Innovative Measures Ensuring Integrity of the Entire Supply Chain or Transport Corridor

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Abstract: The EWTC (East-West Transport Corridor) in the Southern part of the Baltic Sea Region includes more effective testing area of new business models for collaborative logistics flows. Since the EWTC is a corridor requiring transport mode interchanges due to crossing the Baltic Sea, development of intermodal transport solutions making different transport modes fully integrated along the corridor is a key issue for the EWTC. To meet an increased global transport demand, ports and intermodal terminals need to make sure that their facilities are prepared for growth. Thus, for ports in the EWTC it is important to offer the services necessary for handling the maritime freight services (container ships, RoRo ships, railway ferries) demanded by transporters and transport buyers. IT services are needed to support transportation activities along the corridor. This is especially important for the EWTC due to its physical nature, interchange points, multi-language and cross boarder interaction. Information on a constantly updated traffic situation and interchange status, tracking of goods, booking and confirmation services, intelligent truck parking and services opening faster border crossing routes would ensure more efficient transportation and handling thereof. It is expected that the outcomes of the recently completed eMAR project will help to develop a modern Klaipėda Seaport community system as well as effective management architecture along the EWTC based on the CSW (Corridor Single Window) approach.

Key words: Transport corridor, supply chain, global transport network, Corridor Single Window.

1. Introduction

It is evident that transport is impossible to fit into a single country's geographic framework. Transport is fundamentally international [2].

At the same time the challenges of globalization turned the transport system from sectoral towards multi-sectoral cooperation where production-communication (IT)-intermodal terminal-distribution centers are more and more integrated into one international transportation and distribution chain.

There is still a need for better interoperability between different infrastructures, standards and systems, as well as removal of physical and operational bottlenecks.

Research in this area is aimed at ensuring that shippers and service providers operating in the open

global networks are able to align and synchronize their operations in case of changes and deviations from plans [4].

A number of initiatives and projects have pursued similar objectives in the past, but within the boundaries of the single (closed type) supply chain or in a restricted part of the transportation network. The current challenge is to achieve the highest level of automated alignment in open networks, where many parties collaborate along the entire open type door-to-door chain.

In this context, the paper describes a conceptual model of the Corridor's Single Window architecture providing for the development and testing of the systems which enable the exchange of documents and information controlling the flow of goods along the EWTC (East-West Transport Corridor). This paper is based on the outcomes of the pilot study performed by the authors in the framework of the e-Maritime

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Strategic Framework and Simulation based Validation (eMAR) project (funded by the European Union).

The necessity to synchronize infrastructure development and support efficient and innovative intermodal transport services along the global transport networks requires new instruments for cooperation among the business, research and public institutions on international level. This is especially important for the EWTC in the BSR (Baltic Sea Region) and beyond it due to its physical nature, interchange points, multi-language and cross-border interaction. The EWTC has evolved as the backbone of the Pan-European transport corridor IXb (Klaipeda - Minsk - Kiev - Odessa) and recently links it with the Swedish, Danish and German seaports via the port of Klaipeda (Lithuania). It includes several trans-European network (TEN-T) ports, motorways of sea, road and railway links. Finally, following the "EWTC II" project (performed in the framework of the Baltic Sea Region Program 2007-2013) recommendations, the corridor development activity was expanded to Central Asia and Far East (including China) according to the green corridor concept.

One of the priority objectives of the study was to prepare the proposals on how to effectively build the port community by applying IT instruments, as well as to improve the interface between Klaipeda Seaport (as one of most important intermodal transport hubs of the EWTC) and hinterland. One of the main tasks was to analyze intercommunication systems of various services and institutions in order to reduce paper work and to prepare simplified virtual space cooperation documents that facilitate port - hinterland operations and instruments enhancing cooperation among the partners along the global EWTC corridor.

Methodological approach of the study is based on the information exchange oriented business process modeling, which was executed in three stages. The first stage included identification of the "AS IS" situation along the EWTC corridor providing an insight regarding spatial, functional and cargo oriented

information. The second - identification of the user requirements by combining a bottom-up and top-down approach, initially feeding the users with principles, concepts and innovative models of the study in order to subsequently extract their views, requirements and recommendations. Finally, based on the performed investigations, the "TO BE" situation is articulated together with the presentation of the innovative CSW (Corridor Single Window) architecture.

Vilnius Gediminas Technical University's (VGTU) pilot study on the EWTC corridor revealed that at present the SW (Single Window) model for the entire international transport corridor is not yet developed despite the fact that specific forms of SW, in particular PCS (Port Community System), MSW (Maritime Single Window) on national level are being successfully used (or proposed for use). However, linking these different SWs into an integrated international or inter-regional network is still an ambitious challenge. The implementation of the CSW model could enable: transferring all information via one standard communication channel without creating integrating interfaces for each separate information system along the EWTC; enhancement of the end-to-end supply chain security by ensuring integrity of the entire supply chain and prompt risk assessment through CSW as data sharing instrument between the authorities and commercial stakeholders in the EWTC, as well as facilitation of integration of long distance and last-mile transportation. The approach developed by the eMAR pilot study will be further analyzed in the following paragraphs.

