

# FEASIBILITY STUDY FOR THE IMPLEMENTATION OF EDI SYSTEMS FOR INFORMATION EXCHANGE BETWEEN BULGARIAN BLACK SEA PORTS AND ECONOMIC OPERATORS

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**Abstract:** *The present article analyses the feasibility for design and implementation of Electronic Data Interchange (EDI) systems for documentary exchange between Bulgarian Black sea ports and economic operators. The concept of the Port Community System (PCS) is analysed as a necessary information exchange framework for implementation of EDI systems. The main economic operators are identified and their interactions within the port community system are formalised. A methodology for implementation of EDI system has been developed along with the main information flows. The benefits of EDI implementation are outlined as means for increasing ports competitiveness.*

**Keywords:** MARITIME PORTS, PORT COMMUNITY SYSTEM, ELECTRONIC DATA INTERCHANGE, EDIFACT

## 1. Introduction

The quality of port operations and port logistics management is directly related to the quality and timeliness of information exchange between economic operators and port management. The integration of information exchange within the entire logistic chain of maritime transportation ensures for higher level of reliability and efficiency. Electronic Data Interchange systems provide for enhanced conditions not only for cargo handling but also for efficient exchange of resources flows. Innovations in development of information exchange systems between economic operators and maritime ports ensures for increase of ports' competitiveness. Therefore, the application and integration of EDI systems is considered as a vital prerequisite for advancement of both internal and external business processes via design of systems for information exchange between ports and economic operators as clients of port services.

One of the long-term objectives is to create an efficiently functioning and fully operational paperless environment for administration of services. The main benefits of the EDI system implementation for information exchange between ports and economic operators are as follows: accurate exchange of communication between all participants within the port community; receipt of detailed information regarding location of cargoes/containers; efficient exchange of shipping-related documents; better inventory management and productivity of port operations; increased level of security for all stakeholders; enhanced business processes' flows and performance. The latter can be accomplished by simplifying administrative procedures, for establishment of competitive business networks, and supporting improved efficiency of shipping services [3].

The present article analyses the feasibility for designing and implementing Electronic Data Interchange (EDI) systems for documentary exchange between Bulgarian Black sea ports and economic operators. The concept of the Port Community System (PCS) is analysed as a necessary information exchange framework for implementation of EDI systems. Specific to ports, port community systems (PCS), a computerized system within the port environment linking all the players of the transport chain, rely heavily on ICT [1]. The main economic operators are identified and their interactions within the port community system are formalised. A methodology has been developed for the mainframe architecture of the EDI system along with the main information flows. The potential benefits of EDI implementation are outlined as means for increasing ports competitiveness.

## 3. Application of EDI systems in port management and operations

The application of EDI systems for information exchange between ports and economic operators will enhance port efficiency and increase the market outreach of ports thus contributing to the development of local economies. Economic operators, on the other hand, also consider the design and implementation of EDI systems for information exchange as necessary and compliant with EU and international regulations and recommendations. Such systems are generally perceived as trade facilitators: considerable decrease of costs and time needed for procedures related to cargo handling and vessel movements; higher level of integration of PCS and EDI; use of database for efficient decision making. PCS can be considered as a part of basic infrastructure provided by the port [2]. As for the ports the direct benefits are related to: optimized procedures, decreased port congestion (gate management), better operational planning, decreased time for cargo and vessel clearance, optimal utilization of port infrastructure, development of e-services and single windows as means for increasing customer satisfaction. It is worth noting that EDI is applicable, in general, to every port (port community) regardless of port size and market outreach as the effects on vessel traffic management, gate management, cargo and vessels procedures are beneficial for all the members of the port community.

There are several elements of the PCS that contribute to the efficient functioning of EDI systems for information exchange between ports and economic operators. These include the efficiently managed vessel traffic system which ensures for higher turnaround of vessel in ports, higher berth occupancy and overall increased port productivity. Higher productivity of ports can be achieved via automation of berth planning, gate control, cargo handling and customs control. Furthermore, as the connections between the ports and the hinterland are the major bottlenecks, the application of EDI systems can create benefits for reduction of vehicles waiting time to and from the ports. The main purpose of EDI implementation is to ensure for paperless documents and information exchange between various community members and to/from external operators. Figure 1 presents the various types of relations between ports and economic operators. The port authorities have the central role in the design and implementation of the EDI system by arranging for the conceptual model, technical means and architecture for information transmission, messages processing and distribution towards all participants, including economic operators. The main functions and processes of the centralized system can be summarized as follows: port authorities design and implement the EDI system; the entire information related to vessels, cargoes and transfer operations are

handled by a unique database for transmission and reception of information among all participants.

