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Danube Transnational Programme

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Danube Ports Network

D 5.3.5 Prefeasibility Study for Port Community System (PCS) in Constanta Port (Constanta, Midia, Mangalia)

WP5 Port Development

Activity 5.3. Port IT Community System

PP:Maritime Port Administration Constanta

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A. Written Components

Glossary

Term or acronym	Meaning or definition
Back-end entities	The authorities and IT systems receiving data via the National Single Windows
CMU	Constanta Maritime University
DEM	Data Exchange Mechanism
EC	European Community (obsolete)
ECSA	European Community Shipowners' Association
EMSA	European Maritime Safety Agency
EMSWe	European Maritime Single Window Environment
ESPO	European Sea Ports Organisation
ENS	Entry Summary Declaration
EU	European Union
FAL	Convention on Facilitation of International Maritime Traffic
Front end users	The shipping operators providing data into the National Single Window in connection to a port call
ICT	Information and Communication Technologies
IMO	International Maritime Organisation
IPCSA	International Port Community Systems Association
ISC	Inter-Service Consultation
MOVE	Directorate General for Mobility and Transport
NSW	National Single Window
PCS	Port Community System - an electronic platform connecting the systems operated by the organizations and entities making up a seaport community. The Port Community System facilitates exchange of operational or administrative information between different actors in the port; it can also include systems for optimization of processes (e.g. "smart port" systems). The PCS can be operated and maintained either by a public, private or public/private organization.
RFD	Directive 2010/65/EU on Reporting Formalities for ships
Shipping operator	Subject to specific reporting requirements set in the EU legal acts and international agreements, the operator may be a shipping company, a ship master or the representative of the shipping company/ship master
SSN	SafeSeaNet
SSS	Short Sea Shipping
VTMIS	Vessel Traffic and Monitoring Information System
WCO	World Customs Organisation

1 General information on the investment objective

1.1 Name of the investment objective

An analysis of the existing situation and the necessity of implementing a Port Community IT System in the Port of Constanta, identifying the objectives to be achieved by implementing this system, identifying the estimated costs for such a project and the steps to be followed for the successful implementation of such an IT system.

1.2 The main financing authority

National Company "Maritime Port Administration" Co. Constanţa

Address: Incinta Port Constanţa, Gara Maritimă, Constanţa; Secretariat

Registered with the Register of Commerce under no. J13/2308/1998, single ID no. 11062831, VAT no. RO 11062831

Tel: 0241. 601123

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Website: www.portofconstantza.com

1.3 Contracting authority /investor

National Company "Maritime Port Administration" Co. Constanţa

1.4 Beneficiary of the investment

National Company "Maritime Port Administration" Co. Constanţa

1.5 Developer of the pre-feasibility study

The developer of the pre-feasibility study is the Constanta Maritime University

The Table of Content of this pre-feasibility study is imposed by Romanian law under HG907/2016

Difference between pre-feasibility and feasibility studies

Pre-feasibility study is a preliminary study undertaken to determine, analyse, and select the best business scenarios. In this study, we assume we have more than one business scenarios, then we want to know which one is the best, both technically and financially. In pre-feasibility stage we select the best idea among several ideas. It will be hard and takes time if we explore each scenario deeply. Therefore, shortcut method deems acceptable in this early stage and can be used to determine minor components of investment and production cost.

If the selected scenario is considered feasible, it is recommended to continue the study to feasibility to get deeper analysis of the selected project scenario.

Feasibility study is an advanced study based on test work and engineering analysis, which presents enough information to determine whether or not the project should be advanced to be final engineering and implementation stage. This is a "go/no-go" decision point, thereby implying that sometimes the answer is NO. However, once a project is advanced to the feasibility study stage, companies often have committed considerable capital and professional reputation and therefore assume the answer will be that the project is feasible. That is also the second difference between feasibility study and pre-feasibility study.

2 The existing situation and the need to achieve the investment objective

2.1 Context presentation: project area, policies, strategies, legislation and relevant agreements, institutional and financial structures;

The Port of Constanţa land is owned by the Romanian State and was granted through a concession contract to the port administration N.C. "Maritime Ports Administration" J.S.Co. Constanţa, which is a joint stock company (80% Ministry of Transport, 20% Proprietatea Fund).

NC "Maritime Ports Administration" SA Constanţa is a state - owned company and has the role of port authority for the Port of Constanţa and its satellite ports - Midia, Mangalia and the Tomis Marina.

Based on the administration model –landlord port, the port infrastructure is leased to private operators. According to the Law 108/2010, the governing contract type concluded between NC "Maritime Ports Administration" S.A Constanţa and the operators for terminals and adjacent areas is the lease contracts. The port assets are leased out or sub-concessioned to private port operators.

The Port of Constanţa is located at the crossing of commercial routes connecting the markets of Central and Eastern European countries that do not have a sea, the Transcaucasian Zone, Central Asia and the Far East. It is the main Romanian port and is among the top 10 European ports. The favourable geographic position and importance of the Port of Constanţa is highlighted by the connection with two Pan-European Corridors: Corridor VII - Danube (river) and Corridor IV (road and railway). In the vicinity of the Port of Constanţa are the two satellite ports Midia and Mangalia, which are part of the Romanian maritime port complex under the coordination of the Maritime Port Administration Constanţa.

Constanţa Port is one of the main distribution centres serving the Central and Eastern Europe region, providing a series of advantages, among which the most important are:

The Port of Constanţa is located in Constanţa, Romania, on the Western coast of the Black Sea, at 179 nautical miles from the Bosphorus Strait. The geographic coordinates for indicating the position of Port of Constanţa are Latitude: 44° 7' 51" N and Longitude: 28° 39' 43" E (Gara Maritimă Constanţa).

The Port of Constanţa is an intermodal Port - good connections with all the transport modes, also there is ***the main container hub for the Black Sea*** area and also there is a ***multipurpose port – with facilities for all types of cargo.***

The connection of the port with the Danube river is made through the Danube -Black Sea Canal, ending the Rhine-Danube Corridor, which provides the main east-west link across Continental Europe.

Its route along the Danube River connects Strasbourg and Southern Germany with the Central European cities of Vienna, Bratislava and Budapest, before passing through Serbian, Bulgarian and Romanian ports.

Figure 2.1 The Rhine and Danube River - Danube-Black Sea Canal and Black Sea Corridor
(source: http://www.danubecommission.org/uploads/doc/Presentations/2017/DK_88_20170609/DK_88_session_state%20of%20play%20EU%20IWT%20Policy%20June%202017.pdf)

The Port of Constanţa covers 3.926 ha of which 1,313 ha is land area and the rest of 2.613 ha is water area. The total land area of 1.313 ha is shared between the North Port that occupies a land area of about 495 ha and the South Port with about 818 ha. Another 561 ha are included, according to the masterplan, in development project for short, medium and long term perspective.

The Port of Constanţa is not an open shore port. Its infrastructure is basin type with two basins. The main tuning basin for the North Port of Constanţa is located in front of the oil terminal having enough area to enable the manoeuvring of the common vessels calling the North Port. The first is located at the port entrance, after passing the South breakwater, while the second is located at the exit from the port, in front of the basin between piers 1S and 2S.

The standard berthing manoeuvrings require tug assistance and present a significant challenge, especially for berthing container vessels at the Constanţa South Port terminal in which the navigation is limited to one-way traffic.

The Constanţa Port has the maximum draught, natural or dredged, of 19 m and a minimum water depth of 7 m.

The port has ten terminals for bulk cargoes. The dry bulk cargoes (iron and non-ferrous ore, grain, coal, coke, cement, construction materials, phosphate, etc.), are operated in specialized terminals located next to the river -maritime basin. There are specialized

terminals that operate iron ore; bauxite, coal and coke having 13 berths. There is a specialized terminal where fertilizers, phosphate, urea, apatite and other chemical products are operated.

The Port of Constanţa is a traditional partner for the Eastern and Central European countries with high agricultural production that transits their cargoes towards worldwide destinations.

There are many facilities for the operation and storage of dry cereals, which are served by several specialized berths.

The break-bulk (general) cargo are operated by eight terminals. All range of services for general cargo are efficiently provided by stevedoring companies. There can be handled food, beverages and tobacco, paper and cardboard, cellulose, rolled metals, machine parts, bagged cement and other break bulk cargo.

The Port of Constanţa has four terminals for oil/chemical/gas. The main liquid bulk cargoes are represented by crude oil and oil products. The Port of Constanţa has a specialised terminal for the import of crude oil and other oil products and for the export of refined oil products, oil derivatives and other liquid chemical products. The oil terminal is equipped with a modern and efficient fire and pollution fighting facilities.

The Port of Constanţa has two Ro-Ro terminals equipped with two ramps to handle any type of vehicle and Ro-Ro cargo: the car terminal and the Ro-Ro Ferry terminal. There is not a fully dedicated terminal for cars and currently, the main car operator splits its activity in two berths. The Ferry-Boat terminal offers exceptional facilities for the freight loaded in wagons, containers, and trucks and transported by ferry vessels and liner services on the Black Sea.

The two terminals operating the Ro-Ro have a storage capacity of 6,600 CEU

There is suitable equipment for loading and unloading trains using the normal European railway standard. The terminal has five rail tracks for vessel boarding and the wagons are operated using ship's gear. For the time being, no regular Ro-Ro Ferry line is established.

Every quay-side container terminal that operates in the Port of Constanţa has rail access.

The port of Constanţa has no bi-modal terminals separated for rail-road within the port area.

The port is an important node in integrated logistics chains, offering through the five tri-modal terminal quick and safe access to port facilities from an inland transport system including inland water, railway system and road access. Currently there are a limited number of containers moving inland by water freight.

There are eight multipurpose terminals that can accommodate vessels.

For oversized and over weighted cargoes in the Port of Constanţa, private companies provide heavy lift cranes that facilitate the handling of heavy lift and out –of - gauge loads.

The railway infrastructure facilitates handling full block train in the port area as well as along the quay. Therefore, through the round – the -clock train services and every day shuttle trains high volumes of cargo are transported to/from the most important economic areas of Romania and Eastern Europe.

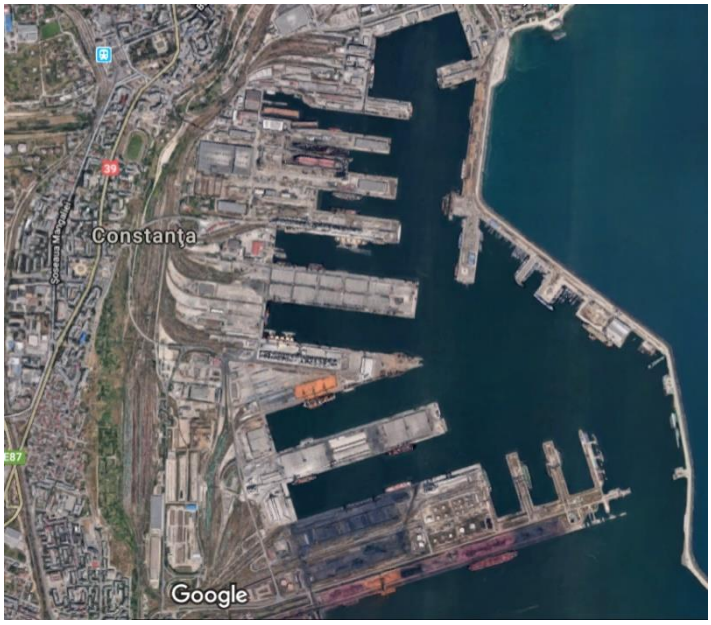


Figure 2.2. Rail network in the Port of Constanța
(source:
https://www.google.com/maps/@44.1584395,28.6393976,4161m/data=!3m1!1e3)

Private companies specialized in cargo transhipment are operating in the Port of Constanța. Using specialized equipment for intermodal transport they provide direct transhipment services for bulk and packed/unitized cargo: Sea vessels – barges, Barges – sea vessels, Wagons – barges and/or small sea vessels, Small sea vessels/barges – wagons.

Liquid bulk can also be transhipped into river vessels to various European destinations or carried through pipelines within the domestic hinterland. Pipelines network connects the port with the main refineries in the country thus securing fast transportation.

The total length of quay in the port of Constanța amounts to 29.830 m and is exclusively vertical. There is no sloped quay. A length of 3.262 m of quay is undeveloped.

The maximum number of vessels that can be handled at the same time in the Port of Constanța is 96. The river-maritime area in the Port of Constanța has recently implemented a waiting area for barges, either self-propelled or not. The facilities have the main purpose of providing temporary mooring quays for incoming and outgoing barges and pushers without interfering in transit coming from the Danube-Black Sea channel and other cargo handling operations.

Considering a mooring scheme with 1 to 2 barges perpendicular to the quay, a barge width of 11.40 m and a safety distance of some 1 to 2 m between the barges the existing terminal allows for safe mooring of some 150 to 200 barges.

The water depth at the Barge terminal is 7 m, the total quay length is almost 1.200 m and the available water area is almost 350.000 m^2. The port has facilities for mooring/anchorage for dangerous cargo vessels.

According to the European Conference of Ministers of Transport classification, the size of the vessel/convoy transiting the waterway connection Danube–Black Sea canal is inland waterway class VIc.

The Port of Constanţa is very well connected with the national and European road network through ten road entrances allowing systemization and organization of traffic through 25 road lanes.

The total length of roads in the port amounts to 100 km. The A2 motorway, nicknamed The Sun's Motorway, is linking Bucharest to city port Constanţa and has a length of 203 km.

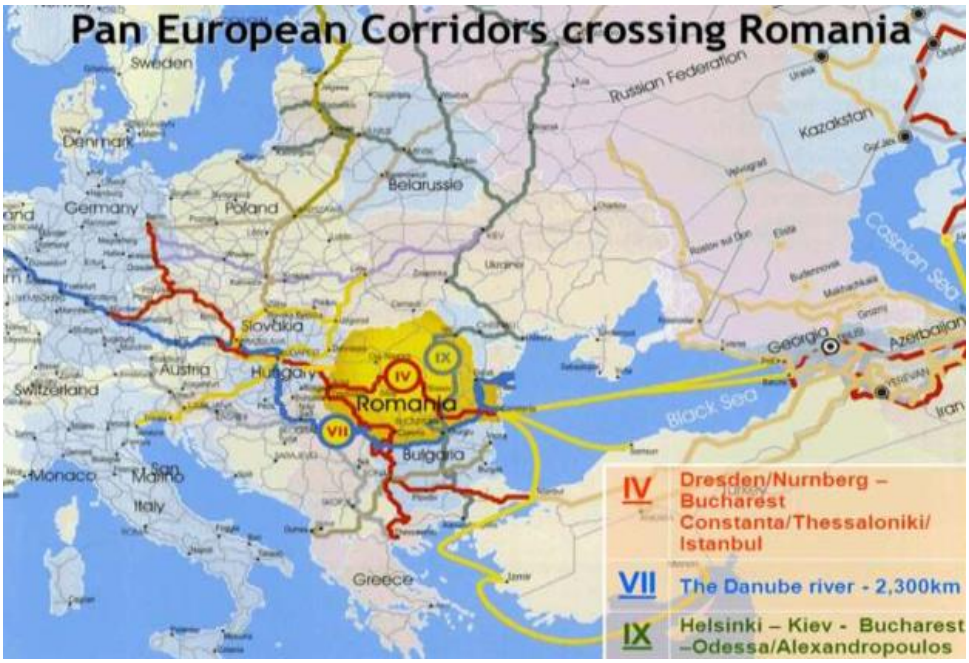


Figure 2.3. Pan European Corridors crossing Romania
(source: https://www.flandersinvestmentandtrade.com/export/sites/trade/files/market_studies/2016-Romania-Transport%20Infrastructure%2C%20Transportation%20and%20Logistics.pdf)

Also the Constanţa Port is a strategic point in Europe with a large market potential because Romania there is a gateway to three major markets: the single EU, the CIS and the Middle East, at the junction of three Pan-European transportation corridors: IV (which links Europe from West to East) – VII (inland water transportation on the Danube) – IX (links Europe from North to South).

The railway infrastructure comprises of six rail gates and nine rail tracks providing the connection between Europe, Caucasus and Central Asia. The total length of rail tracks along the quay walls is 19,873.63 m and the total length of rail tracks within the port area amounts to 300,000 m.

The area of port platforms sums up 3,898,325 m^2 providing a large storage capacity. Within the oil terminal a volume of 1,700,000 m^3 can be stored.

Container terminals have more than double operational capacity comparative with actual traffic (711,339 TEU in 2016), having a storage capacity of 16,000 TEU. The development plans for these terminals are very important.

Port connections - Hinterland connections

The Hinterland of the Port of Constanţa supports the harbor in terms of goods produced, consumed and shipped to/from the port and includes a vast region in Central and Eastern Europe.

Figure 2.4 The Hinterland of the Port of Constanţa
(source: http://bigblogg.info/marrdwn-rhine-and-danube-river-map.awp)

The integration within the national and European transport networks makes the Port of Constanţa the perfect choice for the cargoes dedicated to the landlocked countries located at the heart of Europe.

The Port of Constanţa is located at the crossroads of the trade routes linking the markets of the landlocked European countries to Transcaucasus, Central Asia and the Far East. The port has connections with the Central and Eastern European countries through the Corridor IV (rail and road), Corridor VII-Danube (inland waterway), to which it is linked by the Danube-Black Sea Canal, and Corridor IX (road), which passes through Bucharest.

Rail Infrastructure.

Rail connection, each terminal is connected to the domestic and national/European railway network (Pan European Transport Corridor IV). Permanent railway services ensure the transport of large volumes of freight to the most important economic areas in Romania and Eastern Europe, and the Port of Constanţa represents an important transportation hub of the TRACECA Corridor.

The rail network in the Port of Constanţa is connected to the Romanian and European rail network, with the Port of Constanţa being a starting and terminus point for Corridor IV, a Pan-European corridor. The corridor IV follows the route: Dresden/Nuremberg –Prague–Vienna–Bratislava–Győr–Budapest–Arad–Bucharest–Constanţa/ Craiova–Sofia –Pernik-Thessaloniki or Plovdiv–Istanbul.

Constanţa Port North has a complex railway system, which has been designed to bear the largest part of the port cargo; only a small percentage was foreseen for road transportation.

In the Port of Constanţa South, the railway network hasn't been finished. Nevertheless, from the feasibility studies made for the south side of the port, it is to be seen that railway traffic is increasing.

Because of this, MPAC is undertaking extension and modernization works for the lines in the south side of Constanţa Port, where the majority of the lines are under the administration ownership of MPAC.

The total length of railways in the port amounts to 300 km.

River connection - Constanţa port is connected to the Pan-European Transport Corridor VII - Danube, linking the two European commercial poles: Rotterdam and Constanţa, creating an inland waterway from the North Sea to the Black Sea.

Corridor VII –Danube. The Port of Constanţa is linked with the hinterland by the Danube –Black Sea canal. The entrance to the channel is on the South part of the Port and connects the Black Sea with the European inland waterway network. The canal offers an alternative route from the Black Sea ports to the Danube ports of Central Europe that is shorter by approximately 400 km.

Figure 2.5 Danube - Black Sea Canal (source: Annual Report 2017 – CN AMPC)

The connection between the Port of Constanţa and the Danube is achieved through the Danube - Black Sea Canal and is one of the main advantages of the Port of Constanţa.

Due to the low costs and the high volumes of freight that can be carried, the Danube is one of the most advantageous modes of transport, representing an efficient alternative to the congested road and rail transport in Europe.

The canal branch has a length of 64.4 km and connects the river Danube with the Port of Constanţa. The southern branch, which is also the main one, runs from Cernavodă, on the Danube (km 300), to Constanţa.

The length of this waterway is 2,414 km from Sulina, where the Danube flows into the Black Sea to Helheim, from where it continues through the Main-Rhine Canal, crossing Europe to the North Sea. On the territory of Romania, the length of the waterway is 1,075 km.

The connection between Constanţa Port and Corridor VII through the Danube-Black Sea Canal creates a 4,000-kilometer shorter transport alternative for goods coming from the Far East and Australia via the Suez Canal and which are destined for Central Europe.

The major opportunity offered by the Danube is made up of dry and liquid bulk cargo transport between land-locked countries on the Danube, namely Serbia, Hungary, Slovakia, Bulgaria, Austria and the Black Sea.

Road Infrastructure.

Road connection, each terminal is connected to the domestic and national/European road network.

The Port of Constanţa port is also located close to Corridor IX, passing through Bucharest. The corridor IX follows the route: Helsinki-Vyborg-Saint Petersburg -Moscow-Kiev-Chişinău-Bucharest-Ruse-Dimitrovgrad-Alexandroupolis.

The 10 gates of the Port of Constanţa are well connected to the national and European road network. The connection to the Pan-European Transport Corridor IV (road and railway) and the proximity to the Pan-European Corridor IX (road) passing through Bucharest are of strategic importance, thus linking Constanţa Port with countries without sea access in Central and Eastern Europe.

The total length of roads in the port amounts to 100 km. The highway A2 connects Port of Constanţa with national road network.

Major port users from Constanţa Port Community

Port Operators: The list of data about each operator can be downloaded from the web address http://www.portofconstantza.com/apmc/cc/firma/firma.do?method=refresh

The most important beneficiaries of the Port of Constanţa are represented by terminal operators who use the port infrastructure and receive direct benefit from new cargo being handled.

According to MPAC site there are 873 companies involved in providing services in Port of Constanţa (including the ports Midia and Mangalia), out of which 40 are port operators (37 acting in Constanţa, and 3 in satellite ports).

Oil Terminal and Rompetrol Logistics Constanţa Branch are the most important operators for crude oil and oil products. The Oil Terminal can operate tanks with capacities up to 165.000dwt, being equipped with specialized facilities for loading and unloading and connected with the pipeline system. The other main operators of liquid bulk are Frial, Romned Port Operator, Sargeant Marine Romania, Transbitum.

The main operators for iron ores, bauxite, coal and coke are Comvex, Minmetal, Chimpex, Socep and TTS Operator 250.000 dwt vessels and above can be accommodated and river units are operated in direct or indirect transhipment.

Chemical Products and Fertilizers are operated by TTS Operator, Chimpex, Frial, Minmetal, North Star Shipping, Socep and United Shipping Agency. These are equipped with dedicated areas for operation and storage of chemical products and fertilizers, bulk phosphate and urea.

