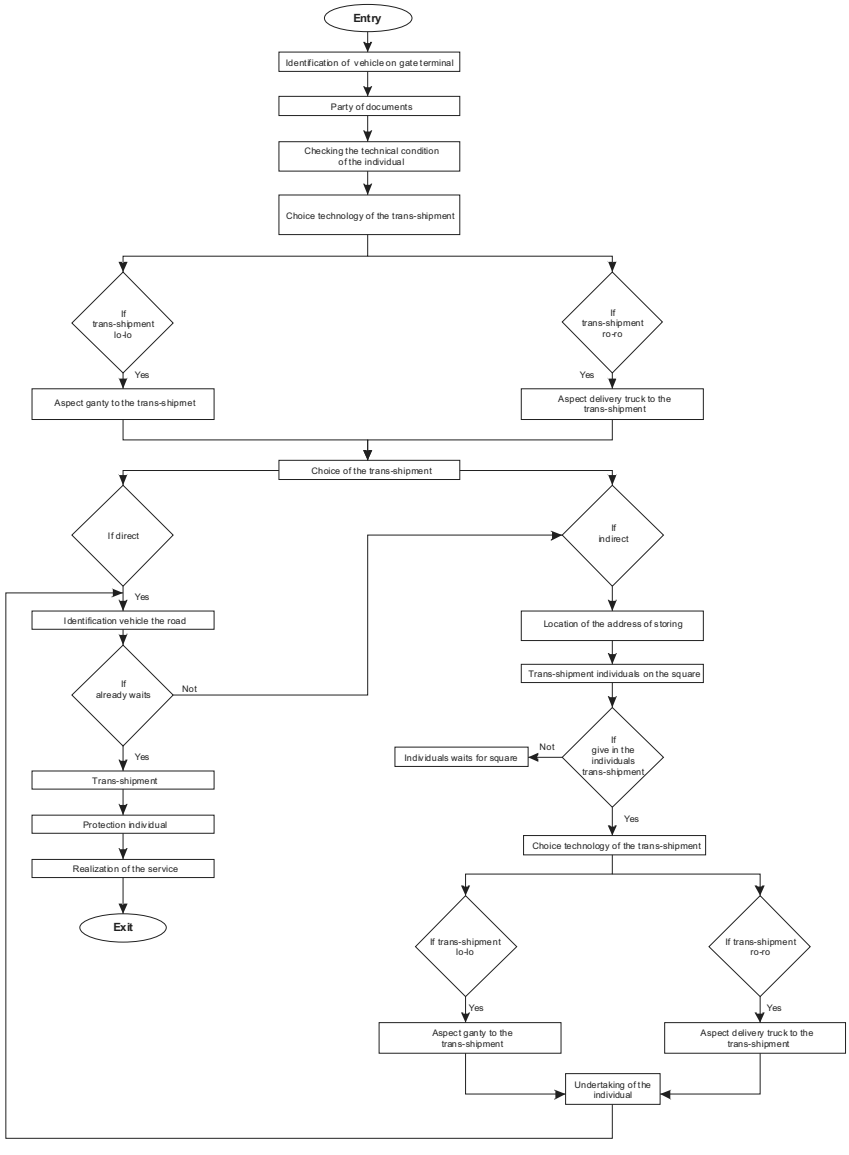

Fig. 9. Road - railway (own study).

In the case, when road vehicles did not arrive on the time of the individual subjected the indirect trans-shipment find, and now the operator of the trans-shipping device before he will undertake the individual from the wagon he knows her exact location on the component square. Trans-shipping works begin then and putting individual in sectors on the component square. When the delayed road vehicle arrives on the land terminal after given individual her identification (technology RFID) follows on the square then, the choice of the technology of the trans-shipment, trans-shipment, the protection of individual on the semitrailer of the road vehicle and last stage documentary evidence the realization of the service. The land terminal leaves after executing all actions individual.