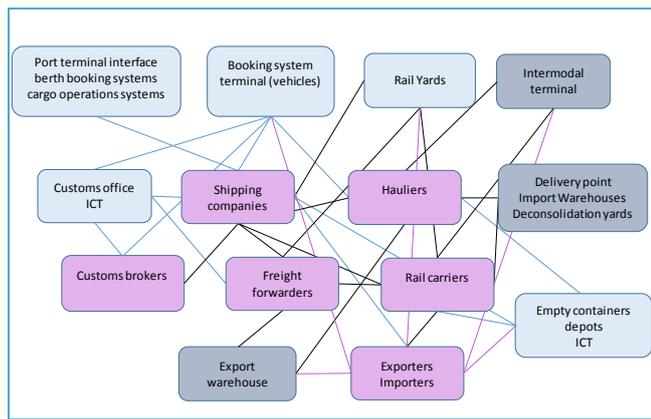


Figure 1. Information flows between ports and economic operators

A modern, automated customs administration brings substantial cost savings in trade and transport logistics [5]. In this way a common database is created for all stakeholders for efficient transfer of information. It should be noted that considerable investment is required for the creation of the information exchange infrastructure, software development and technical means. Figure 2 presents the main stakeholders, including economic operators, of a centralized system for information exchange.

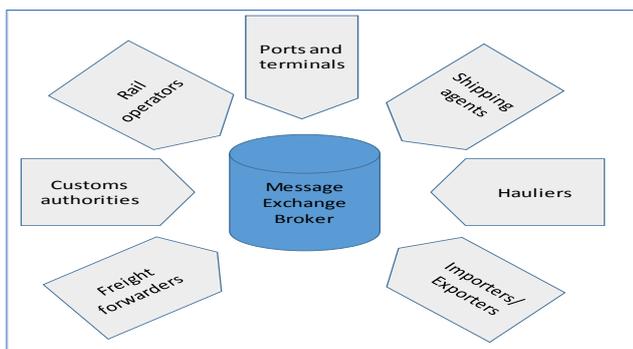


Figure 2. Centralized system for electronic data interchange

The message exchange broker is the central unit in this type of EDI system providing technical capacity, database maintenance and distribution of information. One message exchange broker is required to serve the whole port community and all its members, enabling them to deal with local and foreign trading partners through a unified software module, standard and user interface [4]. Within such a structure each stakeholder operates its own information system and the messages are transferred via email to the message broker. The messages are standardized according to the United Nations Directories for Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT). In this way the message broker acts as a cluster of incoming messages and distribution point for outgoing messages. The message exchange broker serves as a central communication point for handling of incoming and outgoing messages through a mailbox entity. Generally, it uses the approved communication protocols and platforms for international and national connections via internet. There is also an extensive backup of the system to ensure for high standard of information security. The operational structure of the message manager is implemented by financing from all members of the port community (or by the government) and administered either by a newly established company or by a state-owned entity. Many of the contemporary EDI communities are based on a system with central message exchange broker, having started with a few EDI services only that have gradually expanded. It should be noted that EDI system structuring and implementation is often made at a centralized level depending on the type and scale of the port community system and the number of economic operators interacting with the ports. EDI and message exchange broker

systems are typical for port communities where a certain extent of automation already exists for individual participants. The existing EDI community systems usually ensure for provision of various services as concerns economic operators, i. e. related to cargo, vessels and documentation information flows.