Vessels up to 30.000 dwt can be accommodated and the total operation capacity of phosphates is 30.000 tons.

The most important stevedoring companies that operate agribulk in the Port of Constanţa are TTS Operator, North Star Shipping, Minmetal, United Shipping Agency, Silotrans, Chimpex and Socep.

Important quantities of other dry bulk are operated in the Port of Constanţa by the following port operators: Comvex, Chimpex, Decirom, Minmetal, Romned Port Operator, Socep and TTS Operator.

In Constanţa Port there are two container terminals, which offer modern facilities and operating conditions for portcontainer vessels. The container terminals are operated by, Constanţa South Container Terminal, Socep, APM Terminals Romania, Umex.

There are several companies operating general cargo. Perishable goods can be stored in adequate conditions in refrigerated warehouses and are usually handled by specialised stevedoring companies: Frial, Romned Port Operator, Chimpex, Decirom, Casa de Expeditii Phoenix and Socep.

Important quantities of timber loaded in the Port of Constanţa and dispatched over sea are handled by Decirom, Rotrac, Casa de Expeditii Phoenix, Socep and Umex.

Specialised stevedoring companies that are efficiently providing handling operations for metallic products: Minmetal, Decirom, Romned Port Operator, Socep, TTS Operator and Umex.

The Ferry - Boat terminal is operated by SNTFM CFR MARFA and offers exceptional facilities for the freight loaded in wagons, containers, trucks and transported by ferry vessels and liner services on the Black Sea.

The most important companies

Chimpex (owned by Ameropa) - Chimpex is operating a total quay length of 2.26 km including 10 operational berths with water depth of up to 13.5 m. The operating area has 360,000 m^2 and total covered storage capacity is 300.000 tons, having a max. daily intake of aprox. 26.000 tons. There are 10 railway tracks and access for road transport.

Chimpex has finished recently a grain terminal in Constanţa. The new state-of-the-art terminal

has a storage capacity of 200,000 tons on 20 vertical cells, can receive cargo by barge (1 x400 tons per hour), truck (2 x 400 tons per hour) and rail (1x 400 tons per hour) and has a vessel loading rate of 2 x 800 tons per hour. The investment was over 42 million Euro.

Umex - In the Umex terminal are handled about 1.000.000 tons of various cargoes every year, mainly: Bulk cereals; Bulk and bagged fertilizers; Project cargo & heavy equipment; Metallurgical products; Bagged/palletised general cargo.

The Terminal is developed on an area of 140.000 m^2, including 120.000 m^2 of concrete open platforms and 20.000 m^2 of covered warehouses. For vessel operations there are 5 berths with 1020 meters' total length, having the possibility to accommodate and operate 6 vessels simultaneously.

Umex has acquired in May 2016 one new Duplex type forklift with a loading capacity of 16 tons and maximum loading height of 5,47 meters. The acquisition was done in order to increase the capabilities in handling metal products.

Comvex has a quay consisting of 5 berths, with a total length of 1,400 m and a depth of water between 10,8 and 19 m. The unloading equipment consists of 3 cranes, each one having a discharge rate of 2,000 mt/hour.

Comvex also has a specialized crane used for EACS type wagons. There is also a FALS wagon discharge system in operation.

The loading quay consists of 3 berths with a total length of 600 m and a depth of water between 6,6-7 m. There are three barge loading equipment with an average loading capacity of 2,000 mt/hour each, opening the arm allowing simultaneous loading of 2 barges of 3,000 tons capacity.

The company also has the possibility to load the good s in rail wagons via the railway terminal which has a loading capacity of 20,000 mt/day. The storage space extends over an area of approx. 600,000 square meters of which 155,996 square meters are located along the quay.

Comvex started the investment of approx. 52 million euros, excluding VAT, in a grain terminal with a capacity of 200,000 tons, in the berth no. 80, where the draught is 19 m.

Oil Terminal S.A. has three storage farms through which the following products are handled: crude oil, gasoline, gas oil, fuel oil, chemical and petrochemical products, oils from import or for export and transit.

Constanţa South Container Terminal (owned by DP World) With an ultimate surface area of over 76 ha and 52 ha currently operational DP World Constanţa provides a yearly vessel throughput capacity of approximately 1,200,000 TEU.

DP World Constanţa operates over of a total quay length of 1020 m, with an excellent deep draught of 14.5 m, being able to accommodate and operate large capacity vessels. The main berth has 640 m length and the feeder berth has 380 m.

As the next phase for development at DP World Constanţa, a further 1076 m of berth (berths 126-130) will be completed subject to demand.

Socep is part of the DD Group, which includes the following companies: Casa de Expeditii Phoenix –port operator, Celco–leading producer of AAC in Romania, Hotel Condor Mamaia, Hotel Sulina

Neptun, Logistik Park–renting land for industrial purpose, Socefin – financial investment.

The container terminal operates in two berths: D51 and D52, having a total length of 470 m and a platform summing 150.000 m^2. The warehouse is located at the base of the pier, receiving the cargo that is being transported in containers. The terminal has facilities to operate RO-RO vessels.

Socep offers a wide range of terminal services such as: storage and operating containers, storage and monitoring reefer containers, containers stuffing/unstuffing of any cargo type, CODECO Gate in/Gate out reports, EDI capabilities and web access.

The general cargo terminal consists of six operational berths: D35, D36, D37, D41, D42 and D43, with a length of 210 meters each.

Decirom uses 6 operational berths (23, 23/24, 47, 48, 49, 50) placed along the shoreline, both in the southern and northern Constanţa Port, being served by 2 railway lines each. The total quay length is 1480 m and the water depth is 13,5 m. The equipment used by the port operator include: 17 quay cranes, 13 forklifts and 27 tractors with trailers.

Decirom is operating general cargo including wood products, steel bars and coils, sheet paper and packages, metal, food, chemicals, scrap, etc.

The Port of Constanţa is both a seaport and a river port. Every day, more than 200 river ships are in the port for cargo loading or unloading operations or waiting to be operated. The facilities provided by the Port of Constanţa allow the mooring of any type of river ship.

Significant quantities of cargo are carried between Constanţa Port and the Central and Eastern European countries: Moldova, Bulgaria, Serbia, Hungary, Austria, Slovakia and Germany. For the Port of Constanţa the river traffic is of great importance.

The total cargo traffic registered in the first quarter of this year in the ports of Constanţa, Midia and Mangalia was 13.35 million tons, 15.3 percent more than in the first quarter of last year, when 11.57 million tons were registered. (source https://www.zf.ro/auto/aglomeratie-in-porturile-romanesti-traficul-de-marfuri-a-crescut-cu-peste-15-17134852)

In order to cope with the future increase in the river traffic, the Maritime Port Administration Constanţa has drawn up several stages in order to build a Barge Terminal. This investment aims at improving navigation conditions and extending facilities for mooring river ships in the southern area of the port.

The two northern and southern dams shelter the harbour and create optimum safety conditions for port activities. Currently, the total length of the North Dam is 8,344 m and the South Dam is 5,560 m.

The Port of Constanţa has an annual operating capacity of over 120 million tons and depths in port basins up to 19 m.

These features are comparable to those provided by the most important European and international ports, allowing access to and operation of tanks with a capacity of 165,000 dwt and bulk carriers with a capacity of 220,000 dwt.

The Port of Constanţa serves efficiently the flows of goods that come from/go to the countries of Central and Eastern Europe, including Austria, Bulgaria, Hungary, Moldova, Slovenia, Slovakia, Ukraine and Serbia.

Port infrastructure development projects

In 2015 the Masterplan of Constanţa Port was prepared, including a medium and long term port strategic planning (until the year 2040) under the provision of a continuous port development and efficient use of the existing resources and infrastructure (source: Master Plan Port of Constanţa, Final report, December 2016, Ernst & Young SRL -INROS LACKNER SE).

In these days there are some development projects regarding the port infrastructure like:

S1 Modernisation of port infrastructure, by providing deeper approach channels and basins and by increasing the navigation safety in the port of Constanţa (S1 Master Plan)

S2 Implementation of Deep Water Specialized Berth (Berth 8 0) (S2 Master Plan)

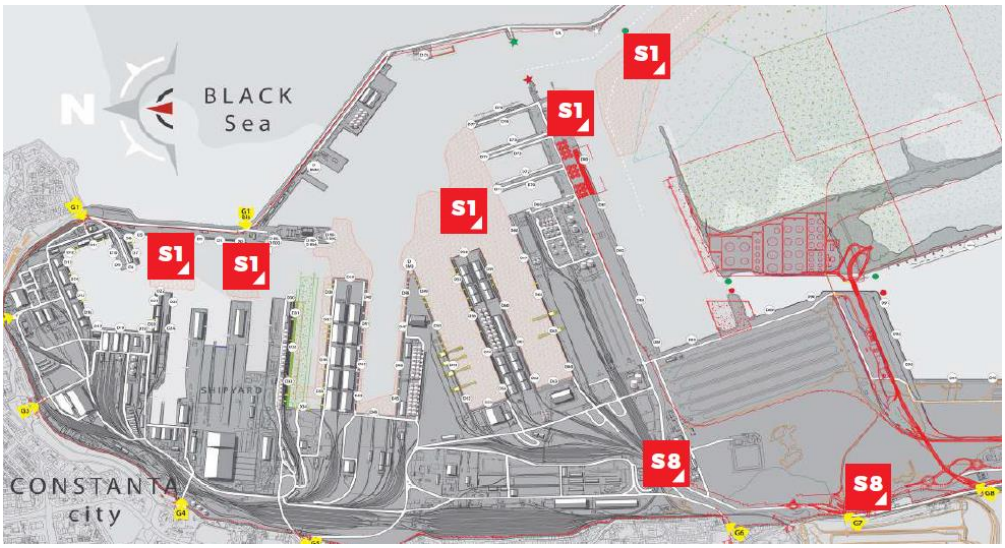


Figure 2.6 Localization S1 and S8 projects on Constanţa port map
(source: Annual Report 2017 – CN AMPC)

S8 Expansion of road between Gates 7 and the junction with "Road bridge at km 0+540 of the Danube Black Sea Canal" [...] (S8 Master Plan)

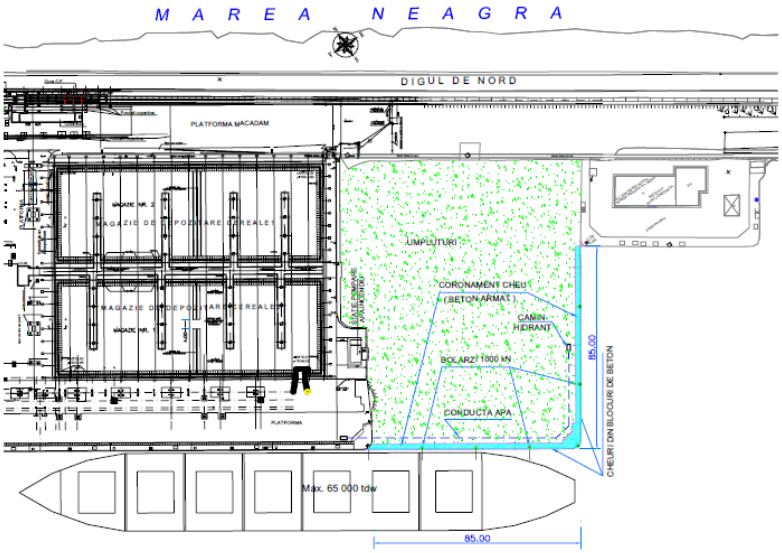


Figure 2.7 Localization Berth barge on Constanţa port map
(source: Master Plan Port of Constanţa, Final report, December 2016, Ernst & Young SRL -INROS LACKNER SE)

Barge Terminal at Constanţa South Port (2nd Stage) (M1)

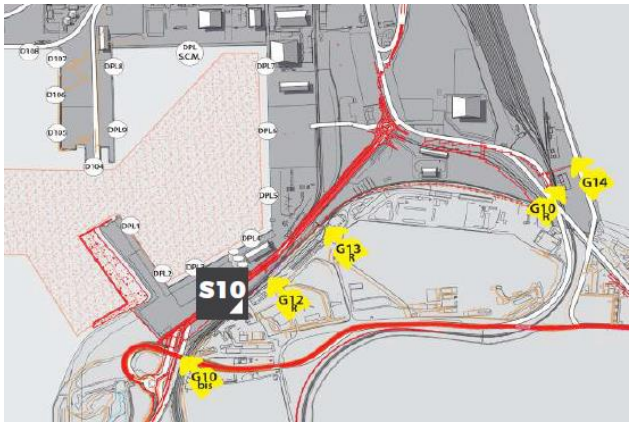


Figure 2.8. Localization S10 project on Constantza port map
(source: Annual Report 2017 – CN AMPC)

S10 Expansion to 4 lanes of the road between Gate no.10 bis and Gate no.10 (S10 Master Plan)

Upgrade of infrastructure and environmental protection of Constanţa port – PROTECT This project is part of the Constanţa Port administration's concerns regarding the provision of a clean, safe environment, thus contributing to the protection of the ROSPA 0076 - Black Sea area.

Planned project in the Port of Constanţa (2018–onward)

There are many other projects from the Masterplan of Constanţa Port that will be implemented in the future, like:

1. RoRo and Car Terminal in Constanţa South Port-Agigea (Pier IIIS) (S3)
2. Container Terminal on the artificial Island (without EPZ) (M5-L2-L3-B)
3. LNG Bunkering Station at Berth no. 99 (M7)
4. Container Terminal at the Island - 1st Stage (with EPZ) (M5-A)

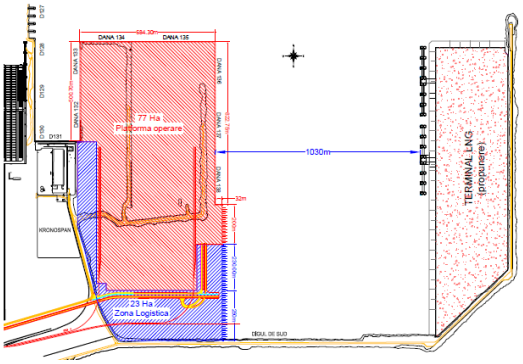


Figure 2.9. The general plan of the container terminals MOL IIIS and MOL IVS
(source: Master Plan Port of Constanţa, Final report, December 2016, Ernst & Young SRL -INROS LACKNER SE)

Table 2.1 Principal characteristic from the harbours (source masterplan CN APMC)

	Constanţa North Harbour	Constanţa South Harbour	Mangalia Harbour	Midia Harbour
Total Area [ha]	817	3109	189.6	823.9
Land [ha]	495	818	32.9	223.8
Water [ha]	322	2291	156.7	600.1
Length [km]	3.5	10.46	2.9	6.8
Length [km]	15.5	14.6	0.5	2.2
Number berths	82	74	2	13
Deep water [m]	14	19	10	10

The Port of Midia is a merchant port with public infrastructure located on the west coast of the Black Sea, about 7 miles north of the Port of Constanţa, neighbouring Năvodari and Corbu. It has a total area of 834 ha, of which 600 ha represent the surface of the basin and 234 ha represent the surface of the territories. Vessels entering/leaving the port use the roadstead of the Port of Constanţa.

The Midia Port is positioned at a major point of the Romanian coastal area (e.g., Cape Midia), at the junction between the northern and southern units of the Romanian Black Sea coastline (see Figure 2.10 a). The Midia Harbour is situated between the Northern Unit, a part of the Danube Delta Biosphere Reserve (an area around 6,000 km^2)

Figure 2.10. The aerial image of the Romanian Black Sea coastal area, including the Midia Port location (a), and an image showing the Midia Port zone (b) (Source: https://www.researchgate.net/figure/The-aerial-image-of-the-Romanian-Black-Sea-coastal-area-including-the-Midia-Port_fig1_299997581)

To the north and south, the Midia Port is bordered by breakwaters, having a total length of 6.97 km (see Figure 2.10 b). The harbour covers a total surface of 834 ha, of which a 234 ha area is represented by land, and 600 ha by water. Within the port, there are 14 berths (e.g., 11 operational and the other 3 belong to Constanţa Shipyard), with a total length of 2.24 km.

There are 14 berths (11 operational berths, 3 berths belong to Constanţa Shipyard) with a total length of 2,24 km.

Table 2.2. Berths of Midia Port

Berth	Length (m)	Max depth (m)	Cargo
1 – 4	532	9.0	Crude oil
5 – 8	637.6	9.0	Live stock
9	204	9.0	Petroleum products
10 – 11	191.3	9.0	General cargo
3 berths belong to Constanţa Shipyard		Ship maintenance and repair	

Further to dredging operations performed the port depths are increased to 9 m at crude oil discharging berths 1-4, allowing access to tankers having a 8 m maximum draught and 20.000 dwt.

Main cargoes: crude oil and derivatives, agribulk, GPL and metallic products.

Connections: road, railway, inland (via Poarta Alba-Midia Năvodari Canal)

Facilities: Quay cranes 2 x 6.5 t (1x 10t – Global Op.).

Storage: Warehouses = 3 x 720 = 2.160 m^2 and platform = 10.780 m^2

Barges: There is a river-maritime access in the port via Danube-Black Sea Canal (Poarta Alba – Năvodari branch)

The Port of Mangalia is a merchant port with public infrastructure located on the western coast of the Black Sea, about 20 Mm south of the port of Constanţa, alongside to Mangalia city and the corresponding shipyard. The port has a total area of 187 ha, of which 156 ha represent the surface of the port basin, and 31 ha represent the surface of the territories. The Port of Mangalia has an open roadstead.

Figure 2.11. The aerial image of the Romanian Black Sea coastal area, including the Mangalia Port location and DAMEN shipyard
(source: http://www.aries-shipping.ro/port-directory/port-information/mangalia-port.php)

Table 2.3. Berths of Mangalia Port

Berth	Length (m)	Max depth (m)	No of berths	Location
General cargo	419	9.0	2	berth 1, 2
Technical Vessels Berth	105	5.5	1	berth 4
Fitting-out Berth	95	5.5 – 9.0	1	berth 3

The N and S breakwaters have a total length of 2.74 km. There are 4 berths (2 operational berths) with a total length of 540 m. The max. depth is 9 m.

Main cargoes: chemicals, fertilizers, bitumen, general cargo

Facilities: Quay cranes available: 1 x 120t, 3 x 50t, 1 x 15t, 4 x 6.3t.

Storage: Open storage of 20,000 m^2 and covered storage of 4,300 m^2 available.

Legislation

Industry is one of the pillars of the European economy – the manufacturing sector in the European Union accounts for 2 million enterprises, 33 million jobs and 60% of productivity growth. We stand on the brink of a new industrial revolution, driven by new-generation information technologies such as the Internet of Things (IoT), cloud computing, big data and data analytics, robotics and 3D printing. Recent studies estimate that digitisation of products and services can add more than EUR 110 billion of annual revenue to the European economy in the next five years. However, high-tech sectors face severe competition from other parts of the world and **many traditional sectors** and small and medium enterprises (SMEs) are lagging behind. There are also large disparities in digitisation between regions.

For reasons of maximising efficiency and avoiding duplication of efforts, there is a need to build on existing national and Union platforms. The EU legislation therefore includes the requirement on Member States to develop and maintain the necessary technical interfaces for electronic data transmission to the SafeSeaNet. This will be further explored through the linking with the National Single Windows (where information is reported once and made available to the various competent authorities), once operational in 2015. Hence, under normal circumstances, the same maritime picture can be used for trade facilitation purposes as well as for enforcement and control purposes in the fields of customs, sea border control, health and general law enforcement.
(https://ec.europa.eu/transport/modes/maritime/digital-services/safeseanet_en)

To further enhance the situational awareness in the maritime domain and to provide tailor-made solutions to authorities, vessel traffic monitoring Directive, has been recently amended (Directive 2014/100/EU), accommodating exchange, sharing, monitoring, surveillance, positioning and observation.

The European Parliament and the Council adopted Directive 2010/65/EU on reporting formalities for ships arriving in and/or departing from ports of the Member States. This directive is more commonly known as the Reporting Formalities Directive (RFD). The

objective of the RFD is to simplify and harmonise the administrative procedures applied to maritime transport and it sets an obligation for Member States to establish National Single Windows (NSW) for reporting formalities from ships arriving in and/or departing from ports by 1 June 2015 for the 14 reporting formalities listed in the Annex of the RFD. The information should be submitted electronically and only once thus removing the need of submitting same or similar information separately to different authorities. Furthermore, the Directive requires that the reporting formalities are requested in a harmonised manner in all ports within an EU country.

In 2016, the Commission launched a REFIT evaluation of the RFD together with the VTMIS Directive. The outcome of the support study leads to the conclusion that the objectives of the RFD were not (or only partially) attained:

Paper reporting is still used to a certain extent in more than 50% of ports, often as duplication;

- Reporting is only fully digitalized and harmonized only in a few EU countries;
- True single window submits only-once reporting is available only in a few EU countries;
- The information is seldom shared and re-used, notably between EU countries;

Furthermore, not enough progress has been made on the EU level harmonisation - all NSWs implemented are different. Therefore, the positive impact of National Single Windows is small, sometimes even negative for the shipping industry.