The algorithm of **the road-railway service** the realization of the operation of the efficient trans-shipment whose aim minimalizing the time is also spent individuals on the land terminal was introduced on (Fig. 9) While the individuals arrive on the land terminal the road vehicle on the gate subjected the identification, the type of individual, protection, technical state become, received documents become

then and the decisions are made on the basis of contained information, what to the choice of the technology of the trans-shipment (the trans-shipment lo-lo perpendicular, if horizontal ro-ro like simultaneously lo-lo, ro-ro the aim of acceleration of the works of trans-shipping). The operator prepares them to the trans-shipment after the choice of the device. In the case, when he undertakes the individual from the semitrailer of the road vehicle he possesses information, if the given individual is subjected trans-shipping direct, if indirect. The operations of the direct trans-shipment are the priority. After identification the wagon on, which the individual has to settle the operations of the trans-shipment begin protection her and documentary evidence the realization of the service then. In the case of the indirect trans-shipment the operator before he will undertake the individual from the semitrailer of the road vehicle he knows exact location and the sector of assembly her on the square (RFID) because the wagons are not prepared to the trans-shipment yet. When wagons be prepared, one can begin the works loading of the individuals which are subjected identification on the square terminal (RFID). The next stage is the choice of the technology of the trans-shipment and undertaking of the individual from square and placing her on the wagon after identification individual. When all individuals are already on wagons moulding the string of cars safe become, in the documents of the realization of the service are prepared between the time. The type - matter of wagons with individuals (conferment) leaves the land terminal after executing all formalities.

4 CONCLUSIONS

The integration of forwarding processes, he requires the development of international systems joint in one net about the large possibilities of the flow of the freight pulp. One talks about the intermodal transportation which unites railway transports with road and sea near one figure of the cargo behaviour more and more often. Support of the development of terminals in the chains of intermodal transportation, the limitation of the transports of goods will let suppose the road transportation which guides not only to decay of the road infrastructure but enlargement of the release of exhaust gas also causes what he guides to the degradation of the natural environment in the consequence. Strong exists so one need the set - back of the tendency to growing utilization of car transportation on the thing of intermodal transportation.

One notes down on the Polish forwarding market of the hesitation of the pace of the growth since several years and the lack of the uniform and dynamic development of transports intermodal. He is the result of this the worsening quality of railway services, the growth of the time of the service of intermodal individuals on terminals (among others problems with identification individuals on the component square), the deepening price uncompetitive of railway transportation in the relation to car transportation and the lack of the complex and effective instruments of the forwarding politics of the state, supporting the intermodal transportation. According to the expectations of the growth of intermodal transportation in the Poland, the terminals have to be prepared on the party of the larger number of inflowing streams individuals. (Kuśmińska A., Łukasik Z. 2005) many of Polish land terminals the present moment stays trans-shipping terminals from the name exclusively. Land terminals functioning on the terrain of our country in the future matched charged tasks should also improve the system the processing and the circulation the information, which together with the system of steering the stream individuals, he was presented in the figure of algorithms and which he will improve the processes in the land terminal.

LITERATURE

Kuśmińska A., Łukasik Z.: „Models trans-shipping processes in the intermodal terminal" Technical University of Radom, „LogiTrans", Szczyrk 2005

Kuśmińska A., Łukasik Z.: „Models the processes of the flow JTI in the land terminal", „IntLog" Stockholm 2006.

Łukasik Z., Kuśmińska A., Matejek T- (stage II),: „ Intermodal transportation in the processes of the flow of cargos" the stage II, III, Technical University of Radom 2006-2007

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2. Maritime Transport Single Windows: Issues and Prospects

