Interreg

EUROPEAN UNION

Danube Transnational Programme

DIONYSUS

Integrating Danube Region into Smart & Sustainable Multi-modal & Intermodal Transport Chains

Inventory on port digitalization capabilities in the Danube Region

Deliverable D.T2.4.1

Version 3

Date: 26.5.2021

Project co-funded by European Union Funds (ERDF, IPA, ENI)

Document History

Version	**Date**	**Authorised**
1	14.5.2021	VPAS
2	17.5.2021	PDM
3	26.5.2021	VPAS

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Table of Contents

1 Abbreviations

Abbreviation	Explanation
DR	Danube region
RIS	River Information Services
NIS	Network Information Security
ERP	Enterprise Resource Planning
NOR	Notice of Readiness
SOF	Statement of Facts
RIS	River information system
PGA	Port Governance Agency, Republic of Serbia
BPI Co.	Bulgarian Ports Infrastructure Company

2 Table of Tables

3 Introduction and scope of the report

This report has been elaborated within the framework of the project DIONYSUS, Work Package T2 Danube Inland & Sea Ports Analysis & Recommendations with the designation T2.4.1.

While principal objective of the project DIONYSUS is to integrate the Danube region ports into smart & sustainable intermodal transport chains, objective of this work package is facilitating the full integration. Global economy gradually increases the demand for efficient cargo transfers. Port have been considered as main nodal points for cargo flow from and to the country. Coordination and connectivity therefore play an important role. Technological progress does not avoid the field of waterway transport and new systems, technologies and innovative ways for interconnection are constantly being developed and introduced. Danube crosses 10 European countries, each with a unique background and unique development. Ports on the Danube river have various development trends behind, various operational and ownership models, specialize on different cargo and provide various services.

Digitalization level of port´s operation and of provided services is no exception. There is a significant impact of technologies on transport-related business, starting from fast and secure information exchange to the full automatization of certain operations and processes. For the Danube ports, digitalization is still a new topic, therefore they should follow the lead of the digitalization development level of major European sea and inland ports.

At the beginning of the document there is a chapter dedicated to the overview of legislative framework on digitalisation applicable to the IWT sector reflecting EC staff working document on digital inland navigation (2018).

The key objective of this deliverable is to summarize the results from the ***Survey on assessing the digital capabilities and preparedness of ports in the Danube Region to undergo a digital transformation,*** elaborated under *DT 2.4.1 Inventory on port digitalisation capabilities in the Danube Region within the DIONYSUS* project by Pro Danube Management, with the support of project partners EHOO, HFIP, MPAC, VP and PGA. *The* survey was conducted among the DR ports to identify the current level of digitalization of DR ports, but also to map the current needs and digitalization capabilities to support future operations.

This deliverable will serve the purpose of providing input for the Integrated Danube Transport Corridor Digitalization Strategy & Action Plan (O.T2.3).

4 Legislative framework overview

RIS Directive

Directive 2005/44/EC of the European Parliament and of the Council of 7 September 2005 on harmonised river information services (RIS) on inland waterways in the Community establishes a framework for the deployment and use of harmonised, interoperable, and open RIS. Member States must provide RIS users with the data necessary for voyage planning and electronic navigational charts for waterways and notices to skippers are provided as standardised, coded, and downloadable messages.

RIS Technical guideline

Commission Regulation (EC) No 414/2007 concerning the technical guidelines for the planning, implementation, and operational use of RIS lays down technical guidelines and specifications for RIS through five implementing acts:

- Commission Regulation (EC) No 414/2007 concerning the technical guidelines for the planning, implementation and operational use of RIS;
- Commission Implementing Regulation (EU) No 909/2013 on the technical specifications for the electronic chart display and information system for inland navigation (Inland ECDIS);
- Commission Regulation (EU) No 415/2007 concerning the technical specifications for vessel tracking and tracing systems (as amended by Commission Implementing Regulation (EU) No 689/2012);
- Commission Regulation (EU) No 164/2010 on the technical specifications for electronic ship reporting in inland navigation.
- Commission Regulation (EC) No 416/2007 concerning the technical specifications for Notices to Skippers.