The Member States and the industry are requesting the Commission to act urgently. On 29 March 2017, the EU Transport Ministers underlined in the 'Valetta Declaration' the shortcomings of the Reporting Formalities Directive and invited the Commission to propose a follow-up to the evaluation of the RFD, which would include a harmonised European Maritime Single Window environment. In their joint statement on 1 March 2017, major EU shipping associations urged the EU to launch a fundamental overhaul of the Reporting Formalities Directive with a view to create a true European Maritime Single Window environment. The Valletta Declaration was endorsed by the Council of the EU on 08 June, 2017. (https://ec.europa.eu/transport/modes/maritime/digital-services/e-maritime_en)

The option of basing harmonisation on a system of mandatory **port community systems** (commercial platforms) was discarded early in the analysis, as fewer than half of all EU ports have such systems today. Making **port community systems** mandatory was considered disproportionate and inconsistent with the subsidiarity principle. It would also have incurred high additional costs for both Member States and industry. The main impact of the options analysed is to reduce the administrative burden on shipping operators. This will in turn boost the efficiency and competitiveness of maritime transport, with a slight shift between transport modes (from road to waterborne transport) as the likely result. It will also improve ship masters' job quality and make the profession more attractive as in 2018/0139 (COD) „Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a European Maritime Single Window environment and repealing Directive

2010/65/EU". The benefits are substantially higher in a comprehensive scope scenario than in the limited scope option. The costs arise primarily from the need to adapt and maintain the technical specifications and IT systems on which the harmonised reporting gateways will be based. Compared with the baseline costs of running the National Single Windows today, both Member States and the EU will need to make a one - off investment, and annual operational costs will be slightly higher. (https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180278-proposal.pdf)

The integrated maritime services are used by other EU Agencies e.g. providing operational services in the areas of anti-piracy, fisheries campaign monitoring and border control on behalf of EU-NAVFOR, EFCA and FRONTEX, respectively. It is also supporting the objectives of MAOC-N, a platform for cooperation in the fight against illicit drug trafficking by sea. The services are also offered to all EU/EEA states, allowing them to make full use of the system and can be tailor-made for specific national purposes such as coastal radar or patrol assets. In future, users will also be able to access vessel behaviour patterns and meteorological and oceanographic data. By developing the system and platform in this way it supports the facilitation and establishment of the maritime internal market – the European Maritime Transport Space without barriers while still maintaining safety, security and sustainability.

Resolution no. 517/1998 regarding the establishment of the National Company "Maritime Ports Administration Constanţa" - Co., with subsequent amendments and completions

https://ec.europa.eu/digital-single-market/en/news/final-report-study-egovernment-and-reduction- administrative-burden-smart-20120061

European Commission, White paper: Roadmap to a Single European Transport Area, COM(2011) 144 final, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0144&from=EN

Communication and action plan with a view to establishing a European maritime transport space without barriers, COM (2009)10 final

Council conclusions on Priorities for the EU's maritime transport policy until 2020: Competitiveness, Decarbonisation, Digitalisation to ensure global connectivity, an efficient internal market and a world-class maritime cluster, adopted by the Council at its 3545th meeting held on 8 June 2017, http://data.consilium.europa.eu/doc/document/ST-9976-2017-INIT/en/pdf

Council conclusions on the digitalisation of transport, adopted by the Council at its 3581st meeting held on 5 December 2017
http://data.consilium.europa.eu/doc/document/ST-15431-2017-INIT/en/pdf

Joint industry statement, 1 March 2017,
https://www.europeanshippingweek.com/joint-industry-statement-clia-europe-eba-ecasba-ecsa-empa-eta-etf-euda-interferry-wsc/

European Community Shipowners' Association, Newsletter 22 December 2017: A single market for shipping– time to make it happen, http://www.ecsa.eu/news/single-market-shipping-time-make-it-happen

https://ec.europa.eu/info/sites/info/files/mobility_and_transport_1.pdf

International Maritime Organisation's Convention on Facilitation of International Maritime Traffic adopted by the International Conference on Facilitation of Maritime Travel and Transport on 9 April 1965

Directive 2002/6/EC of the European Parliament and of the Council of 18 February 2002 on reporting formalities for ships arriving in and/or departing from ports of the Member States of the Community (4) requires Member States to accept certain standardised forms (FAL forms) in order to facilitate traffic, as defined by the International Maritime Organisation (IMO) Convention on Facilitation of International Maritime Traffic (FAL Convention) (https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32002L0006)

Directive 2010/65/EU of the European Parliament and of the Council of 20 October 2010 on reporting formalities for ships arriving in and/or departing from ports of the Member States and repealing Directive 2002/6/EC (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1542486706098&uri=CELEX:32010L0065)

Proposal for a Regulation of the European Parliament and of the Council establishing a European Maritime Single Window environment and repealing directive 2010/65/EU (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018SC0181&rid=5)

Regulation (EC) No 725/2004 of the European Parliament and of the Council of 31 March 2004 on enhancing ship and port facility security (https://publications.europa.eu/en/publication-detail/-/publication/eeccddc7-070a-473c-9c21-3740d61fe1bd/language-en)

Regulation (EU) No 952/2013 of 9 October 2013 laying down the Union Customs Code (OJ L 269, 10. 10. 2013) (only part of customs formalities currently covered by the RFD scope) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0952)

Report from consultation event with the HLSG expert sub-group meeting on Single Window, Brussels, 26th October 2017; Consultation synopsis report, Annex 2

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions, European Union Strategy for Danube Region, COM/2010/0715 final

General Master Plan of Transport in Romania- Revised final version of the Report on the Master, Short and Medium-Term Plan, Ministry of Transport, September 2014

Regulation (EU) 2017/352 of the European Parliament and of the Council of 15 February 2017 establishing a framework for provision of port services and common rules of the financial transparency of ports

Regulation no. 1315/2013 of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU

Special Report Inland Waterways Transport in Europe: Since 2001, there have been no significant improvements in terms of modal share and navigation conditions, the European Court of Auditors, Luxembourg, the Publications Office of the European Union, 2015

2.2 The analysis of the existing situation and deficiency identification

The analysis of the existing situation was based on the research carried out on the websites of the Constanța Maritime Port Administration, the Romanian Naval Authority (RNA), as well as on the interviews conducted by the research team with members of the two mentioned authorities.

Also, the research team has conducted interviews with representative port operators as well as IT experts from companies on the port platform.

From a methodological point of view, the respondents had to respond to a questionnaire with relevant field specific questions that revealed important information about the document flow within the company and the relationship with the port authority and its partners.

According to the European Port Community Systems Association (EPCSA) guide for Port Community System users, **they are members of a port community,** which may differ from one port to another, and **they** may be divided into four groups:

The first group consists of **coordinators and regulatory authorities**: this group consists of two subgroups.

The first sub-group consists of the port authority, the naval authority and the port master's office - the port control center, responsible for the planning, coordination and control of port activities.

The second subgroup consists of members who carry out activities to maintain a high level of security in the seaport: customs, port police and various inspection services.

The second group is represented by **port users**: it includes shipping companies, pilotage companies, tugs, service companies, shipping agencies and freight forwarders (logistics-shippers). **Port user terminology** are recommended by Institute of Chartered Shipbrokers (www.ics.org.uk).

The third group is represented by **carriers**: rail and road transport operators.

The fourth group is represented by **other members**: companies that do not participate directly in the operations carried out in the port, such as banks and insurance companies.

All of these group members are referred to as "stakeholders".

A port community consists of members, private and public entities, operating in the port area and providing port services. A "port community" consists of all economic activities related to the arrival of ships and goods that are carried out in the port region. The port community area varies from port to port, depending on the size and development of the seaport, but generally, it includes a surrounding or wider area close to the developed logistic - transport network.

During regular shipping operations, the entire port community should act in coordination and should agree on an hourly work plan when data is loaded into the IT system.

The complexity of activities carried out in a seaport, mainly given by the variety of stakeholders representing the port community, as well as the large number of data, messages and documents exchanged between the port community members, highlights and enforces the need to implement integrated ICT systems to maintain competitiveness on the port level and to achieve superior service quality.

A large number of stakeholders, depending on the activities and type of activity, have a role to play in the functioning of the Port Community. Actors communicate with each other through various means (paper documents, fax, telephone, e-mail, radio communications). Data is often copied multiple times, from one document to another or sent/received from several devices belonging to the port community members, resulting in errors and slowing processes in seaports.

In the figure below we illustrate the complexity of communication between the port community members and the way in which the exchange of documents and information between stakeholders in the port area is currently taking place.

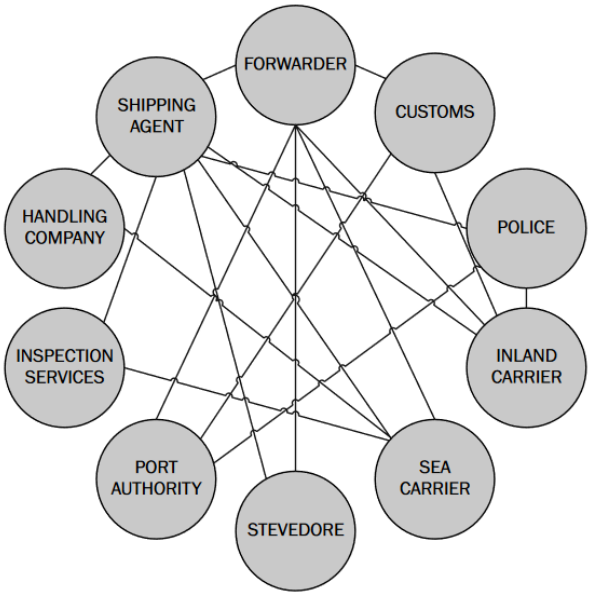


Figure 2.12 Exchange of information and documents between stakeholders in the port area currently

As it can be easily noticed, the transfer of information is varied and apparently chaotic, with a great deal of redundancy in transmitting it to different entities, both in electronic format, especially printed and scanned or reported orally whereas this information is loaded manually into the system for each port operator and for each category of goods.

Administrative processes related to the arrival and departure of ships to and from the port (and also the movement of ships within the port to different operating terminals) include numerous documents and certificates. During the research, data from vessel arrival forms was analysed to identify repetitive entries. The analysis has shown that a large number of ship data is repeated many times, increasing the possibility of errors and causing unnecessary losses due to the multiple input of manual data.

Each member of the port community provides a set of activities (according to their specificity) and therefore participates in maritime and port operations.

The Constanța Maritime Port Administration has the most important role as initiator and creator of the port development strategy and coordinator of the entire Port Community.

The port authority is a field manager responsible for the safe, sustainable and competitive development of the port.

The Government of Romania issued Decision no. 517/1998 regarding the establishment of the National Company Constanta Maritime Ports Administration which is organized and operates in accordance with the laws in force and has the status set forth in the appendix which forms an integral part of the judgment establishing.

Under the provisions of Law 235/2017, port administrations are set up according to the form of ownership of the port infrastructure that may belong to the public or private domain of the state; the public or private domain of the administrative-territorial units; or the private domain.

Thus, CNAPMC is the institution designated by the Ministry of Transport which fulfils the function of port authority and has as main activity the application of the port policy elaborated by the Ministry, the coordination of the activities taking place in the ports and the implementation of the port infrastructure development programs. In this respect, CNAPMC ensures the management of the ports and follows or ensures the provision of the port security services such as:

- Pilotage of seagoing and river vessels at and from ports, and/or between berths of the same port;
- maneuverer towing of seagoing and river vessels in ports,
- Ensure the carrying out of ancillary activities to the shipping activities, including the maintenance and repair of the shipping infrastructure, coastal and floating signalling for navigation, maintenance dredging to ensure depths in ports and the assistance of ships to the operation of dangerous goods, the takeover of residues and waste water ships and general garbage collection including ships.

Port Operators carry out cargo planning and handling activities. In order to ensure that the processes they carry out are performed in accordance with the regulations, the transport police, customs authorities and inspectorates supervise the carriage of goods and ensure safety in the seaport.

The customs authority is also responsible for collecting certain government taxes. The port users (shipping companies, passengers, shipping agents, freight forwarders, etc.), on the basis of concession/rental contracts, carry out various activities in the port area: towing, storage, cargo handling etc.

Maritime agents and freight forwarders have a special role as coordinators in the process of ship arrival/departure and of importing or exporting cargo through the port.

Carriers are important members of the port community because they allow the flow of goods to and from the port, on rail, road, river or at sea.

Other members of the port community do not participate directly in maritime operations; for example, banks and insurance companies.

In the Romanian ports, there is a large traffic of data, documents and messages, which are exchanged daily between the members of the port community and the port authorities. The exchange of documents is partly achieved on electronic support, but mainly on paper, which implies higher costs, the possibility of errors (largely due to multiple inputs of the same data) etc.

The longevity of the whole process should be a significant driver for the implementation of modern ICT systems.

The most important documents in maritime and port operations are:

- Cargo Manifest: description of goods to be loaded or unloaded into/out of the ship.
- Announcement from the railway carrier: Communication with CFR infrastructure by daily notification of goods arriving on or leaving the railways and accessing the port operator at the port.
- Declaration confirming that the carrier has received the cargo for transport on the ship and agrees that upon completion of the shipment it will deposit the goods to the authorized holder of a transport document. The quantity of goods specified in the transport document must be the same as that of the Cargo Manufacture.
- Ship Arrival Report: provides details on ship's arrival and her characteristics.
- Declaration on dangerous/polluting goods: declaration of the presence of hazardous cargo on board and compliance with the rules by the ship in the transport of dangerous goods.
- Hazardous Goods Declaration: Report to the Port Authority on loaded/unloaded cargo classified in accordance with the International Maritime Dangerous Goods Code.
- Ship's permission to communicate with the shore: the issue of a permit for the ship to access the inland port area.
- Vessel departure permit: release of a permit for the ship to leave the port.
- Berthing report: report of the ship mooring at the operation berth for carrying out loading or unloading activities.
- Cargo Manifest: description of goods to be loaded or unloaded.
- Notification from the railway carrier: Communication with CFR infrastructure (Romanian Railway Company) by daily notification of goods arriving or leaving by railway and accessing the port operator in the seaport.

- Declaration confirming that the carrier has received the cargo for transport by ship and agrees that upon completion of the shipment to deposit the goods with the authorized holder of a carriage document. The quantity of goods specified in the carriage document must be the same as that in the Cargo Manifest.

It has been ascertained that there are currently a number of applications in the computerized system for port activity, which regulate part of the data flow required at the operational level of the Constanţa Maritime Port Administration (APMC), as well as the existence of other applications partially taken over from the Romanian Naval Authority (RNA), which allow the exchange of institutional data.

Constanţa Maritime Port Administration implemented a proprietary solution in 1998 namely NEPTUN Information System, consisting of a highly integrated ERP application system covering some of the activities characteristic for port administrations. The integrated ERP system implemented within the administration is outdated (over 20 years old) and is not connected to the new needs of the port administration in accordance with the national and European legislation and is not in line with the new EU directives to which Romania is a signatory. NEPTUN Information System includes applications designed to automate the following types of activities:

- Port activity: Management of sea and river traffic (ships, arrivals, manoeuvres, departures), cargo traffic, port events;
- Financial, Accounting: Financial Management, Financial Accounting, Management Accounting, Budgets, Fixed Assets, Inventory Objects;
- Commercial: Contracts, Litigation, Ship Repositories, Rental Deposits, Billing;
- Maintenance: Equipment Maintenance/Repair, Infrastructure and Superstructure Maintenance, Invoice Calculation Interface, Maintenance/Repair Material Stocks, Supply of Maintenance/Repair Materials, Fuel Consumption for Ships and Heat Plants;
- Services: Distribution services of communications, electricity, heat, water; Miscellaneous services; General inventory management; General Management of Supply;
- Investments: Investment Plans, Public Procurement, Management of Works Invoices;
- Human Resources, Payroll: Employee Record, Recruitment, Assessment Center, Remuneration;
- Access Control: Managing Port Access Information;
- Management Information System: Analysis of Financial and Accounting Indicators, Port Traffic Analysis.

Based on the audit carried out at the specialized departments of APMC, it has been ascertained that they use applications for port activities available in the structure of the IT system. These applications are used computationally in the following activities:

- ✓ pilotage bulletins, manoeuvres permit through the “Ship Catalogue” module of IPS (Integrated Port System)
- ✓ Management of vessel movement in port and freight traffic - “Port activity” mode of the NEPTUN Information System.

✓ Management of free passes in the port area for cars by means of the "Car Access Control" mode of the Neptun Computer System.

✓ Applications for access - the management of applications for individual access cards

When a ship/vessel arrives in a Romanian port, the following general information must be available (source http://navlomar.com/romanian-ports):

1. ETA/ETD;
2. Vessel's name/former names/ call sign/flag;
3. IMO number/MMSI number;
4. Type of vessel/year of built;
5. GRT, NRT, DWT, LOA, breadth;
6. Maximum draft, arrival draft, intended departure draft;
7. Owner's/Operator's/Charterer's name and address;
8. Agent's name and address;
9. Master's full name;
10. Number of crew (including master)/number of passengers;
11. Purpose of call;
12. Last port of call/next port of destination;
13. Cargo on board, cargo to be discharged/loaded, quantities/hatch distribution. (if dangerous cargo, UN number/class in accordance with IMDG or IBC, BCH, IGC, INF Code must be specified);
14. Quantity of ballast to be discharged and provenance;
15. Capacity of sludge/bilge tanks, Quantity of sludge/bilge;
16. Ship's statutory certificates expired on arrival;
17. Validity of ISM certificates (DOC, SMC);
18. Date and place of last PSC report;
19. Any deficiency of hull machinery or equipment may affect safe manoeuvrability of the vessel, affect the safety of the other vessels, constitute a hazard to the marine environment, to person or property;

Also there is supplementary information for tankers only:

1. Whether gas free or in an inert condition;
2. Validity of Civil Liability Certificate (for tankers of more than 2,000 dwt.);
3. Quantity of segregated/clean/dirty ballast on board;
4. Quantity of ballast to be delivered ashore;
5. Capacity/quantity of slop tanks;
6. COW time, if to be performed

Required documents:

On vessel's arrival/departure, the port authorities require the following IMO standard FAL documents:

- 5 (copies) IMO General Declaration,
- 5 (copies) IMO Cargo Declaration
- 3 (copies) Ship's Stores List
- 2 (copies) Crew Effects Declaration
- 5 (copies) Crew List
- 5 (copies) Passenger List
- 2 (copies) Cargo Plan
- 1 (copy) Maritime Declaration of Health
- 1 (copy) Deratisation Certificate, Deratisation Exemption Certificate
- 1 (copy) Phytosanitary Declaration
- 2 (copies) Sanitary-Veterinary Declaration (in case of vessel carry perishable and agricultural cargo, live animals etc.)

The FAL documents will be dated and signed by Master, authorized Agent or Officer. In addition to the above, the following documents have to be available on board:

1. For all ships:

✓ Certificate of Registry
✓ International Tonnage Certificate
✓ International Load Line Certificate
✓ International Load Line Exemption Certificate
✓ Stability Information for Passenger Ships and Cargo Ships
✓ Minimum Safe Manning Certificate
✓ Certificate for Masters, Officers and Ratings
✓ International Oil Pollution Prevention Certificate:
✓ Record of Construction and Equipment for Ships other than Tankers
✓ Record of Construction and Equipment for Oil Tankers
✓ Shipboard Oil Pollution Emergency Plan
✓ Document of Compliance (copy)
✓ Safety Management Certificate

2. In addition to the requirements in the section 1, the passenger ships must have on board:

✓ Passenger Ship Safety Certificate

- ✓ Record of Equipment for the Passenger Ship Safety Certificate
- ✓ Exemption Certificate
- ✓ Special Trade Passenger Ship Safety Certificate
- ✓ Special Trade Passenger Ship Space Certificate

3. In addition to the certificates mentioned in the section 1, the cargo ships must have on board:

- ✓ Cargo Ship Safety Construction Certificate
- ✓ Cargo Ship Safety Equipment Certificate
- ✓ Record of Equipment for the Cargo Ship Safety Equipment Certificate
- ✓ Cargo Ship Safety Radio Certificate
- ✓ Record of Equipment for the Cargo Ship Safety Radio Certificate
- ✓ Exemption Certificate
- ✓ Document of Compliance with the Special Requirements for Ships Carrying Dangerous Goods
- ✓ Dangerous Goods Manifest or Stowage Plan
- ✓ Document of Authorization to Load Grain
- ✓ Certificate of Insurance or Other Financial Security in Respect of Civil Liability for Oil Pollution Damage

4. In addition to the requirements mentioned in sections 1 and 3, all ships carrying noxious liquid substances must have on board:

- ✓ International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (NLS Certificate)
- ✓ Cargo Record Book

5. In addition to the requirements mentioned in the sections 1 and 3 all tankers for chemical products carriage must have on board:

- ✓ Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk (or International Certificate of Fitness for Carriage)
- ✓ Certificate of Fitness for the Carriage of Liquefied Gases in Bulk (or International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)

6. In addition to the requirements mentioned in the sections 1 and 3, all the tankers for liquefied gases carriage must have on board:

- ✓ Certificate of Fitness for the Carriage of Liquefied Gases in Bulk (or International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk)

7. In addition to requirements mentioned in the sections 1 and 3, all the high speed craft must have on board:

- ✓ High Speed Craft Safety Certificate
- ✓ Permit to Operate High Speed Craft

Other Certificates

Special Vessels

- ✓ Special Purpose Ship Safety Certificate
- ✓ Additional Certificate for Offshore Supply Vessels Carrying Limited Quantities of NLS in Bulk

Diving Systems Diving System Safety Certificate

Dynamically Supported Craft - Dynamically Supported Craft Permit to Operate

Mobile Offshore Drilling Units - Mobile Offshore Drilling Unit Safety Certificate

Noise Survey - Noise Survey Report

Note: All the certificates required on board must be original.

The "Maritime Single Window" electronic platform was implemented by the Romanian Naval Authority on the basis of the implementation of the Maritime Single Window Directive 2010/65/EU which has been active since June 2015. Thus:

(1) Vessels shall report data electronically

(2) Vessels shall report the following data in a predefined format only once:

- 72h PSC pre-arrival notification Ship Agents
- 24h Pre-arrival Port Plus Notification
- Arrival notification
- Departure notification
- Notification of dangerous or polluting goods carried on board
- Notification of waste and residues
- Notification of security information
- Border checks on persons
- Maritime Declaration of Health
- FAL form 1: General Declaration
- FAL form 2: Cargo Declaration

- FAL form 3: Ship's Stores Declaration
- FAL form 4: Crew's Effects
- FAL form 5: Crew List
- FAL form 6: Passenger List
- FAL form 7: Dangerous Goods

(3) National authorities shall cooperate with each other

(4) MSW shall use the same types of data as detailed under no. 2) once

Following the discussions with the shipping agencies, it has been established that currently ***reports to port authorities*** of formalities of reporting for ship arrival and/or departure from Romanian ports (documents currently provided for in Directive 2010/65/EU - Directive on Formalities of Reporting

http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/615681/EPRS_BRI(2018)615681_EN.pdf), including standard forms and certificates issued under the FAL Convention, are made ***in printed format***, although the IMO recommends using the electronic exchange of information and the use of e-certificates. It is worth mentioning that the IMO has adopted guidelines for the use of electronic certificates as early as 2016

(http://www.imo.org/en/OurWork/Facilitation/ElectronicBusiness/Documents/FAL.5-Circ.39-Rev.2%20-%20Guidelines%20For%20The%20Use%20Of%20Electronic%20Certificates%20(Secretariat).pdf).