### 3. EDI system for information exchange between Bulgarian Black sea port and economic operators

Based on the EU “Operational Program on Transport 2007-2013” and as pursuant to EU Directive 2010/65/EC, a new organizational and technological structure has been established in Bulgaria: National Centre for Electronic Exchange of Documents in Maritime Transport (NCEEDMT) functioning as a Maritime Single Window (MSW) [6]. The operational functionalities of NCEEDMT allow for single electronic input of data whereas competent authorities receive the required information automatically which considerably reduces the time for documentary exchange. NCEEDMT has two structural entities: Bourgas Information Center and Varna Information Centre that coordinate the activities in the port terminals in Bourgas and Varna respectively. As of December 2015, the Bulgarian Port Infrastructure Company introduced a pilot project “Mover” as an extension of the already developed MSW. The objectives of the pilot project include: improvement of the technology of movement of vessels in the ports, improvement of the safety and quality, facilitation of the business. The pilot project involves the following stakeholders: VTMS authorities, pilot stations, port terminals, tug companies, state authorities (customs, immigration, economic operators). Common interface is used for access to data and traffic planning is made by the VTMS control bodies whereas automatic messages are sent to the users for each re-planning. The model consists of a database, a business layer, validation module, service layer. Data elements cover several classes: initial data, secondary data and reference data. The expected results are related to achieving more efficient traffic planning, facilitation of the planning process, reduction of ships’ stay in ports, financial benefits for the business. The pilot project is a useful technological tool for validating the flow of data between parties and improvement of the functional capabilities of the MSW in general being a technical add-on to the existing MSW.

In order to evaluate the feasibility of implementation of EDI systems for information exchange between Bulgarian Black sea ports and economic operators, the main roles and processes between the participants are to be analyzed. Port authority administers and applies all procedures related to the ports activities via control of the cargo handling and vessels’ traffic. These functions include monitoring and control of vessels’ entry and exit, ensuring for high security level at the port premises, storage, handling and monitoring of cargo movements. As concerns cargo information flows these are typically considered twofold: regular incoming and outgoing cargo flows (via transmission of information on the basis of the cargo manifest and outturn reports) and the dangerous goods information flows. The latter two types of information are provided by the shipping agent via the exporter or importer.

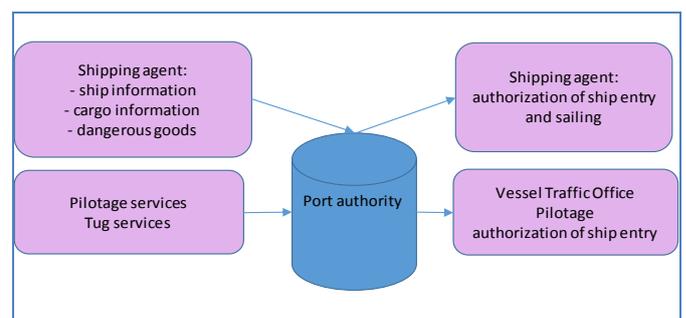


Figure 3 Exchange of information with the Port Authority

Figure 3 presents in general the information exchange of the port authority with various types of economic operators and other state authorities.

Being an intermediary between the shipowners and operators, the functions of the shipping agents comprises various activities. The shipping agent usually provides services to the vessel and the crew while the vessel is at port and informs regularly the shipowner and the port authorities. The duties of the shipping agent also include handling of cargo documentation. All information is forwarded to the port community members authorized to receive it – freight forwarders, customs authorities, port authority, stevedoring company, etc. One of the key elements of the information exchange between shipping agents and the rest of the participants is the timeliness of the exchange. Information about the ship is generated by the shipowner (operator) whereas information about the cargo is coming from the exporter/importer or the freight forwarding company. The information flows between the shipping agents and the stevedoring company concerns the cargo handling only which may involve various types of documents. Figure 4 illustrates the interactions between the participants with the shipping agent.