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ABSTRACT: In the trade, transport and shipping sector, the Single Window (SW) concept has been evolved over time in a number of forms, reflecting respective policy, regulatory, market and technological regimes of the domain. A SW primarily addresses the need for efficient electronic transactions between governmental and business entities; however the SW service model adopted by the responsible authority and the offered SW system functionality differ; currently at least two distinct approaches are observed, namely a customs-centric SW approach, and a maritime and port centric approach. In all respective cases, the SW service model, the SW ownership model (public, private or Private-Public-Partnership), legal and regulatory aspects and the SW revenue model (free or with a fee) consist pertinent SW service design issues. Thus, different types of SW systems evolve in terms of offered service bundle, namely ship clearance, cargo import/export, or port clearance SWs, where often vested interests and policy choices dictate the dominance of one model implementation over the other. Modern ICT tools may significantly help to organize and improve the efficiency of a SW design and implementation process. In this paper, admissible development frameworks and methodologies are examined towards the efficient implementation of SW service models that are explained. Our analysis is based on experiences gained in the Norwegian SW national initiative (http://www.sintef.no/Projectweb/MIS/) and the EU eFreight project (http://www.efreightproject.eu/).

1 INTRODUCTION

The one stop shop business model has been exhaustively researched and applied in the context of e-business and e-government service provision over the last decade (Wimmer, 2002; Lambrou et al., 2008). In a similar vein, in the trade, transport and shipping sector, the "Single Window" (SW) concept was formalized by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT 2005) to enhance the efficient exchange of information between trade and government agencies. The Single Window concept has its origin in the Trade Facilitation and Customs field focusing upon efficient import and export institutions and mechanisms, where declarations of goods related to regulatory information must be reported in cross border activities.

A SW primarily addresses the need for efficient and collaborative electronic transactions between governmental and business entities; however the co-coordinating SW authority and the core functionality may differ, thus we typically observe a customs-centric, import and export oriented approach, a port and ship oriented (maritime focus), and a safety and security centric approach. In both cases pertinent SW service design aspects include the SW ownership model (public, private or public-private partnership - PPP), and the SW cost model (e.g., free use, membership or transaction fee). The organizational level of the SW competent authority, e.g., international, national, regional, or local is an important differentiating factor, as well. Often, vested interests and policy choices dictate the dominance of one model implementation over the other.

In this paper we discuss different types of single window systems and enabling development methodologies and platforms, focusing in particular on a maritime centric model where ship clearance, cargo import/export, and port clearance services are supported. This means that we extend the Single Window Concept to conver not only regulatory information, but also other information related to maritime transport.

2 A TAXONOMY OF SINGLE WINDOW SYSTEMS

There are different reference models of existing and emerging SW systems supporting intermodal

transport activities, as explained in Table 1. A SW system can cover the cargo reporting activities where import and export declarations are the main processes supported, another SW model is organized around ship or vessel clearance activities offered by national governments, whereas a third model is a port clearance oriented SW. The purpose of a ship oriented SW is to support all mandatory information reporting concerning a ship sailing from abroad to a EU or associated country, as based on the SafeSeaNet (SSN) system notifications and formalities.

All countries in EU and Associated countries are connected or will soon be connected to the central SSN system. Every country has to dedicate an internal authority as a National Competent Authority that will be the official connection between the country and the central SSN system that is under the responsibility of the European Maritime Safety Agency, EMSA.

A Port Single Window (PSW) can in many cases be defined as a Port Community System (PCS). It is a community system which based on an integrated series of procedures, rules, standards and ICT solutions supports the automatic exchange of data and documents related to the port authorities' clearance of ships and cargo upon arrival, stay and departure of vessels.

A PSW is primarily supporting the requirements of governmental agencies, but also the requirements of the cargo parties' interests. So a PSW covers Customs requirements and document handling, and the information exchange dealing with the necessary services in a port and the handling of ship and cargo. It is also likely that a PSW will have a stronger focus upon private information and more commercial oriented regarding sale and ordering of port services than the one for ship clearance.