The Maritime Single Window application from the Romanian Naval Authority (ANR), which allows the exchange of institutional data, informs on the following reports (according to the "Manual v0.4" of Maritime Single Windows - msw.ro):

Report forms according to EU legislation

- Notices of ship arrival at/departure from ports in EU Member States (Article 4 of Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system);
- 72h prior notice for ships eligible for expanded inspection (Article 9 of Directive 2009/16/EC on Port State Control);
- Arrival/Departure Notice (Article 24 of Directive 2009/16/EC);
- Border controls on persons (Article 7 of Regulation (EC) No 562/2006 - Schengen Borders Code);
- Notification of dangerous or polluting goods carried on board (Article 13 of Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system);
- Notification of waste and residues (Article 6 of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues);

- Notification of security information (Article 6 of Regulation (EC) No 725/2004 on enhancing ship and port facility security);
- Entry brief declaration (Council Regulation (EEC) No. 2913/92 - Community Customs Code and Regulation (EC) No 450/2008 - Modernized Customs Code).

- FAL declarations according to international legislation (declarations FAL 1-7, health maritime declaration);
- Information to be provided according to the national legislation:
  - Goods formalities;
  - Waste delivery notice
  - Fuel remaining on board;
  - Civil liability certificate for damage caused by hydrocarbon pollution;
  - Ship damage.

ANR also has the RORIS II system that could provide important data for APMC regarding ships entering the seaports (Constanţa, Midia, Mangalia) and arrive at these ports via the Black Sea or the Danube.

The RORIS II system consists in a ship identification and tracking sensor network like the AIS (Automatic Identification System), radar and CCTV (Close Circuit Television). The concept and structure of the communications support network is completely redefined by the digital transfer of all information (including voice messages) into IP (Internet Protocol) technology.

According to their home page (http://www.roris.ro/portal/prezentare-ris/sistem-ris.aspx), the RORIS II system provides the following services:

- voyage electronic reporting;
- notices for navigators;
- water lock management;
- ship traffic statistics;
- ship registration/ tracking application - it is a flexible and fast tool that provides an overview of Romanian flag vessels and their evolution over time in terms of technical characteristics and legal status;
- seafaring personnel application/database - it provides a computerized work environment in the areas of electronic document management and archiving by providing a solid platform for managing and archiving documents and records;
- database application for ship identification (hull database);

Among the RIS services mentioned above, the following may be useful for APMC:

- electronic voyage reporting (of interest to APMC would be the ERINOT message);
- ship traffic statistics;
- ship registration/tracking application - is a flexible and fast tool that provides an overview of Romanian flag vessels and their evolution over time in terms of technical characteristics and legal status;

- Database application for ship identification (hull database);
- Dangerous Goods vessel monitoring application;
- Synthetic information on inland waterway traffic

The two Single Window interfaces, namely the Maritime Single Window, as well as the RORIS II System, already implemented by the Romanian Naval Authority, could successfully integrate into the architecture of a Port Community System and many types of data from these applications can be interchanged:

- Real-time ship tracking and record data (AIS and Radar)
- cargo information;
- dangerous goods;
- statistical data and analyses;
- sensor information: radar, AIS;
- other information from ANR management:
  - a database of ship and ship-owner information, etc.;
  - a database of seafaring personnel.
- Real-time ship localization (AIS and Radar);

Also, on a port operator level, there are different IT applications for data and information exchange with port authorities, part of them developed by APMC and/or ANR and made available to operators for data reporting.

Some of the port operators have developed their own IT applications precisely in order to streamline their work in the company and meet the requirements enforced by port or maritime authorities.

The major disadvantage of this non-integrative development is given by the heterogeneity of computer systems and data formats that do not allow direct interconnection between systems.

For the management of the freight flows that come via railway routes, the port operators have the right to use the various applications implemented by the Railway Informatics

(https://www.infofer.ro/index.php/ro/companie/informatii-de-interes-public/sisteme-si-aplicatii),

through which they route their freight train convoys to different operating terminals. Among the useful applications developed by the Railway Informatics and which can be integrated into the future PCS platform, let us mention IRIS ARGUS - a software application specializing in the management of railway freight operations, the APOLLO application, which allows the tracking of commercial sales, settlement and statistical reporting activities in the rail freight transport, electronic completion and management of transport documents in

accordance with national and international regulations and technical specifications for Interoperability for Telematics Systems (TAF TSI) etc. The implementation of modern integrated ICT systems is therefore one of the key factors for the inclusion of ports (Constanţa, Midia and Mangalia) in modern logistics flows, with the final result of achieving and maintaining competitiveness in the world maritime trade. As the flow of information required to be reported is diverse and massive, it is necessary to implement a platform to which all stakeholders (members of the port community) have access and can exchange necessary information for their fluidization.

2.3 Demand analysis, medium and long-term prognoses;

Any technological leap in the maritime field has as its rationale and source of financial and logistical support the freight flows and high freight traffic in the port area.

Among other countries reporting maritime freight data to Eurostat, Romania handled close to 46.2 million tons of goods in 2016, being on the 21st position in EU28 in terms of total tonnage of seaborne goods handled.

Table 2.4: Gross weight of seaborne goods handled in all ports, 2006-2016 (in million tons) Source: Eurostat https://ec.europa.eu/eurostat/statistics-explained/index.php/Maritime_ports_freight_and_passenger_statistics#Most_EU_maritime_freight_transport_is_with_extra-EU_partners

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016			Growth rate 2015-2016 (%)	Growth rate 2006-2016 (%)
	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Inwards	Outwards	Total		
EU-28	3 860.4	3 965.6	3 945.7	3 466.8	3 671.0	3 786.1	3 742.7	3 719.2	3 790.4	3 840.5	2 290.3	1 570.5	3 860.8	+0.5	+0.0
Belgium	218.9	236.3	243.8	203.4	228.2	232.8	224.0	228.1	237.9	241.5	137.8	114.9	252.7	+4.6	+15.4
Bulgaria	27.5	24.9	26.6	21.9	22.9	25.2	26.0	28.8	27.2	27.2	13.1	15.6	28.7	+5.6	+4.3
Denmark	107.7	109.7	106.1	90.6	87.1	92.6	87.8	88.4	92.2	95.1	56.5	39.4	95.9	+0.8	-10.9
Germany	302.8	315.1	320.6	262.9	276.0	296.0	298.8	297.3	303.7	295.9	175.2	121.9	297.1	+0.4	-1.9
Estonia	50.0	45.0	36.2	38.5	46.0	48.5	43.5	42.9	43.6	35.0	11.1	22.5	33.6	-3.9	-32.8
Ireland	53.3	54.1	51.1	41.8	45.1	45.1	47.6	46.7	47.5	50.7	33.7	17.0	50.8	+0.2	-4.8
Greece	159.4	164.3	152.5	135.4	129.1	135.3	153.3	161.0	168.5	167.0	95.0	80.1	175.1	+4.8	+9.8
Spain	414.4	426.6	416.1	363.5	377.1	403.8	419.9	397.5	427.7	447.0	253.8	197.5	451.3	+0.9	+8.9
France (*)	350.3	346.8	352.0	315.6	316.1	322.3	303.3	303.0	298.2	297.9	196.3	95.9	292.2	-1.9	-16.6
Croatia	26.3	30.1	29.2	23.4	24.3	21.9	19.0	19.4	18.6	18.9	12.7	5.8	18.6	-2.0	-29.5
Italy	520.2	537.3	526.2	469.9	494.1	499.9	476.8	457.1	443.1	458.0	296.0	165.9	462.0	+0.9	-11.2
Cyprus	7.7	7.5	8.0	6.8	7.0	6.6	6.2	7.2	7.2	10.3	6.6	3.7	10.3	-0.1	+33.7
Latvia	56.9	61.1	61.4	60.1	58.7	67.0	72.7	67.1	71.8	67.8	6.4	54.6	61.0	-10.1	+7.2
Lithuania	27.2	29.3	36.4	34.3	37.9	42.7	41.0	39.8	41.1	43.1	16.7	29.5	46.2	+7.2	+69.8
Malta	3.6	3.2	3.4	3.4	3.8	3.3	3.3	3.1	3.5	3.7	3.4	0.4	3.8	+2.2	+5.9
Netherlands	477.2	507.5	530.4	483.1	538.7	550.7	557.3	558.5	571.6	594.3	398.3	190.5	588.8	-0.9	+23.4
Poland	53.1	52.4	48.8	45.1	59.5	57.7	58.8	64.3	68.7	69.5	41.0	32.0	72.9	+4.9	+37.3
Portugal	66.9	68.2	65.3	61.7	66.0	67.5	67.9	78.2	80.2	86.8	53.8	37.5	91.3	+5.3	+36.6
Romania	46.7	48.9	50.5	36.1	38.1	38.9	39.5	43.6	43.8	44.5	20.6	25.7	46.3	+4.0	-0.9
Slovenia	15.5	15.9	16.6	13.4	14.6	16.2	16.9	17.2	18.0	19.9	14.1	7.1	21.2	+6.2	+36.7
Finland	110.5	114.8	114.7	93.2	109.3	115.5	105.1	105.1	105.5	100.0	52.0	53.9	105.9	+5.9	-4.2
Sweden	180.5	185.1	187.8	161.8	179.6	177.1	173.0	161.6	167.5	169.7	93.1	78.2	171.3	+1.0	-5.1
United Kingdom	583.7	581.5	562.2	500.9	511.9	519.5	500.9	503.3	503.2	496.7	303.1	180.9	484.0	-2.5	-17.1
Iceland	5.9	6.1	6.6	6.2	6.0	6.1	6.4	6.8	6.7	7.1	5.3	2.1	7.4	+4.3	+25.8
Norway	196.8	198.5	193.4	182.6	195.1	199.0	206.0	207.1	200.8	193.6	59.3	140.8	200.1	+3.4	+1.7
Montenegro	:	:	:	:	:	:	1.2	1.3	1.2	1.5	0.8	0.8	1.6	+8.7	:
Turkey	:	:	305.3	293.9	338.1	359.1	374.7	379.4	378.7	411.8	244.9	180.9	425.9	+3.4	:

Note: (:) not available.
(*) 2009-2014: partially estimated by Eurostat.

Data for Table 2.4 and 2.5 includes vessels like:

- Liquid bulk: liquefied gas, crude oil, oil products, other liquid bulk goods.
- Dry bulk: ores, coal, agricultural products (e.g. grain, soya, tapioca), other dry bulk goods.

• Large containers: 20 ft. freight units, 40 ft. freight units, freight units > 20 ft. and < 40 ft., freight units > 40 ft.

Ro-Ro mobile units:

a) Mobile self-propelled units: road goods vehicles and accompanying trailers, passenger cars, motorcycles and accompanying trailers/caravans, passenger buses, trade vehicles (including import/export motor vehicles), live animals on the hoof, other mobile self-propelled units.

b) Mobile non-self-propelled units: unaccompanied road goods trailers and semi-trailers, unaccompanied caravans and other road, agricultural and industrial vehicles, rail wagons, shipborne port-to-port trailers and shipborne barges engaged in goods transport, other mobile non-self-propelled units

Table 2.5: Gross weight of seaborne goods handled (inward and outward) in main ports in 2016 by type of cargo (in % of total cargo handled)

Source: Eurostat https://ec.europa.eu/eurostat/statistics-explained/index.php/Maritime_ports_freight_and_passenger_statistics#Most_EU_maritime_freight_transport_is_with_extra-EU_partners

	Share in % of total cargo handled in main ports					Total cargo handled in main ports (million tonnes)
	Liquid bulk goods	Dry bulk goods	Large containers	Ro-Ro Mobile Units	Other cargo	
EU-28	**38.1**	**22.2**	**21.7**	**12.4**	**5.6**	**3 792.2**
Belgium	30.9	13.2	41.1	8.5	6.3	**252.7**
Bulgaria	42.6	38.8	8.0	0.9	9.8	**28.7**
Denmark	33.9	29.4	6.7	26.0	4.0	**84.9**
Germany	15.5	23.7	42.9	12.0	5.9	**297.1**
Estonia	47.7	18.8	5.9	15.2	12.5	**30.2**
Ireland	22.8	30.9	14.6	30.1	1.7	**49.5**
Greece	39.5	20.5	24.9	13.5	1.6	**157.1**
Spain	37.3	21.7	30.6	4.4	6.0	**451.0**
France (*)	46.6	25.0	13.6	12.4	2.4	**289.5**
Croatia	59.5	22.1	10.6	2.4	5.4	**16.5**
Italy	41.0	13.9	20.1	19.4	5.5	**453.5**
Cyprus	45.4	25.7	24.6	1.7	2.7	**10.3**
Latvia	31.7	52.5	5.9	4.3	5.5	**59.4**
Lithuania	43.9	36.1	9.5	6.1	4.3	**46.2**
Malta	39.9	16.0	21.7	16.3	6.0	**3.8**
Netherlands	47.8	23.8	18.6	3.3	6.6	**588.8**
Poland	26.3	36.1	20.5	11.6	5.5	**72.5**
Portugal	39.4	21.1	31.8	1.0	6.7	**87.1**
Romania	28.5	52.3	11.9	0.6	6.7	**45.5**
Slovenia	16.1	34.5	36.5	5.5	7.5	**21.2**
Finland	36.2	24.1	10.0	17.2	12.5	**102.7**
Sweden	39.1	15.8	7.9	26.9	10.2	**171.3**
United Kingdom	40.4	19.5	13.8	22.6	3.7	**472.8**
Iceland	:	:	:	:	:	**:**
Norway	48.4	40.5	3.2	1.9	6.0	**181.0**
Montenegro	:	:	:	:	:	**:**
Turkey	32.8	38.8	21.3	2.0	5.2	**425.9**

Note: main ports are ports handling more than 1 million tonnes of goods annually. (:) not available.
(*) Partially estimated by Eurostat.

Table 2.6 do not present the total handling of goods in ports (inward movements plus outward movements in the ports), but estimate the seaborne transport of goods between the main European ports and their partner ports. As far as possible, double-counting of the same goods being reported as outward transport in one port and inward transport in another port is excluded in these figures.

The Romania seaborne transport of goods increased 4,2 % from 2015 to 2016. The majority of these goods were transported to or from ports outside the EU (international extra EU-28 transport), making maritime transport the most important mode for long distance transport of goods to or from the EU, in tonnage terms.

Table 2.6: Seaborne transport of goods between main ports in the reporting country and their partner ports grouped by main geographical areas (in % of total gross weight of goods transported)Source: Eurostat https://ec.europa.eu/eurostat/statistics-explained/index.php/Maritime_ports_freight_and_passenger_statistics#Most_EU_maritime_freight_transport_is_with_extra-EU_partners

	2015					2016					Total transport growth rate 2015-2016 (%)
	Total transport (million tonnes)	Of which (%)				Total transport (million tonnes)	Of which (%)				
		National	International		Unknown		National	International		Unknown	
			Intra EU-28	Extra EU-28				Intra EU-28	Extra EU-28		
EU-28	**3 092.3**	**9**	**25**	**63**	**3**	**3 112.8**	**10**	**25**	**62**	**3**	**+0.7**
Belgium	241.1	1	33	66	0	**252.6**	1	34	64	0	**+4.8**
Bulgaria	27.2	0	17	82	0	**28.7**	0	21	79	0	**+5.6**
Denmark	82.3	16	52	29	2	**82.6**	16	53	30	1	**+0.3**
Germany	292.5	1	40	59	0	**293.5**	2	40	58	0	**+0.4**
Estonia	31.4	1	62	37	1	**30.2**	0	63	37	0	**-3.8**
Ireland	48.2	2	73	24	0	**48.9**	2	74	23	0	**+1.5**
Greece	128.1	23	21	56	0	**134.7**	21	21	58	0	**+5.1**
Spain	421.2	10	20	59	11	**423.8**	11	20	58	11	**+0.6**
France (')	289.5	5	32	58	4	**283.4**	5	32	57	5	**-2.1**
Croatia	15.3	9	23	68	0	**15.8**	4	22	74	0	**+3.6**
Italy	368.5	23	18	58	0	**365.6**	26	18	55	0	**-0.8**
Cyprus	7.4	0	50	50	0	**10.3**	0	49	42	9	**+38.2**
Latvia	66.1	0	74	26	0	**59.3**	0	76	24	0	**-10.3**
Lithuania	43.1	0	47	52	0	**46.2**	0	44	56	0	**+7.2**
Malta	3.7	0	73	27	0	**3.8**	0	61	39	0	**+2.7**
Netherlands	594.2	0	25	72	3	**588.2**	0	25	71	4	**-1.0**
Poland	68.4	1	54	45	0	**71.6**	2	52	46	0	**+4.6**
Portugal	80.6	7	31	61	0	**80.7**	9	30	61	0	**+0.2**
Romania	43.6	0	20	80	0	**45.5**	0	19	81	0	**+4.2**
Slovenia	19.9	0	29	71	0	**21.2**	0	28	71	1	**+6.2**
Finland	91.9	6	69	26	0	**98.7**	6	66	27	0	**+7.4**
Sweden	164.2	11	66	22	1	**166.5**	11	67	21	1	**+1.4**
United Kingdom	444.7	14	46	37	3	**436.4**	14	47	36	3	**-1.9**
Iceland	:	:	:	:	:	**:**	:	:	:	:	**:**
Norway	176.0	29	55	14	2	**177.1**	26	56	12	6	**+0.7**
Montenegro	:	:	:	:	:	**:**	:	:	:	:	**:**
Turkey	388.9	7	34	57	1	**402.6**	7	35	57	0	**+3.5**

Note: The percentages of international intra-EU-28 and extra-EU-28 transport for non-EU-28 countries express the share of total transport with EU-28 and non-EU-28 countries respectively. Main ports are ports handling more than 1 million tonnes of goods annually. (:) not available.
(') Partially estimated by Eurostat.

Romania, Bulgaria, Croatia, the Netherlands, Slovenia, Portugal, Germany, Spain, Greece, France, Lithuania and Italy, have high shares of extra-EU transport (above 55 %), based on their geographical position or the "deep sea" nature of the transport activities prevailing in their main ports.

The number of vessels calling in main EU ports in 2016 is estimated at just above 2.1 million, a slight increase of 0.1 % from the previous year. In the same period, the estimated gross tonnage (GT) of the vessels calling in EU ports grew by 4.5 % to 17.2 billion GT (Table 2.7).

Data for Table 2.7 include vessels like:

- Liquid bulk: oil tanker, chemical tanker, LG tanker, tanker barge, other tanker.
- Dry bulk: bulk/oil carrier, bulk carrier.
- Container: full container.
- Cargo, specialised: barge carrier, chemical carrier, irradiated fuel, livestock carrier, vehicle carrier, other specialised.
- Cargo, non-specialised: reefer, Ro-Ro passenger, Ro-Ro container, other Ro-Ro cargo, combination carrier general cargo/passenger, combination carrier general cargo/container, single-decker, multi-decker.
- Passenger: passenger (excluding cruise passenger vessels).
- Cruise passenger: cruise ships only.
- Offshore activities: offshore supply.
- Other: dry cargo barges, tugs, miscellaneous, unknown type of vessel.

Table 2.7: Gross Tonnage (GT) of vessels in main ports by type of vessel, 2011-2016 (in 1000 GT, based on inward declarations)
Source: Eurostat https://ec.europa.eu/eurostat/statistics-explained/index.php/Maritime_ports_freight_and_passenger_statistics#Most_EU_maritime_freight_transport_is_with_extra-EU_partners

Port	2011	2012	2013	2014	2015	2016	2016 By type of vessel (%)									Growth rate 2015-2016 (%)	Growth rate 2011-2016 (%)
	Total	Total	Total	Total	Total	Total	Liquid bulk	Dry bulk	Con-tainer	Cargo, spe-cialised	Cargo, Non spe-cialised	Pas-senger (excl. Cruise)	Cruise pas-senger	Offshore activities	Other		
EU-28	16 113 831	16 015 390	15 884 917	15 919 134	16 443 772	17 191 575	8	4	18	3	58	3	6	0	1	+4.5	+6.7
Belgium	568 104	554 009	564 064	566 748	590 135	639 941	12	2	39	32	11	0	2	0	1	+8.4	+12.6
Bulgaria	26 272	28 701	31 726	31 269	29 121	31 988	31	28	20	0	21	0	1	0	0	+9.8	+21.8
Denmark	1 058 660	1 072 400	1 074 814	1 038 752	1 017 921	1 055 924	2	1	2	1	91	0	2	0	0	+3.7	-0.3
Germany	1 133 238	1 172 132	1 169 484	1 176 255	1 167 622	1 306 038	3	3	34	0	54	1	2	0	2	+11.9	+15.2
Estonia	302 077	310 969	338 541	332 248	329 955	338 990	4	2	2	0	86	0	6	0	0	+2.7	+12.2
Ireland	222 399	223 203	208 831	221 238	229 775	236 865	4	4	5	3	80	1	3	0	0	+3.1	+6.5
Greece	1 156 034	1 101 625	1 125 152	1 177 159	1 226 086	1 283 757	5	2	9	3	68	1	12	0	0	+4.7	+11.0
Spain	1 885 820	1 881 947	1 773 652	1 866 870	2 091 665	2 195 271	11	7	22	2	34	14	10	0	0	+5.0	+16.4
France (*)	1 018 768	1 157 591	1 247 257	1 253 231	1 398 864	1 430 974	8	3	19	2	55	6	6	0	1	+2.3	+40.5
Croatia	271 884	263 616	272 531	262 810	316 769	334 653	3	1	4	0	67	11	15	0	0	+5.6	+23.1
Italy	3 091 955	2 765 166	2 469 842	2 261 879	2 299 764	2 353 106	7	2	16	1	59	1	13	0	0	+2.3	-23.9
Cyprus	37 394	32 758	32 321	28 632	29 772	33 351	16	1	43	18	9	5	6	2	0	+12.0	-10.8
Latvia	82 410	90 074	85 348	82 285	76 890	73 540	21	34	11	0	0	28	4	0	1	-4.4	-10.8
Lithuania	59 038	60 336	57 797	59 588	60 030	63 797	25	14	14	0	43	0	4	0	0	+6.3	+8.1
Malta	194 820	197 257	215 998	215 796	235 263	300 307	1	1	60	0	37	0	0	0	1	+27.6	+54.1
Netherlands	691 592	718 774	717 891	725 845	762 542	790 373	27	12	35	1	25	0	0	0	0	+3.6	+14.3
Poland	160 040	164 421	165 848	183 624	186 708	199 559	8	10	16	0	63	1	2	0	0	+6.9	+24.7
Portugal	174 942	177 259	197 822	210 034	233 825	238 800	16	6	43	5	9	2	20	0	0	+2.1	+36.5
Romania	46 251	50 191	51 899	52 766	52 262	52 727	20	42	33	1	4	0	0	0	0	+0.9	+14.0
Slovenia	41 532	39 366	38 943	40 348	48 842	52 963	6	11	43	0	34	0	6	0	1	+8.4	+27.5
Finland	707 641	710 893	740 747	731 142	713 145	728 538	4	1	4	0	86	2	2	0	0	+2.2	+3.0
Sweden	1 147 066	1 132 317	1 134 734	1 163 980	1 184 969	1 172 798	4	2	4	1	86	1	2	0	0	-1.0	+2.2
United Kingdom	2 035 894	2 110 388	2 169 675	2 236 636	2 161 848	2 277 314	8	2	14	5	69	0	1	1	0	+5.3	+11.9
Iceland	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Norway	293 196	312 370	402 750	337 553	315 988	313 926	29	18	9	2	25	0	0	17	0	-0.7	+7.1
Montenegro	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Turkey	604 832	658 668	682 390	696 756	745 015	947 941	16	20	39	3	18	1	2	0	0	+27.2	+56.7

Note: main ports are ports handling more than 1 million tonnes of goods or 200 000 passengers annually. (:) not available.
(*) Partially estimated by Eurostat.