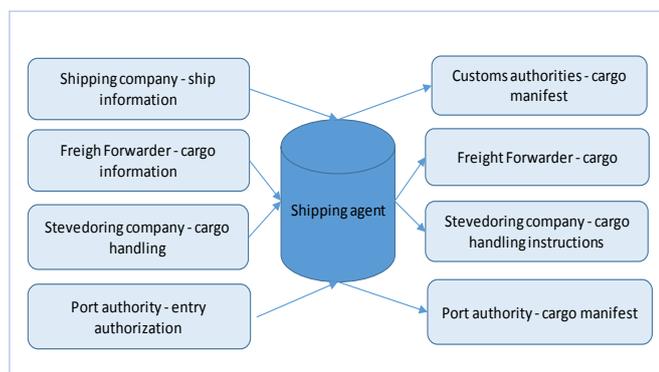


Figure 4. Exchange of information with the Shipping Agent

The main responsibilities of the freight forwarders include coordination of the carriage of cargo from the exporter to the point of delivery (to the importer). At the same time, freight forwarders are in contact with all other participants of the transport chain that are responsible for cargo movement and handling (ship agent, hauliers, customs agents, stevedoring companies, etc.). It is common practice that freight forwarders are carrying out their duties via delegating their activities to local representatives to ensure for more efficient fulfillment. In fact, it is usual practice that the responsible freight forwarder assigns its duties to various companies along the supply chain but retaining the overall responsibility.

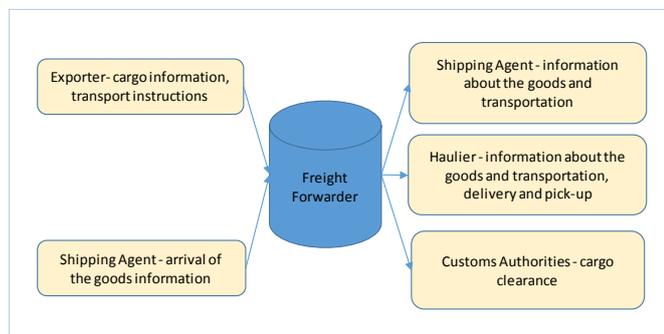


Figure 5. Exchange of information with the Freight Forwarder

Figure 5 illustrates the interactions and information exchange of the other participants with the freight forwarder. The freight forwarder ensures that the exporter disposes of the information about the cargo, receives the shipping instructions from the seller/exporter and the respective terms for cargo delivery. Generally, it is the freight forwarder who provides the exporter with

the necessary information about the goods, shipping instructions and delivery conditions and also the form and content of the cargo documents. Close communication with the shipping agent allows for coordinated transportation of the cargo by sea. As for land transportation, the freight forwarder coordinates same with the land carriers or performs the haulage by itself.

As described above, it is evident that the relations among the participants of the information exchange environment are quite complex and require good coordination for timely and efficient exchange of information.

#### 4. Methodology for implementing EDI system for information exchange between Bulgarian Black sea ports and economic operators.

Port performance efficiency is mainly based on the analysis of information exchange within the port authority and the external stakeholders. Furthermore, all aspects of the business activities are to be considered, including but not limited to business strategy, policy issues, national and international regulations. As a first step it is required that the main participants are identified, the main business processes are outlined as well as the type and content of the documents is determined. The latter will ensure for the design of the system for EDI, continuous monitoring and eventual restructuring of the business processes in terms of fast exchange of information within a secure environment. The stages of the implementation of the EDI system as a process are presented in Figure 6.

The methodology comprises the following components: business process analysis and engineering; software development and applications to support the designed processes and ICT infrastructure to support both the engineered business processes and the software applications; human resources to operate and maintain the system.

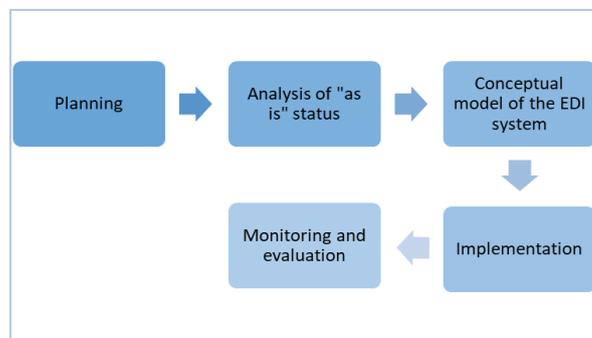


Figure 6 Stages of the design and implementation of the EDI system

At the planning stage the main frame of the project is created, the scope and objectives are set as well as the methodology. During the second stage an analysis of the “as-is” situation and the current industry perspectives and trends are studied along with good business practices. At the third stage the conceptual model of the EDI system is set up via creating “what-if” scenarios, designing the organizational structure and mapping of the business processes and information flows. At the stage of project approval it is necessary that cost-benefit analysis is carried out as well as financial analysis to determine the return of investment. The implementation phase is the most critical one as it allows for comparing the planned objective with practical outcome thus serving as a prerequisite for amendments of the strategy. The stage of monitoring and follow-up allows for continuous improvement of the system and eventually for its expansion and diversification.