2. Current Development Trends: Transition from Independent Supply Networks to Open-Type Transportation Networks

A key development predicted in the next decade is the transition from the current independent supply chains, where transport and logistics resources cannot be shared or accessed by different cargoes and shippers, and opening of global transportation

networks where resources are compatible, accessible and easily interconnected [4]. Research in this area is aimed at ensuring that shippers and service providers operating in the open global networks are able to align and synchronize their operations in case of changes in the plans. Keeping this in the mind, development of open type global transportation networks requires preparation and implementation of innovative models and processes (procedures, structures, instruments etc.) that increase the effectiveness of cooperation between the partners along the global networks. According to the authors of the paper, the following technologies and processes have to be developed in order to achieve the above-mentioned outputs:

- innovative models and processes managing open-type global transportation corridors and logistics networks;
- integration of fragmented and different transport/logistic ICT (along the transport corridor and the logistics network) aimed at forming a common open type information platform;
- integrated processes and technologies for long distance and last-mile carriage;
- innovative concepts and technologies for multimodal transport terminals and platforms.

It is in line with the objectives of this research—to get transportation and supply networks that are operated as a whole; meaning full vertical and

horizontal coordination and cooperation where new instruments and technologies are needed to maximize the resource utilization and manage events across the different stakeholders and systems [4]. Intermodal transport hubs (first of all seaports) along the global networks are important nucleation points for cooperation between different stakeholders. They concentrate impressive freight volumes and, therefore, big synergies could be found to increase operational efficiency [4]. In addition, seaports play an important role as gateways for trade with other regions of the world and within the internal market. Besides, seaports help to create an environment for cluster organizations with intensive flows of information and know-how fostering implementation of innovations in order to meet the current challenges. VGTU researchers have chosen the East-West corridor of the BSR (Baltic Sea region) as a testing area in order to form an open-type transportation network.

In Fig. 1, the EWTC is presented as one of the main transport corridors in the Southern Baltic Sea Region stretching from Esbjerg (Denmark) and Sassnitz (Germany) in the West to Vilnius (Lithuania) in the East. The Eastern part of the corridor is a gateway to and from the Baltic Sea Region connecting it with Russia, Kazakhstan and China to the East, as well as with Belarus, Ukraine and Turkey to the South-East.

Fig. 1 East-West transport corridor in the Southern Baltics area. Source: EWTCII, 2012.

The EWTC is also one of the key links between Sweden and Denmark with Lithuania delivering freight by maritime transport. Future perspectives of the Corridor are first of all related to the increasing container transportation flows along Asia-Europe transport links.

The Global Study [6] on trade and transportation in the EWTC which was aimed to map the current trade and transportation flows in the Corridor and predict its future potential revealed that market share of the EWTC in global (Asia-Europe) perspective was estimated to 2.3 percent (from 552 bill. Euros) of trade between the countries in Asia and Europe in 2010. According to the forecasts made in this study the market share of this Corridor in serving the Asia-Europe trade flows will double by 2030.

The number of vehicle-kilometers undertaken by trucks crossing the country borders within the Baltic Sea region is estimated to increase by 73 percent between 2010 and 2030. The increase is in the region of 20 million vehicle kilometers per day in the BSR and is most notable in Poland, Northern part of Germany and Sweden. The international rail freight transport is estimated to increase by 43 percent between 2010 and 2030 in the BSR [6]. The most significant growth is predicted in Poland, Germany, Lithuania and Sweden. Besides, in the maritime sector a growth of 140 percent between 2010 and 2030 is anticipated. Klaipeda Seaport is an important gateway for the Baltic Sea Region transport network linking the Western and Eastern part of the BSR and extending further to the East and South East. Several routes lead freight volumes to the Corridor via Vilnius and further to Klaipeda. In response to the changing trends in global goods flows, companies operating within the EWTC and the concerned states respond to the market changes and seek to adjust their operations and infrastructure capacities in order to meet market needs.

Altogether, the EWTC is a challenging case to test innovative tools and management models

accommodating the goals of seamless freight flows, harmonized operational indicators and interoperability across the borders of countries with different political and economic goals and settings (EU member states, EU neighboring and Asian countries). Besides, it is necessary to take into account the expectations of the end-users of the services to achieve the market integration along the corridor. The numerous parties involved in the corridor require coordination to develop the corridor and ensure that it works efficiently.