In 2016 Romania exported $64.8B, making it the 40th largest exporter in the world. During the last five years the exports of Romania have increased at an annualized rate of 0.8%, from $61.8B in 2011 to $64.8B in 2016. The most recent exports are led by Vehicle Parts which represent 8.25% of the total exports of Romania, followed by Insulated Wire, which account for 6.42% (source https://atlas.media.mit.edu/en/profile/country/rou/).

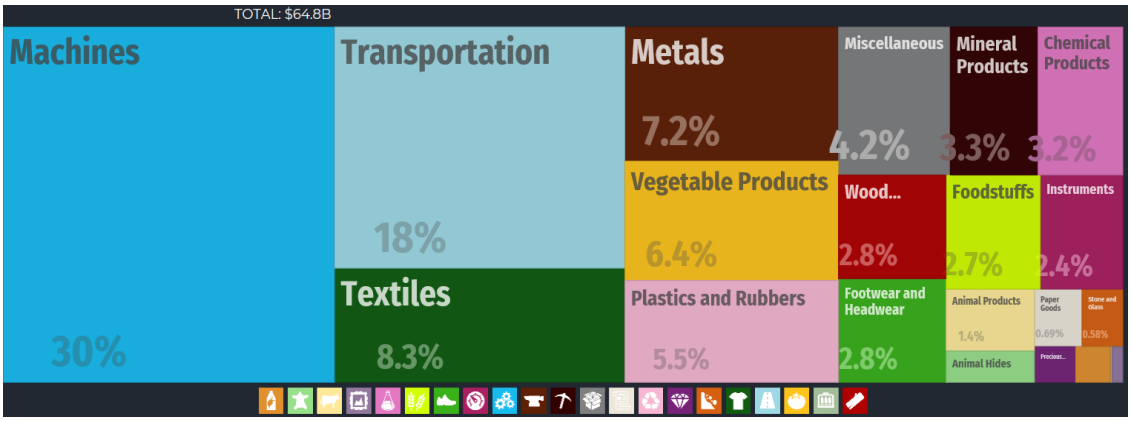


Figure 2.13. Products export by Romania
(source https://atlas.media.mit.edu/en/profile/country/rou/).

The top export destinations of Romania are Germany ($13.1B), Italy ($6.86B), France ($4.32B), Hungary ($2.65B) and the United Kingdom ($2.49B).

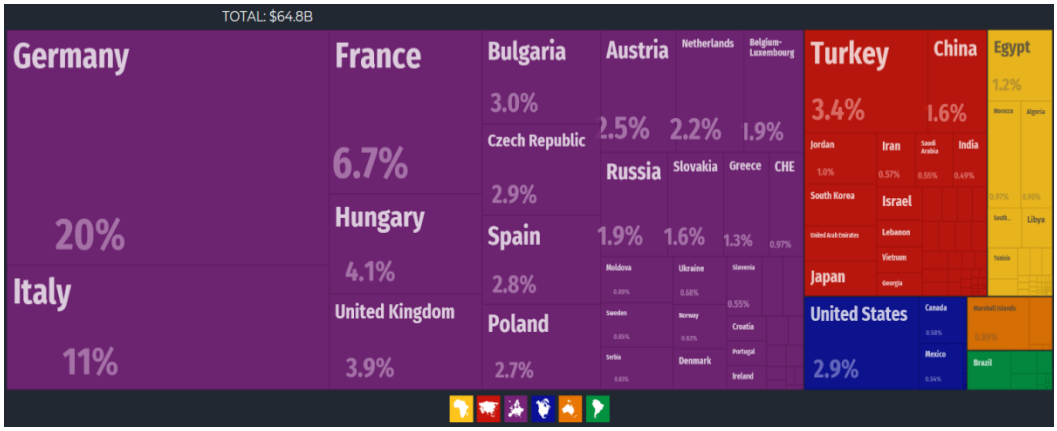


Figure 2.14. Percent of export destinations of Romania
(source https://atlas.media.mit.edu/en/profile/country/rou/).

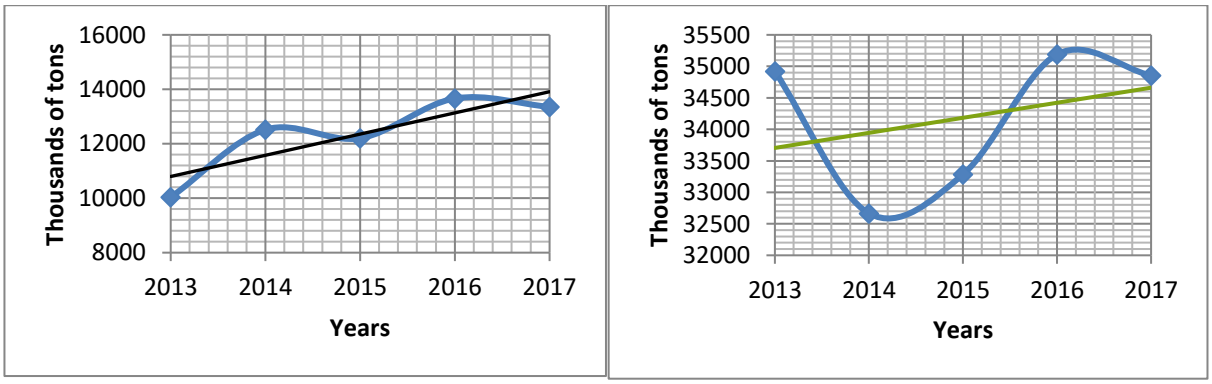
The statistical surveys carried out have had a temporal reporting over a minimum of 6-10 years in order to be able to establish trends for future development. The data that was operated is that provided by the National Institute of Statistics (http://statistici.insse.ro) and that on the Maritime Port Authority website, i.e. the annual report for 2017 (source http://www.portofconstantza.com/apmc/portal/static.do?package_id=st_rap_anual&x=load)

Next page we show statistical data on the quantity of goods discharged, loaded and transited in port.

Table 2.8 The quantity of goods loaded and transported by sea

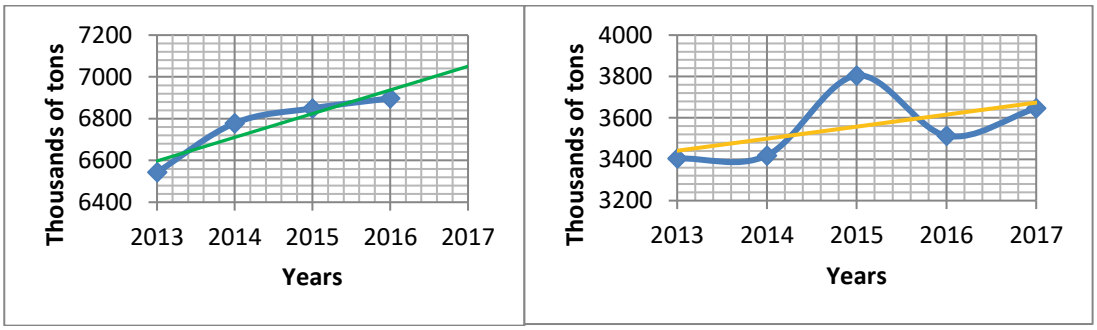
Categories of port operations	Transport modes	Types of merchandise	Years				
			2013	2014	2015	2016	2017
			UM: Thousands of tons				
			Thousands of tons	Thousands of tons	Thousands of tons	Thousands of tons	Thousands of tons
Total	Maritime	Liquid bulk	10035.2	12516.2	12203.6	13662.9	13354.28
		Solid bulk	34920.9	32666.1	33285.1	35189.4	34853.978
		Containers	6543.3	6778.9	6849.6	6897.4	6524.09
		General cargo	3403.9	3418.5	3804.6	3513.8	3646.804

We show the trends for each category of goods, presented in figures 2.15 – 2.16.



a b

Figure 2.15. The quantity of goods loaded and transported by sea
a) liquid bulk b) solid bulk



a b

Figure 2.16. The quantity of goods loaded and transported by sea
a) containers b) general cargo

Traffic figures from the table 2.8 represent both maritime and river traffic for all ports managed by Maritime Ports Administration Constanţa: Constanţa, Midia and Mangalia.

From figures above we conclude that the trends evolution indicates the increasing these category of goods transported by sea in the futures years.

Table 2.9 The quantity of goods loaded and transported by sea

Categories of port operations	Transport modes	Types of merchandise	Years									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
			UM: Thousands of tons									
Loaded goods	Maritime	Total	20848	19687	21181	20743	21199	26765	25349	24954	25739	24848
© 1998 – 2018 National Institute of Statistic												

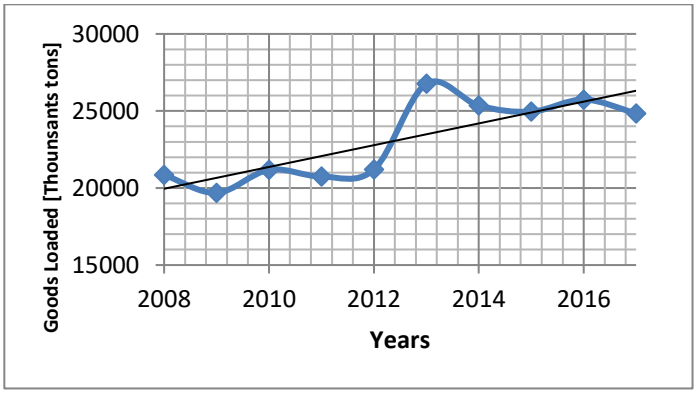


Figure 2.17. The quantity of goods loaded and transported by sea

Figure 2.17. clearly presents the increasing trend of the quantity of cargo operated in the port of Constanţa (export).

Table 2.10 Quantity of goods unloaded

Categories of port operations	Transport modes	Types of merchandise	Years									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
			UM: Thousands of tons									
Unloaded goods	Maritime	Total	29601	16407	16941	18175	18321	16812	18404	19579	20556	21334
© 1998 – 2018 National Institute of Statistic												

Table 2.11 Quantity of Agricultural products, hunting and forestry; fish and other fishery products loaded

Categories of port operations	Transport modes	Types of merchandise	Years									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
			UM: Thousands of tons									
Goods loaded	Maritime	Agricultural products, hunting and forestry; fish and other fishery products	5495	8549	9492	8461	8597	12639	14029	14926	16336	15396
© 1998 - 2018 NATIONAL INSTITUTE OF STATISTICS												

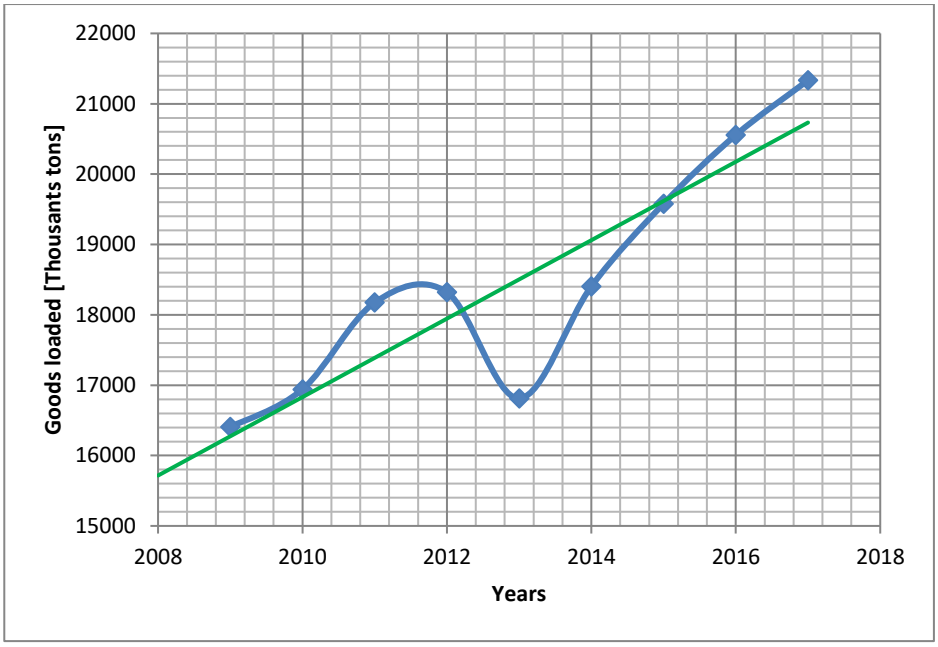


Figure 2.18 The total quantity of goods unloaded in the Port of Constanţa, coming by sea

Figure 2.18 there is the graph extracted from table 2.10 and these data also shows the clear increasing trend of the quantity of cargo operated in the port of Constanţa (import).

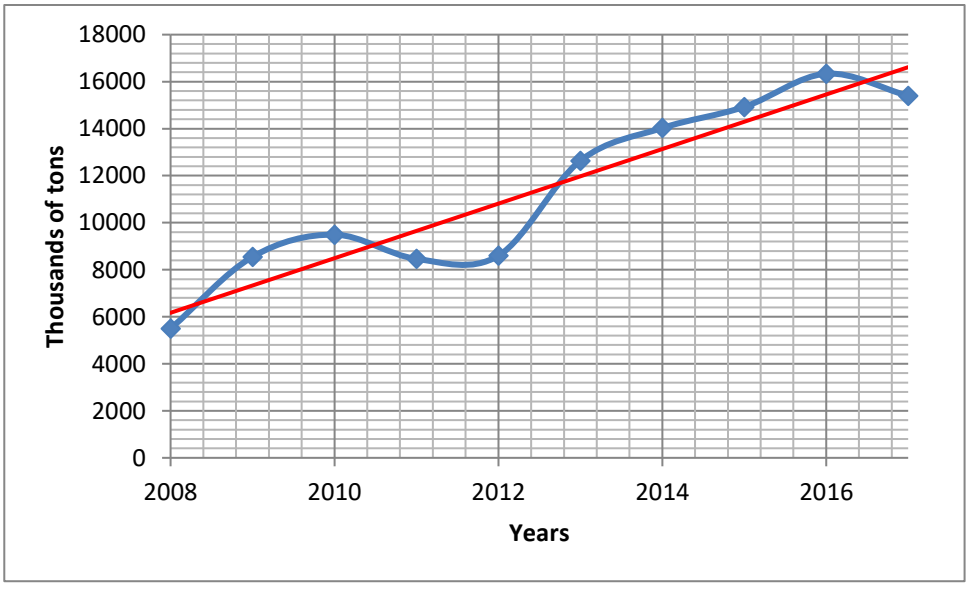


Figure 2.19 The total quantity of goods unloaded in the Port of Constanţa, coming by sea

Figure 2.19 there is the graph extracted from table 2.11 and these data also show the clear increasing trend of the "Agricultural products, hunting and forestry; fish and other fishery products loaded" operated in the port of Constanța (import).

Statistics regarding the cargo traffic in the port of Constanța

(source http://www.portofconstantza.com/apmc/portal/static.do?package_id=st_rap_anual&x=load)

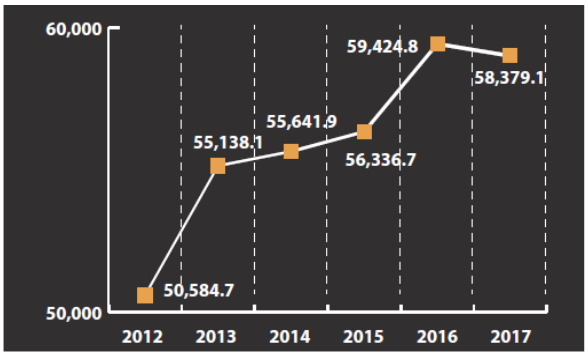


Fig. 2.20 Total Traffic of cargo

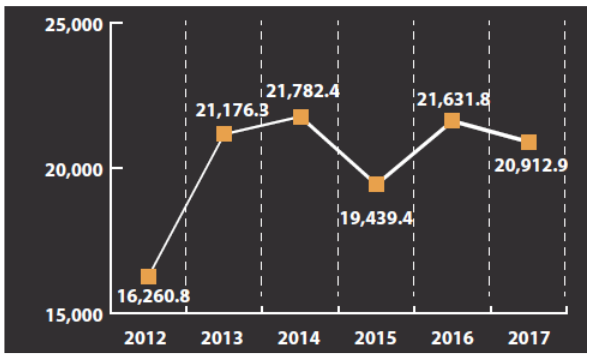


Fig. 2.21. Total Exports

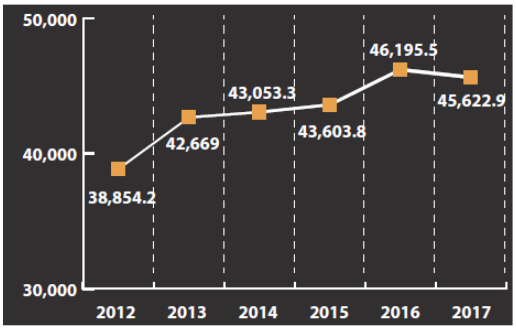


Fig. 2.22 Maritime Traffic

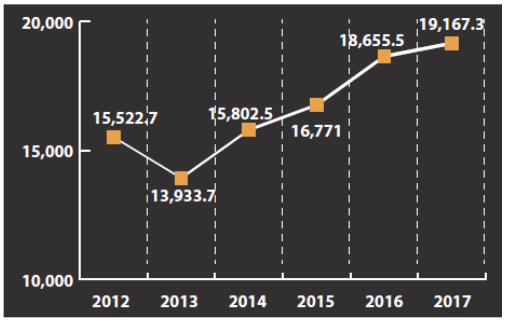


Fig. 2.23 Imports

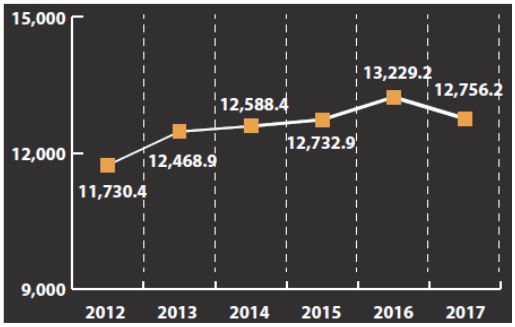


Fig. 2.24. River Traffic

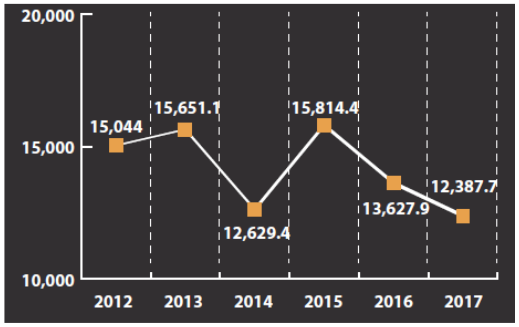


Fig. 2.25 Cargo Transit

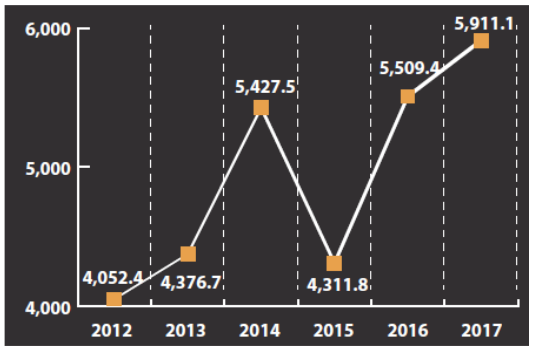


Fig. 2.26. Inshore Traffic

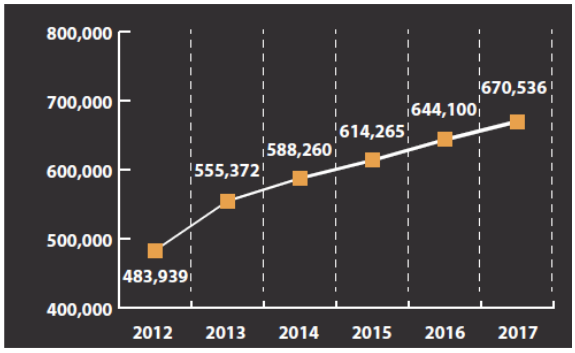


Fig. 2.27 Thousands TEUs

The annual reports from 2013-2017 shows increased trends on almost all levels. Exports, growing at a national level by 9.1%, according to the Institute of Statistics, in the port of Constanţa.

Maritime, river and transit traffic also recorded from 2013-2017 shows increased trends in the range of hundreds of thousands of tons - one million tons, each category.