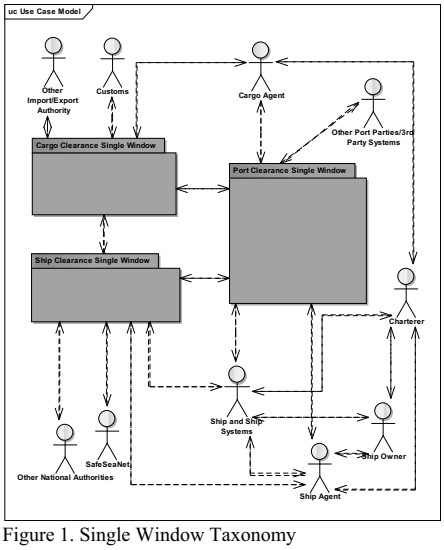

Figure 1. Single Window Taxonomy

EPC (Electronic Port Clearance) is the concept used to refer to vessels visiting a port and their electronically (without the use of paper documents) dealing with all formalities, documentary requirements and procedures associated with the arrival, stay and departure of ships engaged on international voyages. On the one hand, EPC aims to replace the paper documents such as the FAL Forms currently in use; on the other hand EPC tries to make the exchange of information more efficient, through the rationalization of the procedures and simplifying the related data. Figure 1 gives an overview of the three dimensions of Single Window systems and how each of them relates to each of the actors. Note that the actors *Ship Owner* and *Charterer* only interacts with the Single Window through other systems, not as separate actors. The actor *Other Port Parties/ 3rd Party Systems* includes parties involved in the port business other than the port authorities, for instance systems to handle resource bookings.

Table 1. Types of Single Window

Single Window for cargo	
Description	A SW for customs clearance normally contains information about cargo for either import or export.
Users	The users are Consignor's and Consignee's, the Customs, as well as cargo agents
Characteristics	The goods to be defined for import and export will need a release number before the transport can progress from an import area at a terminal. A main functionality for this SW is the cargo clearance process.
Objects	Cargo information and definition, Ownership, The itinerary of the goods, Handling instructions, General statusinformation about the cargo
Functionality	Registers: Goods group, Location register, Tax code Automation: XML and Web-based user interface Accessibility control Hand-over mechanism with other SW-solutions

Single Window for ship clearance	
Description	A SW for Ship clearance contains information about the ship, the voyage, the cargo, the passengers, the crew and information that is required by the SafeSeaNet directive.
Users	The users are the ship it self, agents, the providers on the ship, or the governmental bodies that need statuses and information for controlling duties, for mainly safety/security purposes. Governmental bodies can be Police, Coast Guard, Navy, Coastal Administration, Health authorities, or the ports.
Characteristics	The main purpose of such a SW is to have a good overview of the safety and security issues regarding sea transport. It could be either a site where information about a ship transport could be achieved in a distressed situation, or it could be more used in a controlling purpose where i.e. the crew and passenger list is matched with the list of criminals by the Police authorities. A main functionality for this SW is the ship clearance process.
Objects	Ship information, Cargo information, Crew and Passenger information (also effects), voyage information. Notification messages (hazmat, security, alert, ship) between the different states should also be considered
Functionality	Registers: Goods group, Vessel, Location Automation: XML and Web-based user interface (both ways) Acceptance report/Clearance notification (automatic) Use of sensor data for report purpose Ordering of transport services such as pilot age services Hand-over mechanism with other SW-solutions as well as commercial systems from service providers

Single Window for port clearance	
Description	A SW for port clearance is a reporting site for needed information regarding an entrance to a port. The information could also be about information classified as private, and used within a commercial aspect.
Users	The ship, the ship operators, the agents, the port management, the port service providers
Characteristics	This SW is used to achieve a port clearance of a ship. The information is both of a private and a public character. The ports are using the information to plan the ship entrance, to achieve the port safety and security regulations, and to calculate the fees to be sent to the users. A main functionality for this SW is the port clearance process.
Objects	Ship, Cargo, Load units, Service needs, Security information
Functionality	Registers: Goods group, Vessel, Location, Port services. XML and Web-based user interface (both ways). Acceptance report/Clearance notification (automatic), Use of sensor data for report purpose, Safety and security, Ordering of port services, Accessibility control, Hand-over mechanism/communication mechanisms with other SW-solutions as well as commercial systems from service providers, Statistics, General port information, Site for laws and regulations.