This led to the idea to establish the EWTC Association (in 2010) as a cooperation platform of commercial, academic and public organizations interested in promoting commercial opportunities and ensuring high quality of transportation and logistics services along the Corridor. Having a broad representation of stakeholders from 13 countries in Asia and Europe, the Association seeks to work out an optimum governance and management model for EWTC that allows integration of different business and policy approaches, as well as development of the joint corridor strategy. Since transport corridor is a sum of facilities supplied and offered through the partnership, a core parameter of the corridor management is the quality cooperation between the stakeholders and the ability to expand the activities [5]. It is also important to highlight the feedback of EWTC stakeholders. The main expectations and priorities of 18 respondents from 8 countries in Europe and Asia along the EWTC include:

- development of a monitoring system for KPIs (key performance indicators) by sharing performance data of logistics and freight transport services along the EWTC. It includes measurement methods and IT tools to support companies in collecting relevant data for auditing and reporting purposes;
- implementation of a co-modal transport information and management system increasing reliability and accessibility of intermodal freight transport solutions through One-Stop-Shop booking

reporting and payment services;

- enhancement of the end-to-end supply chain security by ensuring integrity of the entire transportation and supply network and prompt risk assessment through data sharing and Single window services for interaction between the authorities and commercial stakeholders in the EWTC.

3. Case Study: Interconnection of the EWTC Pilot Study with the eMAR Platform

Maritime transport accounting for over 90% of global trade in terms of volumes serves as a critical component in the supply chains (UNCTAD 2009) as shippers may require a single service provider to deliver a door-to-door service on time and at reasonable costs. This type of integrated demand for transport services motivates and urges maritime service providers such as ports and shipping companies to become more supply-chain oriented [7].

The recent European E-Maritime Initiative (see Fig.2) promotes the development of seaport portals enabling port users to access all the required services (Port, Customs, etc.) through just one identifier, a single window [8].

The seaport-hinterland interactions play an

increasing role in shaping supply chain solutions of shippers and logistics service providers. In terms of reliability of transport solutions, seaports and hinterland corridors take up a more important role in the supply chains [3].

The seaport may thus be viewed as integrated in a variety of networks which need to coordinate flows of merchandise, property rights, payments and information in the global supply chain [9].

Seaports hinterlands have become a key component for linking more efficiently and more elements of the supply chain, namely ensuring that the needs of consignees are strictly met by the suppliers in terms of costs, availability and timely freight distribution.

That is why it is important to ensure better information integration and exchange along the entire transportation corridor/supply chain.

In view of the above, the authors carried out the EWTC pilot study (as part of the eMAR project) which was aimed to investigate application-to-application integration across the EWTC and to propose the improved architecture of interoperability with administration and other IT networks serving the entire transport corridor/logistics chain.

Fig. 2 eMAR Platform. Source: eMAR project, 2013.

The pilot study was focused on a more effective exploitation of the existing technical capabilities of the Klaipėda Seaport community actors and services; and on the innovative solutions on how to better integrate port community actors and services with the hinterland actors and services along the corridor. The reason for this is that Klaipėda Seaport is one of the main intermodal transport hubs along the EWTC and plays the role of an important gateway for the transport network of the Baltic Sea Region.

The goal of the research executed by VGTU CCITL (Competence Centre for Intermodal Transport and Logistics) was to prepare proposals on how to effectively build the port community (on the basis of information technologies); improve the interface between the maritime transport and hinterland transport; and build port community by applying scientific instruments. One of the main tasks was to analyze intercommunication systems of various services and institutions in order to reduce paper work and prepare simplified standard virtual space cooperation documents and instruments facilitating port operations and contributing to the formation of a common new EU maritime transport policy.

Following the methodology of the study, the “AS IS” situation on the port community and composition of its hinterland was identified in the first place (it is reflected in Fig. 3).

The study also revealed that the main IT components connecting ship-port-hinterland chain are: KIPIS, LUVIS, KROVINYS and e.KROVINYS.

KIPIS is the basis of the Klaipėda seaport community IT system. The main functions of KIPIS are:

- provision of information required by customs and other state authorities via the Internet connection;
- data exchange amongst the system users to conduct procedures such as temporary storage of goods, import, export and transit, or any other customs formalities;
- electronic data exchange with the stevedoring companies for the purpose of placing and executing the orders for handling operations.

KIPIS system accelerates the exchange of data and information between various participants in the logistics chain, and provides the conditions to enhance the competitive capacity of the port of Klaipėda.

KIPIS also generates other reports and accounts needed for the Port Authority to make decisions related to the strategic port management.

LUVIS system is designed for the automated management of navigation processes of large and small ships and for accounting of port duties. This system will also be beneficial to information systems of data of other institutions and to rendering e-services under a “single window” principle. It will also provide

Fig. 3 Necessary development interrelations in the ship-port-hinterland system.