Directive on technical requirements for inland waterway vessels

Directive (EU) 2016/1629 of the European Parliament and of the Council of 14 September 2016 laying down technical requirements for inland waterway vessels, amending Directive 2009/100/EC and repealing Directive 2006/87/EC maintains the European Hull Database (EHDB). This database contains selected information regarding inland waterway craft, including each vessel's unique European vessel identification number, its name, its dimensions, and an electronic copy of the vessel certificate.

Directive on the recognition of professional qualifications in inland navigation

Directive (EU) 2017/2397 of the European Parliament and of the Council of 12 December 2017 on the recognition of professional qualifications in inland navigation and repealing Council Directives 91/672/EEC and 96/50/EC facilitates the electronic exchange of information about crew members by setting up a system of national registers and a database to be kept by the Commission. Document contains data on crew members' Union certificates of qualification, service record books11 and vessel logbooks.

TEN-T Regulation

Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network establishes guidelines for the development of the trans-European transport network, which also consists of the infrastructure for inland waterway transport. Some of the Regulation's priorities deal with information and communication technology, such as implementing telematics applications (including RIS).

GDPR Regulation

Regulation (EU) 2016/679 and Regulation (EC) No 45/2001 replaces the Data Protection Directive (Directive 95/46/EC). As of 25 May 2018, it sets forth a single set of rules across the EU to protect and empower all EU individuals with regard to the processing of their personal data and to hold organisations processing personal data of individuals in the EU accountable for their processing activities. It gives powers to the competent supervisory authorities to impose corrective measures, fines and penalties on companies that do not comply with these rules.

Network Information Security (NIS) Directive

Directive (EU) 2016/1148 on security of network and information systems (NIS Directive) promotes collaboration between Member States and aims to develop their capacity to investigate incidents rapidly and raise awareness of vulnerabilities at national level. In addition, in September 2017, the Commission published a review of the 2013 cybersecurity strategy in which it proposed that the EU Network Information Security Agency (ENISA) be granted a permanent mandate and that a voluntary scheme for cybersecurity certification and labelling be set up to create a cyber-resilient ecosystem.

eIDAS Regulation

Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market provides a clear regulatory environment to enable secure and seamless electronic interactions between businesses, citizens and public authorities. Electronic identification and trust services are key enablers for building a Digital Single Market Regulation ensures that people and businesses can use their own national electronic identification schemes (eIDs) to access public services in other EU countries where eIDs are available.

5 Inventory on port digitalisation capabilities in the Danube Region

5.1 Participating entities

The survey intended to help port authorities/administrations/PDC in their work towards a digital transformation of their port. By answering all the questions proposed, ports were invited to assess their digital maturity and, at the same time, to get a better understanding of their real digital needs.

Participation at the survey on assessing the digitalisation capabilities of Danube Region Ports was offered to all DR ports, both associated and not associated to the DIONYSUS project consortium. From among the addressed subjects, 17 ports in total answered the questionnaire and provided the requested information.

Majority of replies were from inland ports. However, part of the respondent group was also one seaport (Izmail) and one combined – inland and seaport, port of Constanta (RO).

Table 1: Participating ports / entities

Port / Entity	Country
Ennshafen	Austria
Port of Linz - LINZ AG Hafen	Austria
Public port of Bratislava	Slovakia
Freeport of Budapest	Hungary
Centroport	Hungary
Port of Dunavecse	Hungary
Baja Public Port	Hungary
Adony	Hungary
Port Governance Agency, Republic of Serbia	Serbia
Murfatlar	Romania
Port of Constanta	Romania
Ruse - East	Bulgaria
Port Terminal Ruse West	Bulgaria
Port Lom	Bulgaria
Port Bulmarket - Ruse	Bulgaria
Izmail	Ukraine
Nikopol	Ukraine

The survey was meant to be answered by the team of the port authority/administration/port development company formed by experts from the following departments: IT, Strategy, Marketing, Operations, Transport & Traffic Management and Human Resources. Also, few dedicated questions require the input of the harbor master.