One of the challenges in the specification of SW system is to decide the dimensions and geographical areas the SW system should cover.

Examples of such dimensions are:

- International dimension
- National dimension
- Regional dimension
- Local dimension

Another dimension could be an Ad-hoc solution.

For all those dimensions there are different needs and a different legal basis to follow that also differs within one dimension. An example can be that within a port, which is defined as a local dimension solution, there are some port specific regulations to follow regarding mandatory reporting and the configuration of the SW must therefore follow the properties defined at the port where also the private-public partnership relations must be placed, Figure 2. This means that a Single Window system for one port may differ in several respects to a Single Window system in an adjacent port.

It is likely that the different systems that represent the different solutions must exchange information with each other. A ship normally crossing the defined dimensions where coming from an abroad country and visiting a port, is mirroring the process when returning to an abroad port. In such a case, the ship must first follow the local dimension from departure port, where regulations and other procedures are followed (reporting time, place, etc). Then, in some cases, new reporting and procedures must be followed when sailing in a certain region such as a fjord or vulnerable regional areas. Then, when the ship is leaving the national waters, information must be reported to the NCA (National Coastal Authorities) or the Coast Guard of the departure nationality, and finally follows international conventions in open international waters. The same approach will be relevant when sailing into the arriving port.

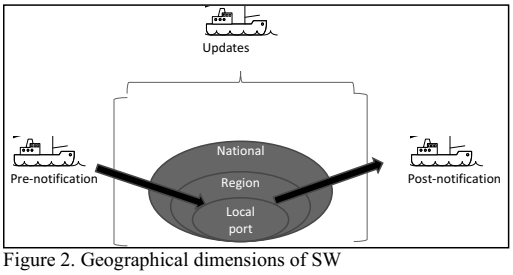

Figure 2. Geographical dimensions of SW

3 DEVELOPMENT METHODOLOGIES FOR SINGLE WINDOW SYSTEMS

Several methodologies relevant for the development of Single Window systems can be exploited. A number of available methodologies focus on the analysis and design phase using various process modeling techniques, while other methodologies are related to the technical implementation of a SW system (e.g. SoaML).

3.1 *Zachman Framework*

The Zachman framework (Zachman, 1997) was first presented in 1987 and has since then evolved in several directions and several versions. For maritime Single Window development, it is most relevant to view it as a taxonomy for organizing architectural artifacts, design documents, specifications and models. The framework addresses the question of who is the target for the description and also what is described, for instance data and functionality. In this sense, the Zachman Framework is not a methodology since it lacks methods and processes for collecting the information, and also for managing or using the information. Rather, Zachman describes the framework for enterprise architecture as follows: *"The Framework as it applies to Enterprises is simply a logical structure for classifying and organizing the descriptive representations of an Enterprise that are significant to the management of the Enterprise as well as to the development of the Enterprise's systems."* A key point in the Zachman framework is that the same complex item can be described for different purposes in different ways using different types of descriptions.

The framework has 36 categories for completely describing anything related to the enterprise, organized with six columns and six rows. Each row represents a total, distinct and unique view of the solution from a particular perspective. Each column represents a category of the enterprise architecture component, called focus. These are data description (what), function description (how), network description (where), people description (who), time description (when), and motivation description (why).

Some aspects of the Zachman framework that are convenient for analyzing SW systems include:

1 Analysis of several organizations that have to cooperate in an interoperable SW system:
A SW is an environment which has to support interoperability among highly heterogeneous environments. This means that a structured way to present the analysis of the organizations with different viewpoints is important. The Zachman Framework for systematically describing changes to an organization based on various viewpoints and various abstraction levels is very useful in the analysis phase of a SW development.

2 Clarification of different views of the same artifact:
The Zachman Framework focuses on different views of the same artifact (process, data), which is important in a SW system covering processes and data originating from various applications, both cargo, port, and ship clearance, but also orig-