The methodology includes determination of the objectives of each of the services pertaining to the participants’ activities. Each participant is assigned a role in the system and its role is to be justified according to its duties and responsibilities. After that the

functions of each role (participant) are described and the interactions with the other participants are mapped. Subsequently, the mainframe architecture of the EDI system is created as a basis for software development.

The proposed EDI system will include the following workflows:

- Import and export of dry bulk and general cargo

The procedure will include following elements: warehouse planning, intra-port movement of the cargo, quantity measuring procedures, declaration of the cargo at the customs office, cargo handling, payment of fees and services related to cargo import. The export procedure would include the following: customs clearance of the exported parcels, warehouse planning, determining of cargo quantity, payment of fees for cargo handling, storage, etc.

- Import and export of containers

At the port of Varna West containerized cargo is handled by various entities in the port community and EDI system. The process includes following elements: location planning of the containers on board and in the container yards, internal movement of containers in the port, dangerous cargo handling, customs clearance, gate control and operations, payment of fees, cargo handling (loading and discharging operations on/from the vessel).

- Vessels' traffic

The process is related to the information exchange from the ship agents (time of arrival, arrival formalities, berthing, stevedore activities, details regarding cargo operations until sailing of the vessel. The data regarding vessels' movement should be derived and integrated with the existing VTMS so that to achieve seamless and reliable exchange of information.

- Platform for exchange of information

The platform will ensure for information exchange and transformation of the documents' information into standardized form based on the UN EDIFACT requirements. The platform will distribute the information according to the rules and terms created thus ensuring for information transmission to the right participant. The latter process is basically extraction of necessary information and distribution to the respective participant via the message exchange engines. The proposed message exchange platform must be multifunctional, i.e. messages are to be distributed on the basis of messages' content and subject, recognition and validation of the messages to be made according to stored messages templates and information content, maintaining of a database of information of past information exchange, different levels of access via login credentials of authorized participants.

- Control and data center

These refer to the control of the area and retrieval of information and data by authorities when needed. The latter is related to various inspections of the cargo, inward and outward formalities of the vessels; arrival and sailing. At the same time this element will control the access of vehicles and persons to the gates and devices for measuring of cargo. The main functions will include: control of movement of persons and vehicles along with their identification, monitoring of vehicles movement within the port premises, maintaining and control of the security procedures.

The proposed methodology describes the main stages for implementation of EDI system for information exchange between port authority and economic operators (shipping agents, freight forwarders, customs offices) for the Bulgarian Black sea ports. The benefits of the proposed EDI system are well recognizable: seamless and quality reporting of vessel' traffic and movements of vehicles within the port premises, reporting of vessels' status, cargo information and cargo documentation movement for shipping companies, shipping agents, stevedoring companies and freight forwarders. timely receipt of data within online environment,

reliable database with secure access of users, ease of payment procedures for various services, improved communication between all participant of the EDI system.

## 5. Conclusion

The present article has analysed the feasibility for planning and implementation of EDI systems for documentary exchange between Bulgarian Black sea ports and economic operators. Existence of Port Community System is proved to be the basis for implementation of the EDI system. The main economic operators, interacting between each other and with the port authorities have been identified along with their functions. The information flows between the main participant of the EDI system are outlined. The implementation process of the EDI system is presented and explained in detail. Furthermore, the core elements of the system are described and their potential benefits proved. The benefits from the implementation of the EDI system will improve the ports competitiveness. Despite the fact that EDI system benefits are evident for all participants, the implementation of standardised exchange of information is a major technological challenge. It is evident that the planning, design and implementation of the EDI system involves various layers and elements with diverse transactions between various participants. The development of an EDI system for information exchange between Bulgarian Black Sea ports and economic operators is inevitably on the right track on the basis of the already fully functional MSW and the applicable national and EU legal framework.

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