This survey consisted mostly of multiple or single choice questions, to facilitate a quick and easy answering. Few open questions have been included to allow each port to present on a case by case basis its particularities.

5.2 Focus areas

The survey was structured into 9 thematic clusters (sections) chosen with the aim to assess digital maturity of DR ports and, at the same time, get a better understanding of their real digital needs:

1. Short introduction to the port
2. Internal needs of port authority / administration/ PDC
3. Solutions supporting a port authority / administration /PDC in its function as provider of basic port services
4. Solutions to the needs of the harbor master
5. Solutions supporting port operations and interactions with port actors
6. Fully integrated solutions
7. Human resources – new skills
8. Smart solutions to enhance safety and sustainability
9. Data management and cybersecurity

6 Survey analysis

6.1 Internal needs of your port authority / administration/ PDC

Not surprisingly all analysed ports have fixed and stable internet connection, which is an inevitable condition for any kind of digitalization and 5/17 ports include digitalization and/or digital transformation in theirs port development strategies.

First question mark may be visible in terms of investment in upgraded digital infrastructure. 9 ports could not define whether they could afford such investment. Other ports replied positively what can be interpreted as sign of ongoing projects dedicated to particular updates. Positive outcome is that ports are in general aware of the necessity of investing in digital infrastructure. The ports approach towards the development of digital infrastructure is reflected in the respective budgets.

Annual budget for digital infrastructure varies from several hundred euro (e.g. Murfatlar) to tenths of thousands of euro (Bratislava, Ennshafen). The highest annual amount was indicated by port of Constanta (650 000 EUR) which is relevant to the fact that it is a combined (inland waterway and maritime) port.

ERP systems (Enterprise Resource Planning), an integrated software solution that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management and compliance, and supply chain operations are currently implemented in 5 entities (Port Terminal Ruse West, Port of Linz, Port Bulmarket - Ruse, PGA, Port of Constanta), whereas other 2 ports(Ruse-East, Bratislava) plan to implement such solution in the near future.

In terms of software solutions used in ports and/or by port authorities, these solutions should be divided into subcategories. As expected, almost all respondents indicated standard office applications running under operational system Window such as Microsoft Office. Second category was accounting software, namely commercial software OMEGA (Bratislava), Oracle (Constanta), SAP (Ruse West) and state software for accounting, taxation, for operational, HR and inventory control (Izmail). Port operation itself is administered usually by inhouse solutions (e.g. Linz, Constanta), port of Adony indicated usage of Metrisoft, commercial application for weighing / dosing.

Asset management software is an important topic since it provides overview of the port assets, installations, maintenance, inspections, repairs, etc. 7 respondents indicated having an asset management implemented:

- Freeport of Budapest - defect repair system and software; inventory, fixed asset records
- Port Terminal Ruse West - SAP ERP system; GIS
- Port of Linz - in-house software solution
- Izmail - management of port assets
- Port of Constanta - Neptun (locally developed solution, based on Oracle forms)
- Ennshafen – BMD

Adony and Port Bulmarket - Ruse indicated high interest in the topic.

Among all respondents, the highest amount of inhouse solutions were indicated by Bulgarian Ports Infrastructure Company:

- **Integrated Information System (IIS)** for planning and managing the resources in the company.
- **Geo-information system (GIS**) to maintain current data on the state of port infrastructure, land, buildings, facilities, and road and railway terminals, warehouses, adjacent water areas etc.
- **Bulgarian river information system (RIS) – BULRIS**, real-time rendering of river information services is an important condition for the reduction of the risks upon the vessels passing through critical sections of the Danube River thus increasing the level of navigation safety.
- **Vessel Traffic Management Information System - /VTMIS/** - a system to control the hazardous cargo haulage and pollution prevention of the marine environment.
- **Monitoring and Information system for the Black Sea** - platform including data for the condition of the specific parameters of the environment, marine spaces and coastal area that have environmental impacts related to the preservation and sustainable development of Black Sea.
- **National maritime single window system MSW** - fully integrated with the information system for information provision for the planning of maneuvers in seaports.
- Other:
  MOVER, the activity management system, **WASTE,** receiving and processing of waste, resulting from shipping activity which receives data from MSW, customs systems **BIMIS** and **MISI**, which implement customs import and export procedures and integrated system for monitoring of port security zones.

BPICo. is in process of developing a Port Community System (PCS) within the Bulgarian maritime ports. This platform will provide electronic exchange of data, with a task to provide reliable and secure information sharing for business needs between all stakeholders. The solution should eliminate unnecessary paperwork, which circulates between various port community members, slowing down the operations, often clogging up cargo handling. PCS aims to improve efficiency at all stages of the process of manifesting, through vessel discharge and loading, Customs clearance, port health formalities and truck/rail arrival coordination and delivery in and out of the terminal.

On the initiative of the Bulgarian Port Infrastructure Company, in conformity with the requirements of Directive 2010/65/EC, there has been put into operation a **National Center for the exchange of electronic documents** which entirely covers the European concept of Maritime Single Window and facilitates the exchange of electronic documents relating to the control of borders.

Another sub-area of focus was the **optimization of processes**. Any kind of process optimization must be based on process mapping. Process optimization is desired by the vast majority of respondent, however only 5 of them indicated the process mapping methodology in use. This is a sign that respondents understand the importance and see the opportunity for optimization. An overview of the best practices in this area could find its purpose and help partners to define the goals and strategy to undertake.

Centralized data storage & management is done mostly by the centralized servers. Inhouse software solutions are being used in Linz, Izmail and Constanța.

6.2 Solutions supporting a port authority / administration /PDC in its function as provider of basic port services

The focus area presents ports with more than 1400 customers, more than 100 terminal operators and more than 900 vessel operators in total.

In four of the DR ports (Freeport of Budapest, Port of Linz, Izmail and Ennshafen) business / industrial parks are located with more than 170 companies. Apart from basic port operations (assisting ships during arrival/departure, tugboat / boxer service) ports offer fresh water supply, onshore power supply, fuel bunkering, waste & sewage water collection and disposal including hazardous waste (e.g. Freeport of Budapest), etc.

The **most important solution** to be made digitally available to DR ports customers was recognized as demand for availability and booking of mooring/berthing places, booking of tugboats or pilot services and sharing information about port dues calculation and water depth. Currently used solutions for booking such as phone calls and emails are outdated. Online application is only used in the port of Izmail.

Another important requirement was online availability and booking of onshore power supply facilities.

Currently the reservation of berths and other services are provided by email or telephone request, online application is used in the port of Izmail. Automatic invoicing is available only at 3 ports (Baja Public Port, Port of Linz and Izmail). Most ports are equipped with CCTV cameras.

6.3 Solutions to the needs of the harbor master

For the monitoring of vessels in restricted areas of the DR ports, the harbor masters are mostly using automatic identification system (AIS) - an automatic tracking system that uses transceivers on ships, supporting vessel traffic services (VTS). The vessels entering or leaving ports are not always digitally registered; if so, DR ports are using own automated digital solutions.

The communication between port and vessel is in most cases provided by phone, radio stations or even paper based. 16 from 17 DR ports deem necessary to have reliable solutions for predicting the arrival of vessels in the ports.

ETAs and ETDs of the vessels entering/departing from the port is digitally recorded in 6 ports (Murfatlar, Ruse-East, Port Terminal Ruse West, Port of Linz, Port of Constanta, Centroport) either via in-house solutions or standard office applications (MS EXCEL).