Table 2.12. Total (maritime and river) quantity of goods loaded and unloaded

Tons/Year	2012	2013	2014	2015	2016	2017
unloaded	241,106	274,631	291,875	311,660	329,876	341,399
loaded	242,833	280,741	296,385	302,605	314,224	329,137

Table 2.13. Total (maritime and river) quantity of containers coming by sea

Units/Year	2012	2013	2014	2015	2016	2017
Containers	423,081	399,372	408,990	420,793	434,439	413,253

Table 2.14 Total and maritime and river calls

Ship calls/Year	2012	2013	2014	2015	2016	2017
Maritime calls	5,057	4,833	4,771	4,605	4,331	4,093
River calls	9,405	9,280	10,053	9,765	10,203	9,272
Total	14,462	14,113	14,824	14,370	14,534	13,365

Traffic from the table 2.14 represents both maritime and river traffic for all ports managed by Maritime Ports Administration Constanţa: Constanţa, Midia and Mangalia.

The number of calls are cumulated for all three ports.

Table 2.15 Type of vessels cumulated for all three ports

Arrivals of sea-going vessels by type of ship/Year		2012	2013	2014	2015	2016	2017
Cargo		2,692	2,525	2,143	1,971	1,812	1,815
Passenger		52	68	95	37	17	13
Port container		651	579	578	610	684	592
Tank		673	636	719	668	665	608
Bulk carrier		439	533	555	589	607	574
Others		550	492	681	730	546	491
	Total	5,057	4,833	4,771	4,605	4,331	4,093

From the statistics analysed, it is easy to see that both traffics of goods in the Port of Constanţa and on the Danube-Black Sea Canal have an upward trend.

The traffic growth trend will require a more complex and larger volume of data exchange, in particular for containerized or barge traffic managed by the Navigable Channel Authority (e.g. for a barge convoy, all data relating to the cargo on each barge must be recorded).

It is worth mentioning that these data are currently manually entered into the application, whereas only rarely are there data files imports (but still in manual mode).

In conclusion, as the traffic increases, it will be enough to require more and more human operators to operate the traffic data, with the typical consequences of this type of approach, namely delays and the occurrence of errors in data entry or un-correlation or duplication thereof.

Table 2.16 Traffic by category of goods cumulated for all three ports

Cargo type (tons)/Year	2012	2013	2014	2015	2016	2017
Cereals	12,628,340	15,261,789	17,420,547	19,616,118	20,393,803	17,891,285
Cellulose and waste paper	25,832	45,684	63,451	65,189	78,058	39,089
Cement, building materials	547,769	349,422	265,413	140,997	169,874	165,702
Chemical products from coal/tar	131,411	134,144	72,962	108,478	102,331	153,372
Solid mineral fuels	3,504,331	2,890,793	2,157,731	3,207,635	2,226,771	2,830,470
Crude oil	5,042,697	5,396,525	6,750,866	6,593,434	7,487,357	7,352,164

Food stuff and animal feed	497,245	563,137	416,089	764,390	796,547	504,549
Glassware and ceramic products	64,588	48,740	8,066	2,001	2,959	17,679
Iron ores, scrap	6,888,094	9,676,268	5,501,674	2,750,024	2,594,201	3,924,125
Leather textile/other products	172,811	398	0	0	0	553
Livestock, sugar beet	49,245	64,993	58,690	61,382	93,299	97,738
Machines, transport equipment's	369,418	437,955	365,651	363,638	356,800	337,910
Metal products	1,871,458	1,593,497	1,888,533	2,062,785	2,047,544	2,217,403
Metal ware	2,833	7,485	5,124	429	3,545	5,263
Miscellaneous	6,958,497	6,544,679	6,782,263	6,850,355	6,897,358	6,525,662
Natural and chemical fertilizers	2,153,597	1,763,452	1,742,245	1,842,646	2,927,072	3,094,332
Non-ferrous ores and scrap	2,643,509	2,325,828	2,551,646	3,109,993	3,158,060	3,111,182
Oil products	3,999,621	3,820,247	4,714,318	5,165,550	5,653,512	5,473,279
Oilseed, oleaginous fruits/fats	736,300	1,932,875	2,478,251	1,951,341	2,918,535	3,215,811
Other chemical products	1,029,540	906,680	1,151,105	525,026	619,988	559,649
Potatoes, other fresh vegetable	20,604	15,171	11,734	6,488	5,696	6,913
Raw or processed minerals	318,400	304,694	316,140	293,295	334,379	438,273
Wood and cork	928,522	1,053,601	919,411	855,578	557,132	416,751
	Total 50,584,662	55,138,057	55,641,910	56,336,772	59,424,821	58,379,154

It can be predicted based on statistics that in the future freight traffic will increase and consequently, in order to ease document bureaucracy and make port and maritime business profitable, it is necessary for the port administration to consider introducing a computerized management system such as PCS just as all the major ports of the world. It is also necessary that Constanţa Maritime Port Administration intends to invest in modern information systems, based on M2M technologies and validation steps, to automatically take data directly from the source and integrate them into the future Port Community Systems.

It is recommended, in order to help decision-makers that these IT systems also benefit from modules that provide scenarios for future activities taking into account the history of each operator or type of activity.

2.4 Necessity of the investment.

Seaports are hubs both in international trade and in the supply chain, providing links between land transport (road and rail) and river and maritime transport alike.

Maritime ports face continuous changes and challenges in international trade. Information technologies play an essential role in port competitiveness because information

is one of the key resources of any port. Seaports have to cope with increasingly strong competition and alternatively with periods of stagnation or economic recession.

By investing in information and communication technologies, seaports will be able to survive and thrive on a competitive transport market.

The implementation of PCS in Romanian ports represents an important investment in infrastructure.

Last but not least, substantial savings should be made by reducing the time needed for coordination and reducing paperback documentation and should certainly increase the competitiveness of Romanian ports.

Romanian ports should be aware of the importance of implementing a Port Community Systems (PSC) platform to achieve and maintain competitiveness with other ports around the world.

By implementing the PCS concept, Romanian ports will achieve better connectivity in port communities and will become "communicating ports".

The necessity and the opportunity for the realization of this information system (PCS) also arises from the analysis of the requirements and the observations gathered from the interviews conducted at Constanţa Maritime Port Administration, the Romanian Naval Authority, Port Master's Office, as well as at different port operators, which we describe centrally in the following table.

As far as we know, the future Port Community System integration is a potential investment subject, such that there are no published research results available on the topic for Romanian ports.

Therefore, this research approach puts the emphasis on obtaining first-hand experience and opinion of the stakeholders to whom PCS integration can potentially be interesting.

The stakeholders have been approached with a request to take part in an interview, where the potential for PCS integration was to be discussed.

We made interviews with different stakeholders, and the interviews have been prepared with the open questionnaire face to face made by our team.

Table 2.17 Requirements and observations derived from interviews made with stakeholders, enhanced with preliminary analysis with respect to requirements and observations

Stakeholders Description of stakeholders. Explanation of why they could be potential users.	**Prerequisites**	**Observations**
Constanţa Maritime Ports Administration	Access to vessel information from different **stakeholders**	For example, Maritime Single Window (MSW) contains limited fields in terms of port information, with only limited access to this interface.

	Early access to ship arrival and departure	Eliminates possible conflicts in assigning taxes or anticipating crowded port traffic conditions
	Separation of ship information with the requirements of port operations	Clarity of the information/documents necessary to authorize ship's entry to the berth for operation (loading/unloading/repairs) - elimination of ship delay
	Necessary to clarify the relationship between the Maritime Single Window (MSW) application already implemented by the Romanian Naval Authority and the specific application implemented by the Customs Office	Avoiding two single window applications, one for ships and another for reporting goods
Port Master's Office	Timely information	Decide on a single port approval for the ship arrival at the port.
	Rapid communication with stakeholders	Requesting missing/additional documentation, communication of entrance refusal etc.
	Controlling the transmission of erroneous data	Incompatibilities found in terms of declarations in relation to data declared in other ports
	Document Harmonization	Standard format of documents conveyed
Ship agent/Carrier/Ship-owners	Communication with the port master's office	Avoiding vessel to office communication problems so that the ship's captain understands and complies with port process formalities, eliminating significant differences between reporting countries
	Harmonize and simplify port process formalities	Decision to report a single set of data/documents to be submitted (at least at EU level).
	Extensive Inspection Control	Agents find it difficult to determine if some ships require extensive inspection. These data may be transmitted to them through EMSA
	Elimination of unnecessary data/documents transmission	Receiving and processing data from other EU countries, i.e. those transmitted via EMSA and MSW (unplanned)
	Ship Documents Management System	The set of data and documents required by the ship on her route through different countries and ports showing differences in their regulations

Cargo owners/Freight forwarders	Simplifying the port transit/reporting process: - Increase efficiency in the transfer of goods - Reduce administrative costs - Reducing human errors and time in the process of information exchange between relevant parties (removal of papers as printed documents)	The neutrality and confidentiality of the information conveyed should be ensured in the case of interconnectivity with other ports' PCS platforms.
	Visibility of real-time uploaded data	The neutrality and confidentiality of the information conveyed should be ensured in the case of interconnectivity with other ports' PCS platforms.
National Single Window	Data harmonization	Remove/Convert Standard Encoding Data
	Electronic data exchange	Automatic transmission of data/documents
	Exchange of data /documents between single local windows: information required by law shall be reported only once	To be executed within the competence area of ANR
EU member state	Removing local disadvantages due to excessive administrative burdens	Harmonization of European formalities regarding port processes
	The distribution of data/documents shall become a de facto standard for port operators in member states. Maintain compatibility with European standards	The PCS platform can act as a facilitator for local operators to adapt it to national standards
	Accelerating the implementation of regulatory changes along the logistics chain between local authorities and port operators	By harmonizing regulations, reporting formats, data sets, coding standards, and the use of the PCS platform in order to facilitate adaptation to the internal reporting systems of the reporting parties.
European Commission (**DG Move**) (**EMSA** - The EU Maritime Safety	Harmonization of European reporting formalities regarding port processes Simplifying reporting and port processes	On the international trade market with the rest of the world the European Union is dependent on maritime transport. Maritime transport has several advantages, such as lower costs and reduced

Agency brings together and combines information from different sources and performs combined actions with national authorities. Operational services consist in: **Vessel Reporting** (to keep fishing, piracy etc. under control.), **Earth Observation, Integrated Maritime Services, and Pollution Response Services**		environmental impact in relation to the quantity of goods carried. Shipping is not used to its full potential due to the existence of specific port formalities through excessive reporting given by the transmission of signed documents, resulting in significant time and financial losses.
	Inappropriate control/declarations and/or inaccuracy in the data reported to EMSA	Declaration control measures. Assuming reporting responsibility by stakeholders. Measures to avoid recurrent errors or inaccuracy.

The interview topics was the following:

1. Intro by stakeholder

a. Who we are (stakeholder and interviewer)

b. Purpose of the interview: very short on DAPhNE project lead by CN AMPC and future investment regarding PCS integration

2. Short company background

a. Interviewee short introduction

b. Company, industry, size, core business, core stakeholders

3. Is your company interested in the future integration PCS?

4. Open question: please outline your vision of the future report of document exchange between your company and authorities:

a. Why would the e-reports and e-certificates integration be relevant for your organization?

b. Which specific functionalities?

c. Which documents should be exchanged between future PCS on your behalf?

5. Open discussion: please provide your thoughts on the barriers of future PCS integration, main beneficiaries and opponents of it, as you see it. Who would oppose it and why?

3 Identification of possible scenarios/options /technical and economic alternatives for achieving the investment objective

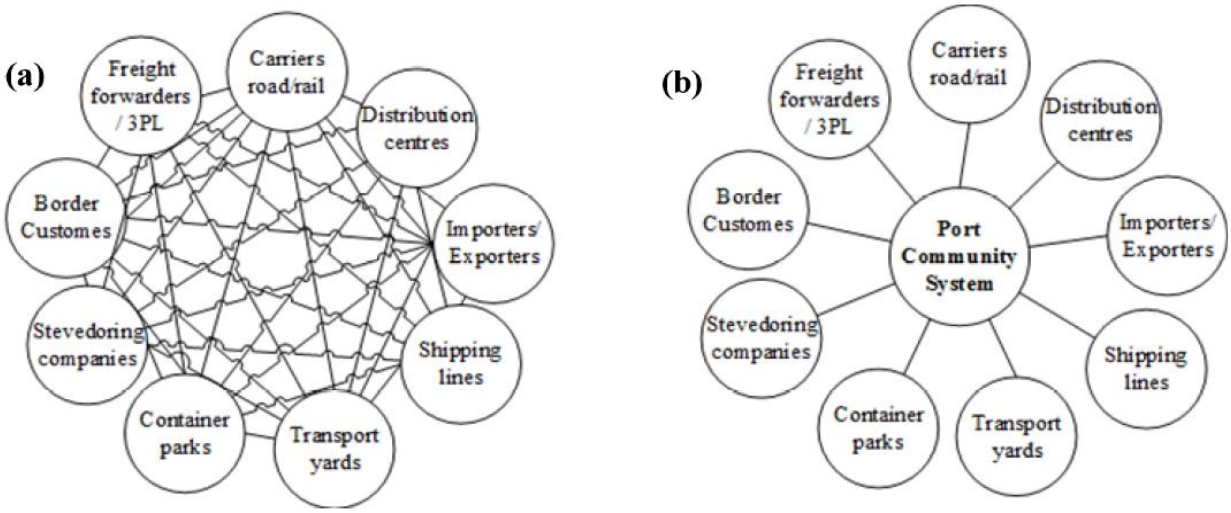
3.1 Technical and functional data of the investment objective

3.1.1 Destination and functionalities

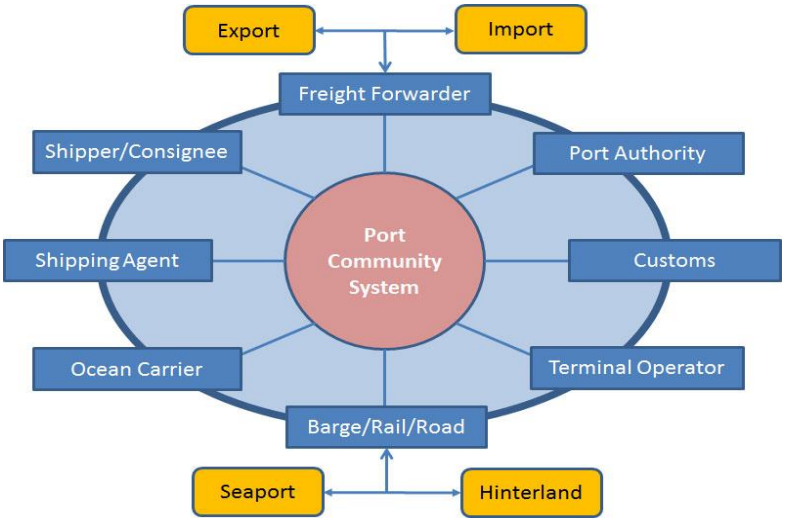
Port Community Systems (PCS) Interface

The Port Community Systems (PCS) interface is a neutral and open electronic platform that allows intelligent and secure information exchange between public and private sector stakeholders operating in the port area and which through its modules allows port operators to improve their competitive position opposite other maritime communities around the world. The Port Community Systems (PCS) interface optimizes, manages and automates the processes involved in port and logistics activity through a single data transmission and linking transport and logistics chains. The Port Community Systems (PCS) interface is also a "Single Window" portal, allowing trade and transport stakeholders to submit standardized information and documents.

There are many sources and recommendations regarding this type of information flow with slightly different structure. However, the main principle is the same with large applicability in port of Constanta. The further feasibility study can determine the real-time port interactions available in the study time frame.

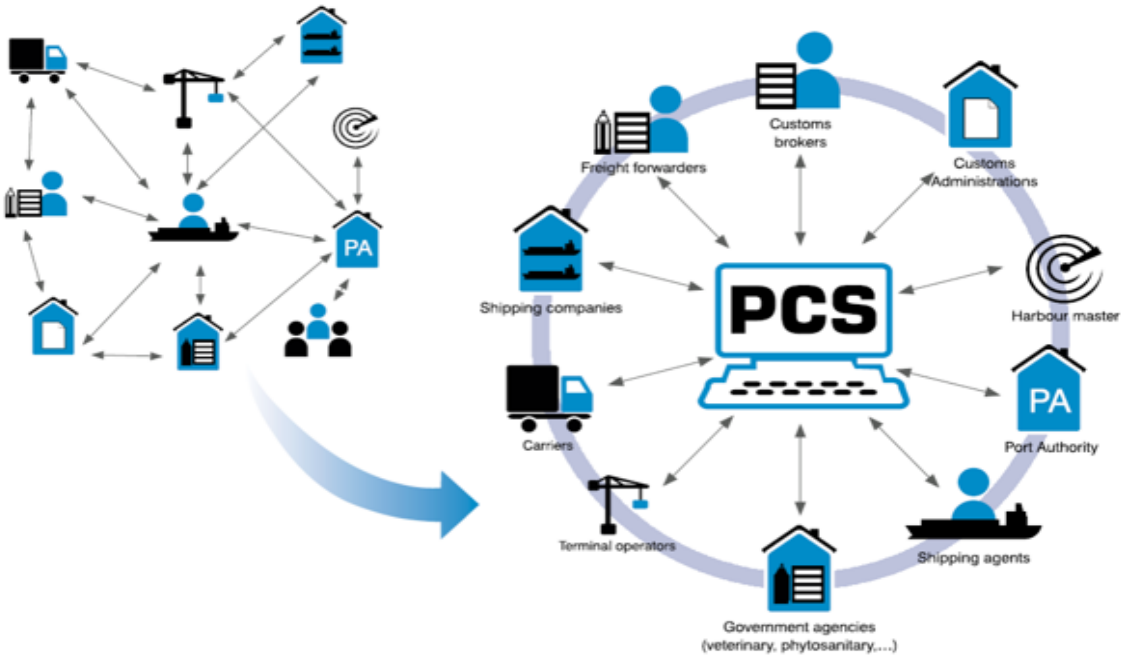


Communication between individual port-related freight agents without (a)/with (b) PCS (Source: Elsevier, Science Direct, ABMTrans 2017, E. Irannezhad, M. Hickman, C. Prato, Modelling the Efficiency of a Port Community System as an Agent Based Process)



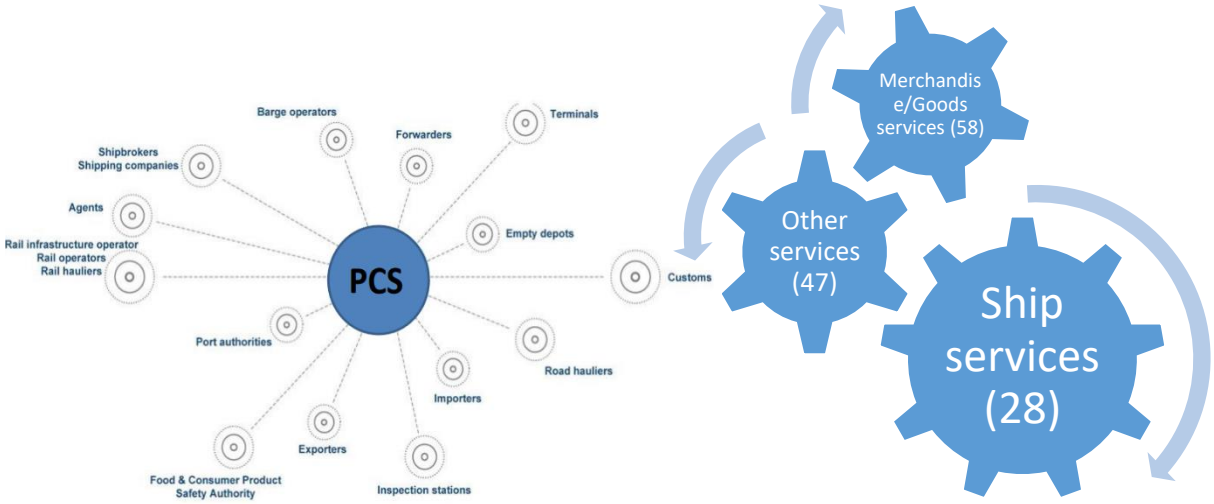
(c)

PCS overall diagram in United Nations recommendation (EU directive 2010/65) highlights the importance of implementing a National Single Window that automates the information exchange of the flow of goods across national borders. Many European countries, have implemented their own version of this Single Window. Individual seaports must be linked up to these Single Window systems. This means radical adjustments to the PCS's general philosophy.
(Source: http://euro-logistics.nl/expertise/port-community-system)



(d)

However, due to UN and EU implementation requirements there are several custom approaches to fit the real port needs. (Source Port Community System (PORT-Line PCS): http://www.actual.si/?main=2&sub=1)



(e) **(f)**

(e) Loosely structured (elastic features and port community actors) PCS architecture intended for PCS simulation in Port of Constanta
(f) Synoptic view of class of services (Maritime Ports Administration SA Constanta services)

Fig. 3.1.1 (a), (b), (c), (d), (e), (f) Ways to user's connection to the PCS portal (worldwide different approaches)

Table 3.1.1 General services (ship & goods) in Port of Constanta

Servicii nave/Ships services	
Activitati de evaluare a riscului de asigurare	Insurance risk assessment activities
Activitati de proiectare nave	Ship design activities
Agenturare nave	Ship agent
Agenturare nave fluviale	River Ship Agent
Aprovizionare nave	Ship Supply
Asistenta, salvare si ranfluarea navelor	Assistance, rescue and refloating of ships
Buncheraj nave (prin conducte)	Ships' Bunkering (via pipelines)
Bunkeraj nave (cu nava)	Bunkering ships (with ship)
Bunkeraj nave cu cisterne	Bunkering ships with tanks
Bunkeraj nave cu cisterne si nava	Bunkering ships with tanks and ship
Bunkeraj nave (cu autospecializata)	Bunkering ships (self-specialized)
Constructia de nave si structuri plutitoare	Shipbuilding and floating structures
Curatarea hambarelor si magaziilor navelor	Cleaning of ships' bins and hulls
Curatarea si degazarea tancurilor navelor	Cleaning and degassing of ship tanks
Depoluare in danele petroliere (excluzand deseurile de la nave)	Depollution in oil spills (excluding ship-generated waste)
Incarcare/descarcare nave	Loading/unloading ships
Inspectia periodica a navelor	Regular inspection of ships
Intretinere si operare statie fixa de bunkerare	Maintenance and operation of fixed bunker station
Legare/dezlegare nave	Binding/unbinding ships
Pilotaj nave maritime	Ships' pilotage
Remorcaj nave	Ships' towage
Remorcaj nave fluviale si tehnice in incinta portului	Towage of river and technical vessels within the port
Reparatii nave	Ships' repairs
Servicii de fumigare la nave	Ships' fumigation services
Transport de marfa cu nave fluviale inspre/dinspre Port Constanta	River freight transport to/from Port Constanta
Transport prin remorcarea sau impingerea barjelor	Transport by towing or pushing barges