Fig. 4 KIPIS data flow. Source: Klaipeda State Seaport Authority, 2012.

for separation of the real-time management of the navigation processes from process accounting functions; development and implementation of e-services ensuring effective communication of port services and ship agents, owners/freighters and skippers; and elimination of “traditional” information exchange methods.

The main functions of IT KROVINYS (Railway Information System) include:

- preparation/management of freight documentation;
- preparation/management of documents on the provided additional services;
- management and accounts of journals and the accompanying documents;
- tax calculation for services provided by JSC “Lithuanian Railways”;
- invoicing;
- customs procedures and preparation of pre-arrival customs declarations;
- preparation and coordination of international and local freight carriage applications.

In order to optimize the process of freight transportation by railway and maritime transport through the development of the integrated freight transportation electronic services, currently preparations of a new project e.KROVINYS have

commenced (e.Freight).

During the performance of the EWTC pilot study the requirements and expectations of the users and main stakeholders (supervising public authorities, port community actors, IT companies and road/railway carriers) were identified and assessed carefully. Their expectations concerning the common IT system along the EWTC are reflected in Fig. 5.

Finally, based on the performed research, the stage “TO BE” focused on presentation of the innovative architecture of the CSW (Corridor Single Window). The authors’ proposed eMAR connectivity architecture (CSW of EWTC) facilitates interfacing of different Maritime services with the hinterland (see Fig. 6).

The Corridor’s Single Window is a facility that allows transport corridor parties involved in trade and transport along the corridor to exchange by SWs standardized information and documents with a single entry point to fulfill all import, export, and transit-related regulatory requirements. Implementation of this integrated IT architecture aims to increase collaboration of maritime stakeholders (both private and public) with different sectors and transport modes along the global EWTC.

Implementation of CSW provides an opportunity to reduce time, costs and complexity in preparing and submitting the data for exports and imports.

Fig. 5 Respondents' expectations with respect to the common IT system along the EWTC.

Fig. 6 Corridor Single Window (CSW) architecture.

It must be underlined that EWTC pilot case results, including the CSW model (architecture) proposed by VGTU, have been successfully presented at the International Maritime, Transport and Logistics Conferences in St. Petersburg (Russian Federation),

Dalian (China), Riga (Latvia), Brussels (Belgium), Kaunas, and Vilnius (Lithuania).

Preparation of a roadmap aimed to linking the existing SWs (in the countries along the international corridors) into the CSW could be the next step in

implementing the model of VGTU. In view of this, it is necessary to further develop the international collaboration in the area of preparation of common interconnectivity strategies, data harmonization and standards.

4. Conclusions

IT (Information technology) plays a strategic role supporting the transport corridor management and networking.

The architecture of the CSW (Corridor's Single Window) presented in this paper facilitates interfacing of different Maritime services with hinterland. Implementation of this integrated IT architecture aims to increase collaboration of maritime stakeholders (both private and public) with different sectors and transport modes along the global transport corridor/supply chain.

Preparation of the roadmap aimed at linking the existing Single Windows (in the countries along the international corridors) into the CSW could be the next step in promoting and implementing an innovative solution.

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References

- [1] Bisogno, M., Nota, G., Saccomanno, A., and Tommasetti, A. 2015. "Improving the Efficiency of Port Community Systems through Integrated Information Flows of Logistic Processes." *The International Journal of Digital Accounting Research* 15: 1-31.
- [2] Commission of the European Communities. 2001. "European transport policy for 2010: time to decide." *White Paper*. Brussels, 124.
- [3] PEMAR. 2013. E-Maritime Strategic Framework and Simulation based Validation project: D3.2 Transport Logistics e-Maritime Solutions, 172.
- [4] European Technology Platform for Logistics, Global Supply Network Coordination and Collaboration research & innovation roadmap, 2014, 32.
- [5] FINAL REPORT BSR TransGovernance project. Applying multi-level governance in transport planning and management in the Baltic Sea Region.
- [6] Global study on trade and transports in the East-West Transport Corridor" performed by SWECO 2012 SWECO. 2012.
- [7] Lam, J. S. L., and Zhang, L. 2014. "Enhanced Logistics Service Provider Framework for Higher Integration and Efficiency in Maritime Logistics." *International Journal of Logistics Research and Applications: A Leading Journal of Supply Chain Management* (17): 89-113.
- [8] Baron, M. L., and Mathieu, H. 2013. "PCS Interoperability in Europe: A Market for PCS Operators?" *The International Journal of Logistics Management* (24): 117-29.
- [9] Bagchi, P. K., and Paik, S. K. 2001. "The Role of Public-Private Partnership in Port Information Systems Development." *International Journal of Public Sector Management* (6): 482-99.