7/17 ports (Nikopol, Port Lom, Freeport of Budapest, Port Terminal Ruse West, Izmail, Port of Constanta, Centroport) have a communication platform in place to share information about a port call with other authorities involved (e.g. Single window, Bulris, Maritime Single Window, Port Community System, KSH Elektra), other ports use telephone, email and paper.

Port dues are mostly calculated manually or by software and there was identified demand for the solution to accurately calculate port dues with minimal administrative workload that allows an easy integration with the existing billing system. Murfatlar, Freeport of Budapest, Public port of Bratislava, Port Terminal Ruse West, Port of Linz, Port Governance Agency, Izmail, Port of Constanta indicated usage of software, for example ISSP (integrated fee management system), SAP ERP, Neptun ERP or inhouse solution. Other ports did not indicate usage of any dedicated software.

Only 4 ports (Murfatlar, Baja Public Port, Port Terminal Ruse West, Centroport) have digital overview with all information about vessel 's call (e.g. time spent in the port, service usage, etc.)

Data exchange and communication with other participants via a common platform between DR ports appears to be a suitable solution through which the individual requirements of the harbor masters for digitization could be implemented.

6.4 Solutions supporting port operations and interactions with port actors

The survey showed that communication between vessel, shipper, harbor master and port authority is in most cases not provided digitally. The most common communication canal at ports is email or phone, in few cases it is still the paper-based communication. Similar is the communication between vessel, shipper and Customs.

Information on the status of Customs clearance can by followed in real-time only in 5 DR ports (Port Terminal Ruse West, Port of Linz, Port Bulmarket - Ruse, PGA, Izmail). 3 of requested ports are communicating with the vessels by RIS related to navigation, the remaining ports are using email communication or even do not have digital communication between the vessel, the shipper and the navigation authority.

7 ports (Port Lom, Port of Dunavecse, Baja Public Port, Adony, Port of Linz, Izmail, Centroport) can provide a real-time update on the cargo volumes and information on the loading and unloading status of vessels.

NOR and SOF reports are either paper based or provided by email. Data generated by the Gate in/Gate out procedure are stored digitally only in 3 ports (Port of Linz, Izmail and Ennshafen).

80% of the respondents do consider necessary to upgrade the traditional bill of lading, river waybill to an Electronic format.

6.5 Fully integrated solutions

A Port Community System (PCS) handles electronic communication in ports between the private transport operators (shipping lines, agents, freight forwarders, stevedores, terminals, depots), the private hinterland (pre- and on-carriage by road, rail and inland waterways), the importers and exporters, the port authorities, Customs and other authorities. It optimises, manages and automates port and logistics efficient processes through a single submission of data and connects transport and logistics chains. This applies both to business-to-government (B2G) communication and to communication between companies (B2B).

To the question of how many ports use aPCS solution, only 3 ports are working with one (Nikopol, Port of Linz and Izmail), other ports communicate via phone or email. Only Nikopol has a PCS solution and the National Single Window integrated. Port Terminal Ruse West was the only one that reported digitally the exchange of information within the local port community. This exchange works under Bulris software. Storage & management of multimodal traffic data is in all DR ports still paper-based, whereas 13 ports indicated a combination of paper-based and digital solutions.

In 5 DR ports (Nikopol, Port Terminal Ruse West, Port of Linz, Izmail, Ennshafen) port operators have real-time information about all possible hinterland connections.

5 DR ports (Freeport of Budapest, Baja Public Port, Public port of Bratislava, Port of Linz, Ennshafen) track & trace container cargo. Cargo management solutions used were not revealed in general, since operators do not share such information. According to the survey, Port of Constanța uses SAP, Microsoft - Warehouse management system, Adony keeps track of stocks via weighing system.

Port clients in Nikopol, Port of Dunavecse, Port of Linz, Port Bulmarket - Ruse and Ennshafen have the possibility of matchmaking the hinterland transport (based on the real time information on the availability of transport operators and their capacity).