Transportul deseurilor solide contaminate cu reziduri petroliere	Transport of solid wastes contaminated with petroleum residues

Servicii marfă/Merchandise/goods services	
Comert cu amanuntul in magazine nespecializate cu vanzare predominanta de produse nealimentare	Retailing commerce in non-specialized stores with sale of non-food products
Comert cu amanuntul in magazine nespecializate	
Comert cu amanuntul al produselor cosmetice si de parfumerie	Retail sale in non-specialized stores
Manipulare la uscat	Retail sale of cosmetics and perfumery
Depozitare marfa	Handling on land
Expeditii marfa	Storage of goods
Control marfa	Freight forwarding
Comert cu ridicata al materialului lemnos	Merchandise control
Transport rutier de marfa	Wholesale of wood
Comert cu ridicata al zaharului, ciocolatei si produselor zaharoase	Freight transport by road
Inchirierea bunurilor imobiliare proprii	Wholesale of sugar, chocolate and sugar confectionery
Comert cu ridicata al masinilor agricole, echipamentelor si furniturilor	Renting of own real estate
Comert cu ridicata al cerealelor si semintelor	Wholesale of agricultural machinery, equipment and supplies
Comert cu ridicata al animalelor vii	Wholesale of grain and seeds
Testari si analize tehnice	Wholesale of live animals
Repararea articolelor fabricate din metal	Testing and technical analysis
Stivuire	Repair of articles made of metal
Comert cu amanuntul de carburanti	Stacking
Comert cu ridicata al produselor chimice	Retail of fuels
Fabricarea tuburilor si profilelor din material plastic	Wholesale of chemical products
Amarare	Manufacture of tubes and profiles of plastics
Fabricarea betonului	Mooring
Comert cu ridicata de materiale de constructii	Manufacture of concrete
Comert cu ridicata nespecializat	Wholesale of building materials
Comert cu ridicata al uleiurilor navale	Non-specialized wholesale trade
Cantarire	Wholesale of naval oils
Ambalare	Weighing
Comert cu ridicata al imbracamintei si incaltamintei	Packing
Transport rutier de marfa in incinta portuara	Wholesale of clothing and footwear
Activitati de dezinfectare si deratizare	Road haulage in port area
Comert cu ridicata al bauturilor	Disinfection and disinfestation activities
Comert cu ridicata de cafea	Wholesale of beverages
Comert cu ridicata al deseurilor metalice	Wholesale of coffee
Comert cu amanuntul al produselor zaharoase	Wholesale of metal waste
Comert cu ridicata al altor produse intermediare	Retail of sugar confectionery
Comert cu ridicata al uleiurilor comestibile	Wholesale of other intermediate products
Comert cu alte autovehicule	Wholesale of edible oils
Comert cu ridicata al metaleleor si minereurilor	Trade of other motor vehicles
Comert cu ridicata de bauturi si tutun	Wholesale of metals and ores
Comert cu ridicata al combustibililor solizi	Wholesale of beverages and tobacco
Comert cu ridicata al masinilor-unelte	Wholesale of solid fuels
Comert cu ridicata al combustibililor	Wholesale of machine tools
Comert cu autoturisme si autovehicule usoare	Wholesale of fuels
Comert cu ridicata al produselor din carne	Trade of cars and light motor vehicles
Recuperarea materialelor reciclabile sortate	Wholesale of meat products
Comert cu ridicata al altor masini si echipamente	Recovery of sorted recyclable materials
Comert cu ridicata al deseurilor metalice si nemetalice reciclabile	Wholesale of other machinery and equipment
Comert cu ridicata specializat al altor alimente inclusiv peste, crustacee	Wholesale of recyclable metallic and non-metallic wastes Specialized wholesale of other foods including fish, crustaceans
Distributia combustibililor gazosi prin conducte	Distribution of gaseous fuels through pipelines
Intermedieri in comertul cu gaze tehnice	Agents involved in the sale of technical gases
Transporturi maritime si costiere de marfa	Sea and coastal freight transport
Antiseptizare	Disinfection services
Pachetizare	Packetization
Comert cu ridicata al produselor textile	Wholesale of textiles
Colectarea deseurilor nepericuloase (excluzand cele de la nave)	Collection of non-hazardous waste (excluding ships)
Taierea si rindeluirea lemnului	Sawmills and fairing of wood
Comert cu ridicata de containere ptr. transport	Wholesale of containers for transport
Pregatirea semintelor in vederea insamantarii	Preparing seeds for sowing

PCS is an effective, fast, focused, flexible and multi-dimensional real-time information system designed to improve efficiency at all stages of port processes, from unloading and loading the ship, customs clearance of goods, health formalities, and up to managing deliveries to and from the terminal.

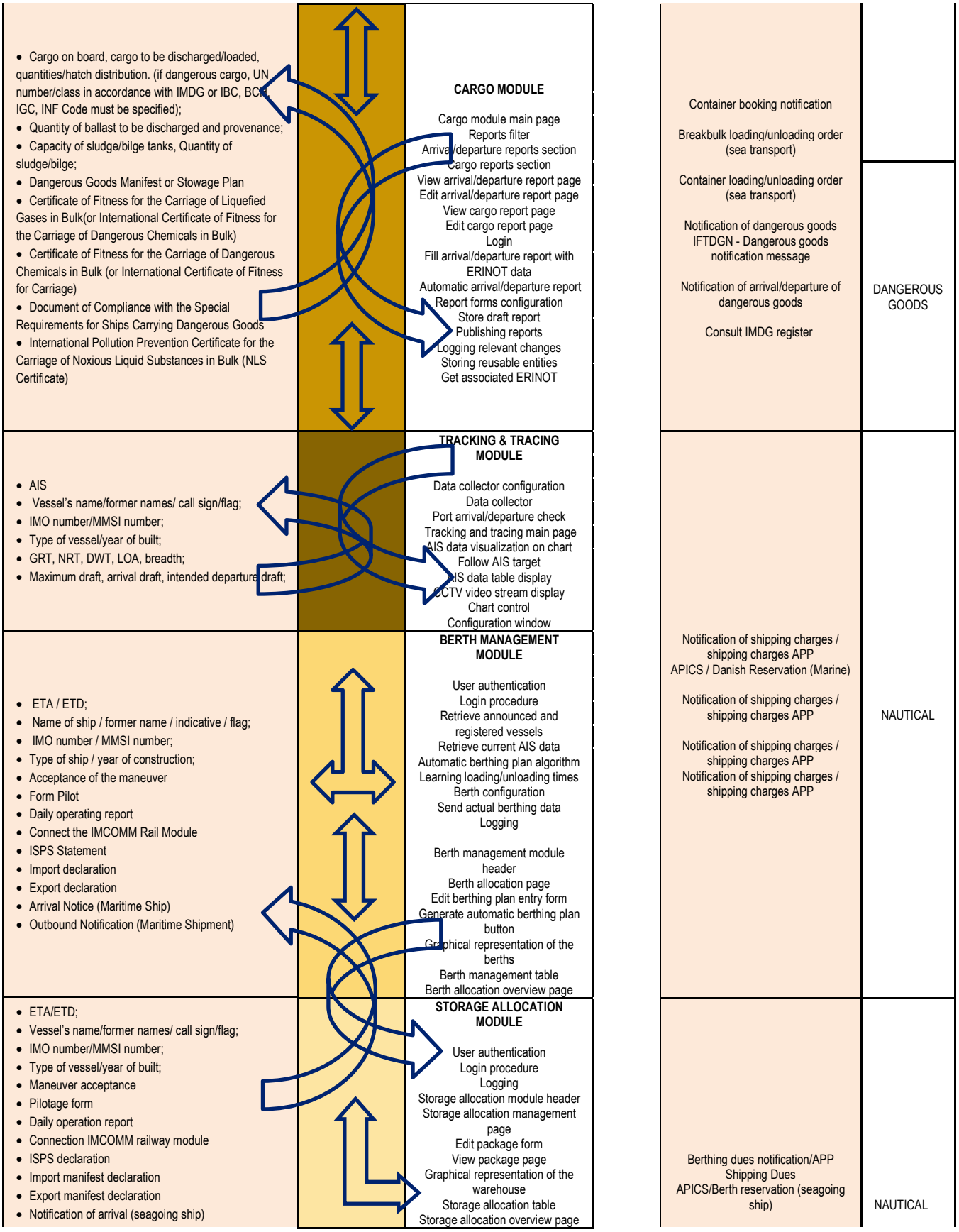
Services provided by the PCS platform

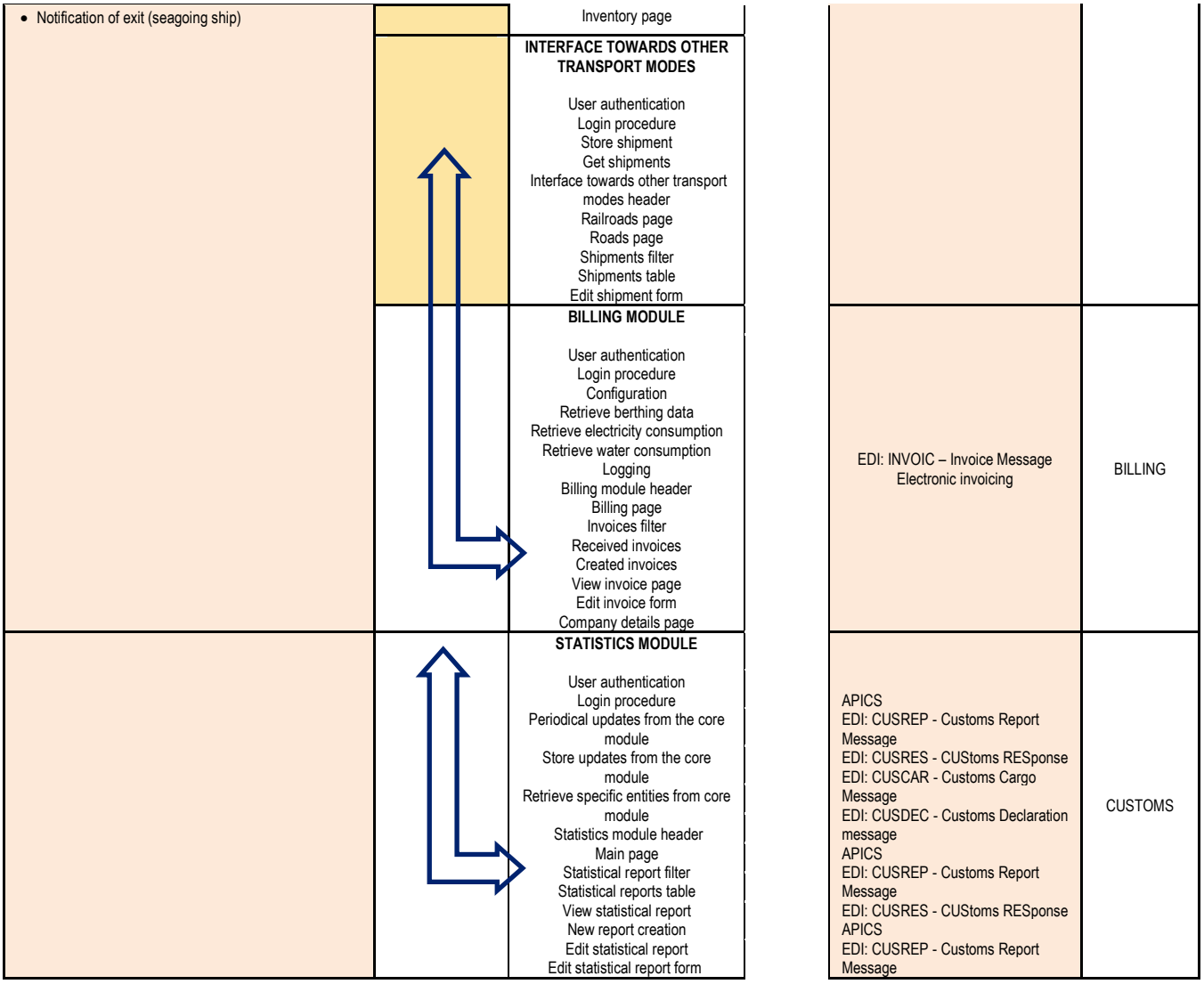
PCS is a centralized intelligent electronic platform that facilitates the standardization of multiple protocols for data exchange between port community members, which allows data transfer in XML and UN/EDIFACT formats. The platform can hold a centralized tracking and forwarding database and at the same time serves as a storage database for research and further analysis.

At the same time, PCS provides a secure application based on web technologies for accessing data, information, and exchange between the central base and stakeholders for common processes.

Table 3.1.2 CNAPM loosely structured information matrix flow vs RGO PCS vs Antwerp PCS

CNAPM Document-Loosely structured data	Information Flow	PCS - module	Antwerp PCS - SPECIFIC APP	Antwerp PCS
• Vessel's name/former names/ call sign/flag; • IMO number/MMSI number; • Type of vessel/year of built; • GRT, NRT, DWT, LOA, breadth; • Maximum draft, arrival draft, intended departure draft; • Owner's/Operator's/Charterer's name and address; • Agent's name and address; • Master's full name; • Number of crew (including master)/number of passengers; • Purpose of call; • Last port of call/next port of destination; • ETA/ETD • Maneuver acceptance • Pilotage form • FAL - Declaration: • Clearance Permit • Loading Declaration • IMO Declaration ETA/ETD; Vessel's name/former names/ call sign/flag; IMO number/MMSI number; Type of vessel/year of built; GRT, NRT, DWT, LOA, breadth; Maximum draft, arrival draft, intended departure draft; Owner's/Operator's/Charterer's name and address; Agent's name and address; Master's full name; Number of crew (including master)/number of passengers; Purpose of call; Last port of call/next port of destination;		**CORE MODULE** Authentication Request UserInfo Request Get data (API method set) Filtering data Post data (API method set) Post arrival/departure Get arrival/departure Entity change Entity search Entity delete Reference data search Login Core module header Users page Edit user page User roles management section Vessels section User profile page Edit vessel Change password Authorized users Roles page Data matrix Data matrix filter Data matrix table	APICS/Berth reservation (seagoing ship) APICS	NAUTICAL
			APICS/Berth reservation (seagoing ship)	CARGO LOGISTICS


• Cargo on board, cargo to be discharged/loaded, quantities/hatch distribution. (if dangerous cargo, UN number/class in accordance with IMDG or IBC, BCH, IGC, INF Code must be specified);
• Quantity of ballast to be discharged and provenance;
• Capacity of sludge/bilge tanks, Quantity of sludge/bilge;
• Dangerous Goods Manifest or Stowage Plan
• Certificate of Fitness for the Carriage of Liquefied Gases in Bulk(or International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)
• Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk (or International Certificate of Fitness for Carriage)
• Document of Compliance with the Special Requirements for Ships Carrying Dangerous Goods
• International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (NLS Certificate)
CARGO MODULE
Cargo module main page
Reports filter
Arrival/departure reports section
Cargo reports section
View arrival/departure report page
Edit arrival/departure report page
View cargo report page
Edit cargo report page
Login
Fill arrival/departure report with ERINOT data
Automatic arrival/departure report
Report forms configuration
Store draft report
Publishing reports
Logging relevant changes
Storing reusable entities
Get associated ERINOT
Container booking notification
Breakbulk loading/unloading order (sea transport)
Container loading/unloading order (sea transport)
Notification of dangerous goods IFTDGN - Dangerous goods notification message
Notification of arrival/departure of dangerous goods
Consult IMDG register
DANGEROUS GOODS
• AIS
• Vessel's name/former names/ call sign/flag;
• IMO number/MMSI number;
• Type of vessel/year of built;
• GRT, NRT, DWT, LOA, breadth;
• Maximum draft, arrival draft, intended departure draft;
TRACKING & TRACING MODULE
Data collector configuration
Data collector
Port arrival/departure check
Tracking and tracing main page
AIS data visualization on chart
Follow AIS target
AIS data table display
CCTV video stream display
Chart control
Configuration window
• ETA / ETD;
• Name of ship / former name / indicative / flag;
• IMO number / MMSI number;
• Type of ship / year of construction;
• Acceptance of the maneuver
• Form Pilot
• Daily operating report
• Connect the IMCOMM Rail Module
• ISPS Statement
• Import declaration
• Export declaration
• Arrival Notice (Maritime Ship)
• Outbound Notification (Maritime Shipment)
BERTH MANAGEMENT MODULE
User authentication
Login procedure
Retrieve announced and registered vessels
Retrieve current AIS data
Automatic berthing plan algorithm
Learning loading/unloading times
Berth configuration
Send actual berthing data
Logging
Berth management module header
Berth allocation page
Edit berthing plan entry form
Generate automatic berthing plan button
Graphical representation of the berths
Berth management table
Berth allocation overview page
Notification of shipping charges / shipping charges APP APICS / Danish Reservation (Marine)
Notification of shipping charges / shipping charges APP
Notification of shipping charges / shipping charges APP
Notification of shipping charges / shipping charges APP
NAUTICAL
• ETA/ETD;
• Vessel's name/former names/ call sign/flag;
• IMO number/MMSI number;
• Type of vessel/year of built;
• Maneuver acceptance
• Pilotage form
• Daily operation report
• Connection IMCOMM railway module
• ISPS declaration
• Import manifest declaration
• Export manifest declaration
• Notification of arrival (seagoing ship)
STORAGE ALLOCATION MODULE
User authentication
Login procedure
Logging
Storage allocation module header
Storage allocation management page
Edit package form
View package page
Graphical representation of the warehouse
Storage allocation table
Storage allocation overview page
Berthing dues notification/APP
Shipping Dues
APICS/Berth reservation (seagoing ship)
NAUTICAL



The PCS system is a multi-functional modular system with a multi-user access interface that operates in a port area while preserving its integrated system character. The electronic platform offers users port activities, multiple menus that include reporting exports, imports, transhipments, consolidations, and dangerous cargo.

PCS generally offers a wide range of key services and features that can be summarized as follows:

- Faster collecting of customs duties from all actors working in the port community.
- More efficient detection of smuggling goods.
- Rapid processing of customs documents, as the data provided in the PCS are easily accessible by Immigration Police officers.
- Rapid approval of permit certificates.
- Constanta Maritime Port Administration will be capable of providing various port services to different port authorities, including online shipment services, including tracking of cargo outside port areas as future services.
- Improved management and efficient use of ship loading.

- Better coordination of transport agents with respect to booking, purchase and document processing through a single electronic interface (PCS).
- Faster declaration of goods by customs agents by filing online documents for customs processing and online payment.
- Saving time and increased efficiency by conveying information to port authorities electronically.
- Electronic Data Interchange (EDI) fast and efficient information exchange, reuse and centralization, available 24/7/365
- Electronic handling of all information on the import and export of general and bulk containerized goods
- Information about the status of the goods as well as their control and tracking through the entire logistics chain
- Processing of dangerous goods data
- Processing of maritime statistics and other statistics needed by the port community to make port activities more profitable

The main benefits for all parties involved in using the Port Community Systems (PCS) interface are increased efficiency and speed in reporting port processes, especially by automation and reduced bureaucracy.

In this way, PCS contributes to sustainable transport logistics, offering improved security and cost savings.

3.1.2 Features, modules, parameters, equipment level and facilities, forecast specific technical data

PCS Features – integration requirements and market demands

The proposed modules for building a PCS architecture in the Port of Constanta are part of an elastic architecture, designed for a large time scale, from the perspective of implementing a system that can be used and expanded without space and time restrictions. Taking these considerations into account, the system will have to have functional features distributed both on a database level and with algorithms and the knowledge base used to assist decisions.

For an independent and uninterrupted operation, it is necessary to develop a cloud-based solution that, through the geographic and physical distribution of the computing resources and their load, can ensure safe, indefinite and minimum cost performance.

Taking into account the critical infrastructure character, it is imperative to ensure the security of information by appropriate cryptographic methods applied to data storage and transit, and authentication procedures. For processes of particular importance, it is necessary to implement multi-factor authentication (two factor authentication, HW token-based, OAUTH etc.).

From the analysis of the data exchanged between stakeholder(s) and CNAPM, the requirement to ensure data consistency through intermediate checks was determined under conditions of better standardization of inputs. It is necessary to identify APIs usable in already existing computer systems for automatic data sampling. It is imperative to start implementing some existing IT systems assessment measures and, depending on their caducity, to decide on appropriate upgrades or replacements through new modules developed in line with PCS requirements. Secure security features (SSL) alignments are required for both existing CNAPM software systems and those with which CNAPM exchanges data (e.g. MSW http://msw.ro).

It is recommended that the web technologies used in the development of the PCS platform be of the open type in order to ensure high sustainability at minimum costs for a long time.

Given the complexity of PCS, it is recommended to use technologies that allow massive data processing with minimum operating latency, easy integration with third-party solutions and a mature and abundant market for software developers.

In order to facilitate the cost-maintenance of the CNAPM, it is necessary to ensure continuous and free access of CNAPM's IT department to documentation and software development resources. The technologies used by PCS will have to be scalable both horizontally (the ability to support as many users as possible simultaneously) and vertically (the ability to add new functionalities without affecting the existing functional performance), criteria that constitute long-term efficiency indicators. Aggregate table 3.1.2.1, shows functionalities and development periods for PCS systems in major world ports.