Since there is only one combined (seaport / inland port) port in the group, there is no comparison possible in terms of data exchange between a Danube port and a seaport. According to information provide by Port of Constanta, the data exchange is provided via email.

DR ports are dealing with a lack in the field of automation, only half of the ports are using some type of an automated system. Invoicing and statistics purposes are identified as the most suitable and the most desirable applications for automation in the nearest future.

There was identified a significant demand for single PCS solutions for the DR ports, that will deal with exchanging information digitally in the port community.

Interesting information is that only 20% of ports offer the possibility of sharing information from RIS further into the port community, even though the majority of DR ports indicated regular usage of national RIS, mostly for tracking the position of vessels.

6.6 Human resources – new skills

Table 2: Total number of staff at port / administrative unit

Staff members	Respondent entity

1-10	Murfatlar, Nikopol, Port Lom, Port of Dunavecse, Baja Public Port), Centroport, Ennshafen
11-50	Ruse-East, Freeport of Budapest, Public port of Bratislava, Port Governance Agency (RS)
51-100	Adony, Linz, Port Bulmarket - Ruse
201-300	Izmail
301-500	Ruse - West
500+	Port of Constanta

Table 3: Total number of staff at port

Staff members	Port
1-100	Murfatlar, Nikopol, Port of Dunavecse, Port Terminal Ruse West, Adony, Port Bulmarket - Ruse, Centroport
101-200	Ruse-East, Port Lom, Freeport of Budapest, Port of Linz
201 - 400	Baja Public Port
401 - 600	Public port of Bratislava
801-1 000	Port Governance Agency (RS)
1 500 - 3 000	Izmail, Ennshafen
10 000 +	Port of Constanța

Table 4: Entities with separate IT department with number of dedicated staff

Respondent entity	Staff members
Murfatlar	3
Ruse-East	n/a
Public port of Bratislava	2
Port Terminal Ruse West	16
Port of Linz	4
Izmail	5
Port of Constanta	12

Table 5: Share of the employees that deal daily with IT equipment (computers, tablets, servers, printers, telecommunication assets, process control and automation systems)

%	Respondent entity
1 - 20	Ruse-East, Nikopol, Adony, Port of Linz, Port Bulmarket - Ruse, Izmail
20 - 40	Port Lom, Port of Dunavecse, Baja Public Port
40 - 60	Port of Constanta
60 - 80	Murfatlar, Freeport of Budapest, Bratislava, Port Terminal Ruse West, Port Governance Agency (SR), Centroport, Ennshafen

Majority of respondent entities rates overall IT literacy level of the employees as average and the majority indicated openness of staff to acquire new IT related skills.

However, only three entities offer its employees regular IT trainings (Port Terminal Ruse West, Port of Linz and Port of Constanța).

Eventual requalification has been the topic in 8 entities (Murfatlar, Port Lom, Port Terminal Ruse West, Port of, Port Bulmarket - Ruse, Port of Constanța, Centroport, Ennshafen, whereas at the rest of the ports this has not been discussed yet.

Concerns related to digitalization transformation (automation of processes) might affect jobs (in the sense that some dedicated jobs could disappear) have been identified in Ruse-East, Port Bulmarket - Ruse and Izmail.

6.7 Smart solutions to enhance safety and sustainability

Sensors are the drivers of Industry 4.0 and the Internet of Things (IoT) in factories and workplaces. Once implemented at scale, the combination of sophisticated sensors and increased computational power will enable new ways to analyse data and gain actionable insights to improve many areas of operations (UNIDO, What can policymakers learn from Germany's Industrie 4.0 development strategy?,2018).

Current status of monitoring among respondent partners is the following:

- Only four ports indicated active monitoring present at their facilities, Murfatlar, Bratislava and Freeport of Budapest (water depth) and Baja Public Port (water depth and purity).
- Port Terminal Ruse West, Centroport and Bratislava are planning to implement the monitoring of water depth and water quality (emission control).
- Monitoring in place in Baja Public Port and Murfatlar transmits measurements and information independently.
- In addition, 6 partners expressed their interest in installing smart buoys in the port.

Monitoring is very often in relation to waste management. Only 2 ports (Linz and Ennshafen) have a digital overview of the waste in the port. Despite not having digital monitoring in place, 10 other partners see digital waste monitoring as useful.

Separate subcategory where monitoring is extremely important is handling of hazardous cargo. Here the rate of active monitoring among partners looks differently comparing to other types of monitoring. The common trend visible here is that handling of hazardous cargo is not the direct responsibility of the port / port authority. For example, Izmail and Ruse-East do not use digital solutions. In Freeport of Budapest, Port Terminal Ruse West, Port Bulmarket - Ruse and Port of Constanța monitoring is on the agenda of the respective operator (MOL - HU, Dalby – SK).

For handling of hazardous cargo there are procedures in place in all relevant ports, either in the form of emergency plans (e.g. Port Lom, Freeport of Budapest, Baja), official requirements / state emergency response plan (Port of Linz, Izmail), contingency plans for operators and Port administration (Constanta). In case of emergency in Bratislava, standard intervention units (police, firefighters, ambulance) would be alarmed. If emergency situation is in relation to water, the Transport authority would intervene.

To general question "whether it would it be useful to have a digital solution for administrating and monitoring dangerous goods in the port," all relevant partners replied positively. 8 partners would even be interested in aerial (drones) support in hazard management.

6.8 Data management and cybersecurity

Data management solution (data integration, preparation, visualization, governance) for analysis, reporting or loading into other application purposes is currently being used in only 5 ports and in other 4 implementation is planned. Port Terminal Ruse West uses SAP and Archimed, Linz and Izmail are using inhouse IT solution and Port of Constanța uses Confluence, Neptun ERP and SIIP.

What can be evaluated very positively is the fact that all partners are familiar with the terminology of cybersecurity and its implications in the field of transport. On the other hand, IT strategy to cover the topic of cyber risk management & cyber threats mitigation was labelled as not applicable for 7 partners. Same

number of ports answered positively (Port of Dunavecse, Bratislava, Ruse West, Port of Linz, PGA, Izmail and Port of Constanța).

Last sub-area assessed was cybersecurity. Among the partners we can observe significant reserves, since less than half of them see currently used solutions as reliable. The rest of the group is either not content or sees potential for the increase of reliability. Majority of partners (12/17), therefore see potential in establishing a cybersecurity governance framework within Port Community System.

Cybersecurity awareness may be supported by dissemination of activities of the European Cyber Security Agency (ENISA), since only 4 partners are familiar with it (Freeport of Budapest, Ruse West, Port of Constanța, Ennshafen).

Thankfully only two ports from the group (Public port of Bratislava and Port Terminal Ruse West) indicated cyber-attacks happening. Public ports of Bratislava increased the protection on software level (antispam / antimalware software).

Terminal Ruse West hired a consulting company, formed a crisis team, and implemented the consultant's recommendations for solving the issues causing vulnerabilities.

7 Conclusion

According to the data collected with the support of the survey, which has been summarized and evaluated, the following conclusion have been formulated:

- Many of the tasks related to port operations is not digitalized and provided in an outdated way (emails, spreadsheets, phone calls)
- Communication platform among port stakeholders and private / public entities involved in port operation is missing in most of DR ports
- Instant digitalized monitoring of ports is mostly reduced only to CCTV, with no other information (water pollution, ongoing loading/unloading etc.)
- Reported cyber-attach rate is quite low. Fact, that less than half of DR ports see currently used solutions as reliable combined with low rate of IT trainings, there is a significant area for improvement in awareness.
- Survey showed not only room for improvement, but what is even more important is the will of DR ports to implement digital solutions for port operations, communication and monitoring of port assets.
- Invoicing and port statistics are identified as the most suitable and the most desirable for automation in the nearest future.
- Significant demand for a single PCS solution for the DR ports was identified.