Table 3.1.2.1 PCS systems in international ports [10], [31]

Port	System	Operator	Function		
			Port Related	Customs Related	E-Business among customers
Singapore	Portnet	Portnet.com	o	o	o
	TradeXchange	CrimsonLogic Ltd.	x	o	o
Hamburg	Dakosy	Dakosy AG	o	o	o
	COAST	HHLA	o	x	x
Hong Kong	OnePort	OnePort Limited	o	x	x
	Tradelink	Tradelink Electronic Commerce Limited	x	o	o
Rotterdam	Port Infolink	Port Infolink B.V.	o	o	x
	Portofrotterdam.com	The Port of Rotterdam Authority	o	x	o
	WebJonas		x	x	o
Busan	PORT-MIS	KL-Net	o	x	x
	KTNET	KTNET	x	o	x

Nr	Name	Type of IS	Location	Key objectives	Founded	Users
1	Port Infolink	Port Community System	Rotterdam, Netherlands, Europe	Port process coordination with extension to supply chain	2004-2007	~1200
2	Synchron8	Barge Synchronization System	Rotterdam, Netherlands, Europe	Planning and coordination of barges	2005	~70
3	Informore	Datahub	Netherlands, Europe	Supply chain coordination	2000	5-10
4	Secure Logistics	Cargo Card (smart card)	Netherlands, Europe	Authentication and authorization of truck drivers and terminal visitors	1998	~700
5	Dakosy	Port Community System	Hamburg, Germany, Europe	Port process coordination	1981	~1500
6	Seagha	Port Community System	Antwerp, Belgium, Europe	Port process coordination	1986	~800
7	Freight Information Real-Time System for Transport (FIRST)	Port Community System	Port of New York and New Jersey, USA	One-stop-shop' for freight and port information, providing real-time information	2001-2002	<1% of Registered Port Trucks
8	Freight Information Highway (FIH)	Supply Chain Orchestration	Federal Government Initiative, USA	Pilot of system to minimize the number of data-exchanges between the multiple transport providers in a containerized freight supply chain	2000-2003	20
9	Portnet Tradenet	Port Community System	Singapore, Asia	Port process coordination Paperless government applications	1984 1988	8000 2500
10	OnePort Tradelink	Port Community System Supply Chain Orchestration	Hong Kong, China, Asia	Port process coordination Paperless government applications	2003 1988	800 53000

The **features** of a PCS system must ensure that the seven internationally recognized functional dimensions associated with stakeholders in the transport chain are met, where the main functionalities of the PCS platform have to meet the frame requirements in Figure 3.1.2.1:

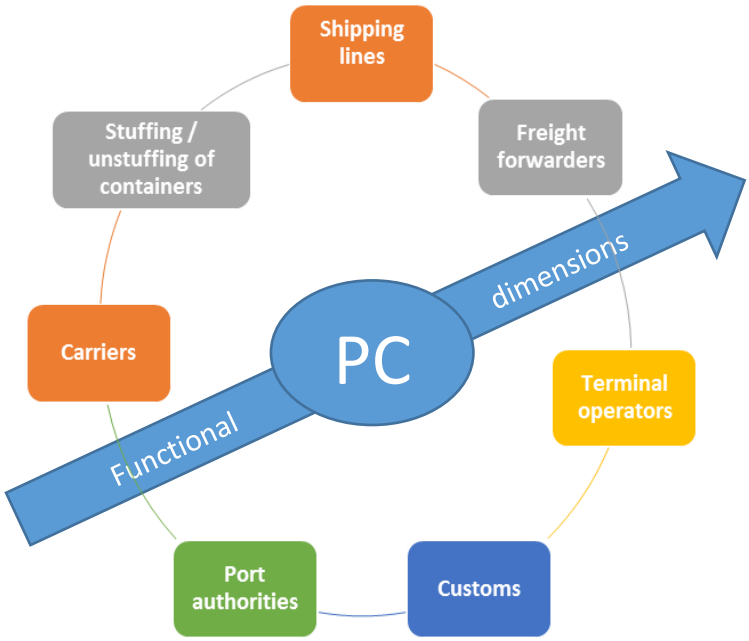


Fig. 3.1.2.1 Functional dimensions of the transport/PCS framework requirement chain

The primary functions were identified for each dimension. The following list summarizes the **PCS features for each stakeholder dimension.**

I. 18 classes of services are necessary for **Shipping Lines**:

1. Distribution of transport offers of regular lines
2. Booking requests to multiple carriers
3. Booking information and status
4. Real time tracing of goods status and movements
5. Collection of the B/L information entered by freight forwarders
6. List for goods loading
7. List for goods to be discharged
8. Discharge report (discrepancies between previously announced containers and actually discharged ones)
9. Customs declaration
10. Dangerous goods declaration
11. Waterway activity
12. Berth soundings
13. Vessel inspection request
14. VPA anchorage
15. Ship departure confirmation
16. Waste disposal notification
17. Harbour dues
18. Vessel declaration

II. 12 classes of services are necessary for **Freight Forwarders**:

1. Facilitation for searching transport offers
2. Booking requests to multiple carriers
3. Booking information and status

4. Transmission of the B/L data to the shipping agents
5. Real time tracing of goods status and movements
6. Truck nominations
7. Transport order management
8. Unloading confirmation
9. Dangerous goods declarations
10. Customs declaration
11. Transmission of the Customs clearance status
12. Government agencies (e.g. veterinary inspection) declarations

III. 10 classes of services are necessary for **Terminal Operators**:

1. Presentation of reception and storage conditions of dangerous goods
2. Vessels schedule
3. Information transmitted on the list of goods to be unloaded
4. Beginning and end time-stamping of unloading operations
5. Transmission of information on goods to be loaded with seals and stocks, goods remaining on quay to shipping agents, freight forwarders and Customs
6. Customs scan process
7. Truck appointment system
8. Truck arrival pre-notification
9. Fleet management (managing port's vehicles)
10. Rationalization of controls by means of the targeting functions

IV. 5 classes of services are necessary for **Customs**:

1. Authorization control and loading receipt
2. Customs declaration
3. Follow-up of shipping agents' stock accounting write-off
4. Discrepancy list
5. Customs scan process

V. 15 classes of services are necessary for **Port Authorities**:

1. Ship departure confirmation
2. Harbour dues
3. Vessel inspection request
4. Immigration clearance
5. Surveyor clearance
6. Reception of dangerous goods declaration
7. Vessel arrival notification
8. Notification for waste disposal
9. Berth soundings
10. Transmission of the agreement and conditions of dangerous goods landing on quay, physical follow-up
11. Transmission of information on the storage and pick up of dangerous goods
12. Truck nominations
13. Statistics for users
14. Supply Chain performance indicators for users
15. Berth allocation management

VI. 8 classes of services are necessary for **Land Carriers**:

1. Viewing of goods status needed to leave the port
2. Web cameras at the terminal gates

3. Truck appointment system
4. Truck arrival pre-notification
5. Barge planning
6. Rail planning
7. Port traffic alerts
8. Transport order management

VII. 6 classes of services are necessary for **Stuffing/Unstuffing Centres** (using the terminology under recommendation of International Chamber of Shipping (http://www.ics-shipping.org) and World Shipping Council (http://www.worldshipping.org):

1. Unstuffing* lists recovery
2. Transfer of stuffing instructions
3. Goods status display
4. Checking of the Customs status
5. Container tracing: from the stuffing center to goods loaded "on board"
6. Unstuffing management

* In order to mitigate the misperceptions at operational port level, we provide the following sources related to **unstuffing/stripping/devanning** container terminology usage:

- **Source (reference industry guide)**: Industry Guidance for Shippers and Container Stuffers (2008)
http://www.worldshipping.org/pdf/industry_guidance_shippers_container_stuffers.pdf

- **Source (glossary of shipping terms):** Glossary of Chartering & Shipping Terms, Kevin Stephens, Rickmers-Line (2007)
http://providenceship.com/images/publications/shipping-terms.pdf

- **Source:** Lloyd's Maritime Institute (2018)
https://www.lloydmaritime.com/en/maritime-dictionary

- **Source**: UNCTAD (1973)
https://unctad.org/en/PublicationsLibrary/rmt1972-73_en.pdf

- **Source (port authority):** Port of London Authority Handbook (2018)
https://server1.pla.co.uk/assets/pla2018withcovers72dpi.pdf

- **Source (reference book):** The Economics of Containerization, K.M. Johnson, H.C. Garnett, Routledge Library Editions: Transport Economics (1971)
https://books.google.ro/books?id=SHrCDgAAQBAJ&pg=PT73&lpg=PT73&dq=rotterdam+%22unstuffing%22&source=bl&ots=K_wx9yP183&sig=wG0JNX7l8gYIkDnFaM7bl-biBAs&hl=en&sa=X&ved=2ahUKEwiR4onQy4TfAhXPhaYKHRGuA-c4ChDoATAAegQICRAB

- **Source (job offer task list):** DB Schenker (2018)
https://www.dbschenker.com/es-en/joboffer-201712290012%23en

- **Source DAPhNE Project, D.5.1.1:** Status of port infrastructure, development along the Danube, pg. 186, pg. 190 (2018)
http://www.interreg-danube.eu/uploads/media/approved_project_public/0001/16/a53054c9cc293aed37966daac163a2df16e580b0.pdf

In order to fulfil the functional dimensions of the transport chain, CNAPM carries out a series of regulated activities as follows:

1. The implementation of port policies drawn up by the Ministry of Transport;
2. Drawing up seaport development plans, in line with the development policy and programs developed by the Ministry of Transport and the Regulation on Seaport Operation;
3. Coordination of activities taking place in seaports;
4. Implementation of seaport infrastructure development programs;
5. Issue of permits to authorize economic operators to carry out maritime transport activities within the perimeter of maritime ports;
6. Approval of port activities other than those subject to authorization by the Ministry of Transport and issue of work permits;
7. Trace and take the necessary measures to ensure that cargo traffic in seaports and their storage does not affect the security of port infrastructure and vessel operation;
8. Perform control actions on ship loading or unloading activities and prohibit or stop them in the cases provided by the regulations in force;
9. Ensure the functionality, administration, maintenance, repair and upkeep of the minimum technical characteristics of the conceded shipping infrastructure in the ports of Constanta, Midia and Mangalia and the Tomis Marina as well as its own patrimony and make it available to users in a non-discriminatory manner, in accordance with the regulations in force;
10. Establishment of the of ship entry order into seaports, allocation of berths and issuance of berths;
11. Provision of services, operations and works, by delegation of competence, in order to fulfil the obligations incumbent upon the Romanian State in the international agreements and conventions to which Romania is a party, such as the search for and saving of life at sea and the intervention in the case of pollution;
12. Representation of the Ministry of Transport in relations with the concessionaires of the shipping infrastructure or of the safety services.

Information gathering sample/unintentional informational redundancy

The following sample address one side of data collecting process during interaction phases in normal data exchange using standardized form (only paper format):

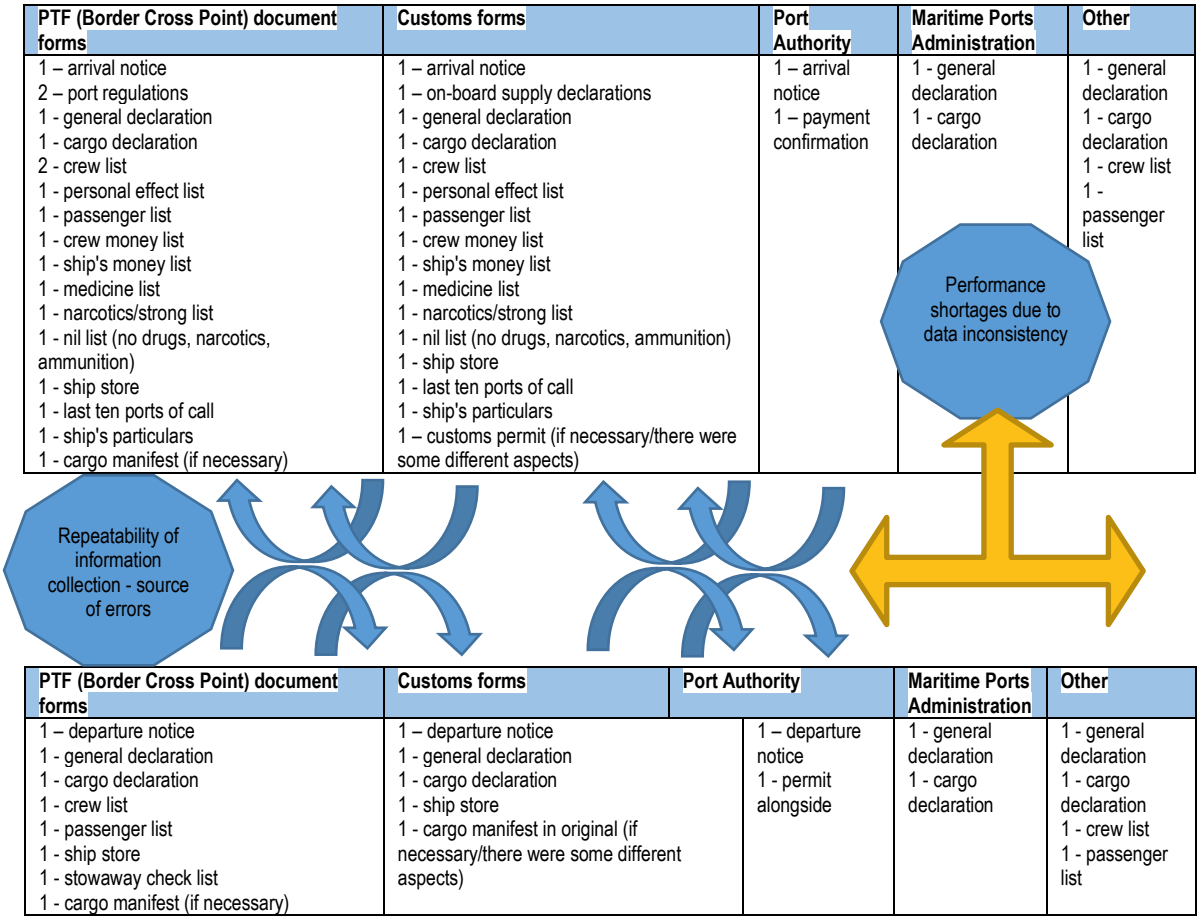


Fig. 3.1.2.2 Documents processing information area (manual approach, loosely structured) in the Port of Constanta

Further feasibility study will consolidate the information aggregation and will structure it to a level to make the comprehensible flux analysis in order to evaluate the value of loses generated by unstructured data approach.
As in DAPhNE Project Work Plan version 4/01.06.2017, there are well known drawbacks in data information system in port area where stakeholders normally exchange information via fax, email, phone etc. reducing port operation effectiveness due to factors such as different message format, paper administration, double data entry, data loss etc.

In carrying out the listed activities, CNAPM operates a logical structure of port information as provided by the legislation in force and by the technical-economic practice, while the computerization of the port processes is partial. The information structure and recurrent elements

currently used in the port area generate physical redundancy, logical redundancy, as the redundancy of the pre-existing information systems also arises.

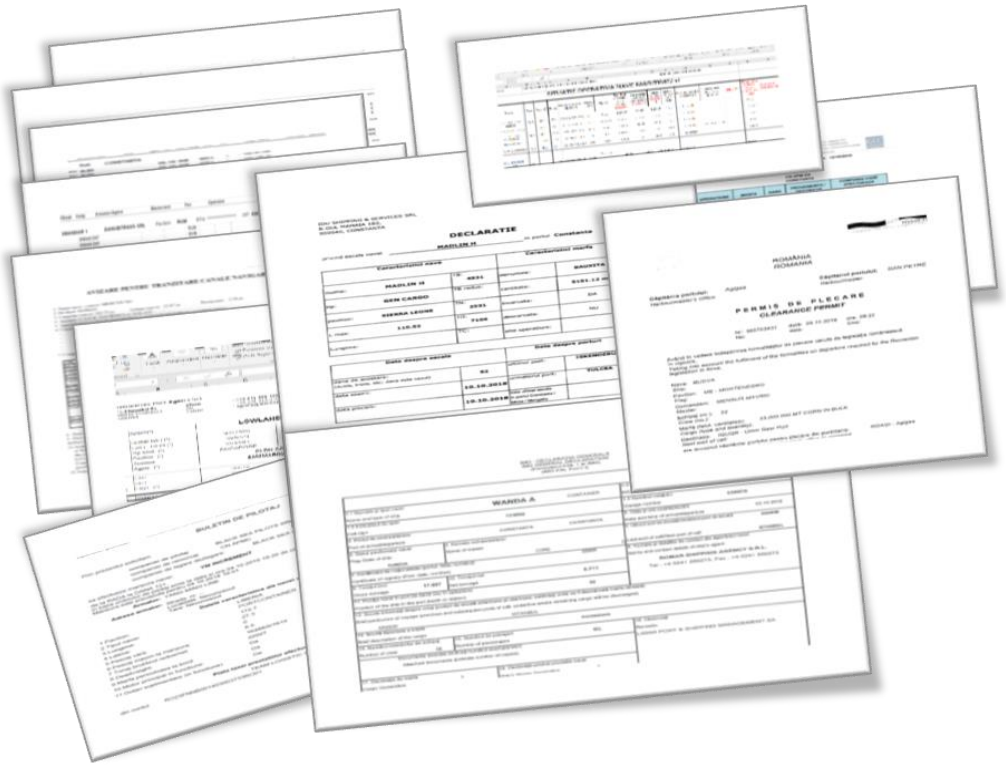


Fig. 3.1.2.3 Unintentional information redundancy on physically format using standardized forms in Port of Constanta

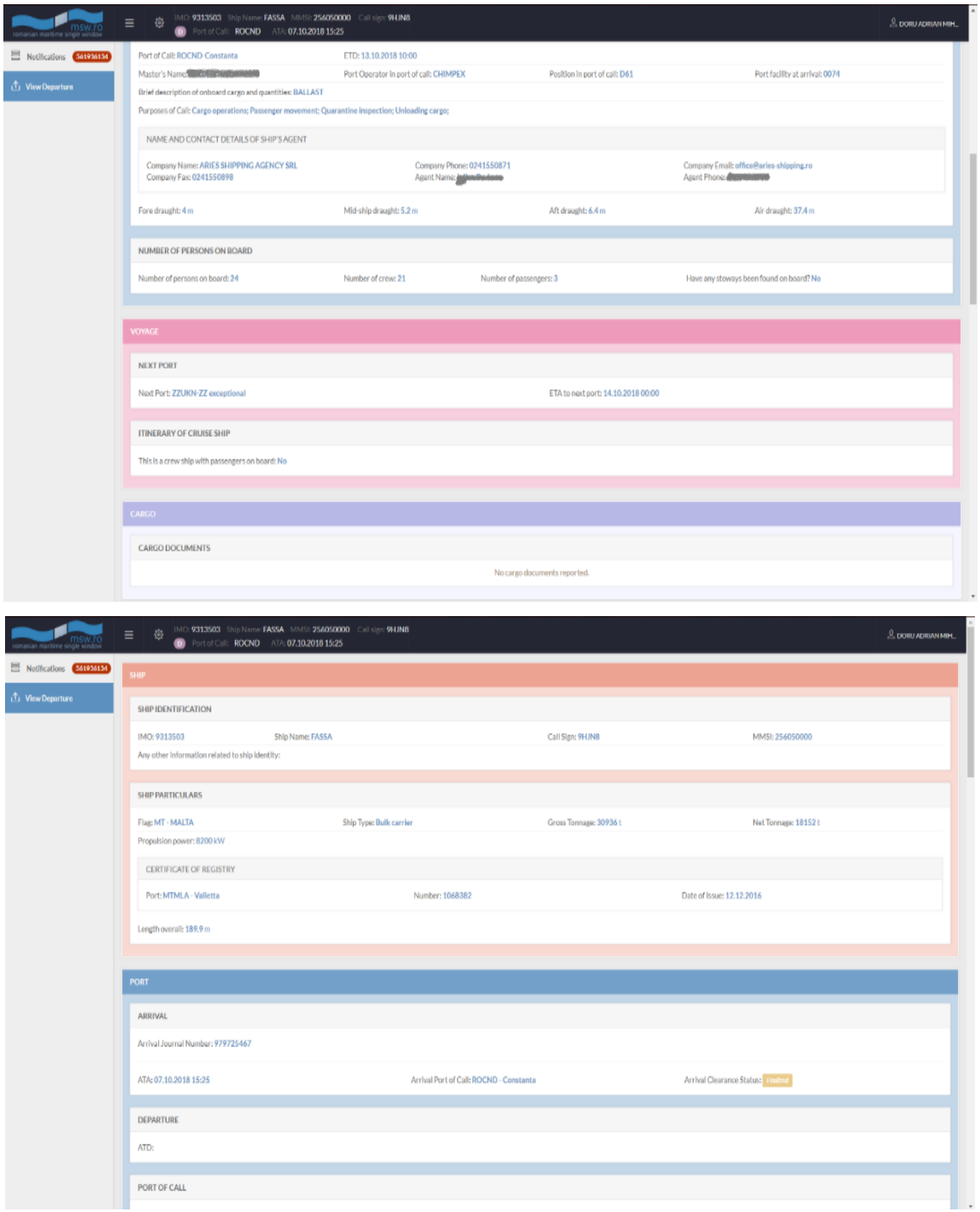
Unwanted/unintentional informational redundancy, for the purposes of this chapter, is the unjustified storage of information several times in different physically and logically different systems. In the activity of CNAPM redundancy comes from recurrent data collection, sometimes from possible sources of information and from the lack of control and data compliance at a systemic level through validation algorithms. The employees' professionalism is a corrective factor, acting in the sense of early identification of inconsistencies in structuring and the veracity of the information, but this stage is subject to human errors. The heterogeneity of the information retrieval formats entails a series of risks of occurrence of data mistakes made by sampling the same data differently and/or incompletely structured as in Figure 3.1.2.2.

There are different kinds of unwanted information redundancy in Port of Constanta due to the different nature of data processing modes: manual system vs automated systems. However, the automated systems tend to cover only some part of harbour processes (e.g. billing, where every port operator as well as CNAPM have their own systems), ship data collection (MSW operated by Romanian Naval Authority, CNAPM and Customs had their own systems, etc.)

There are two main ways to aggregate the overall data flux: to import from several systems already active in harbour area or to develop a new system which can act as main integrator to achieve a better data model in order to use the real port features interactions.

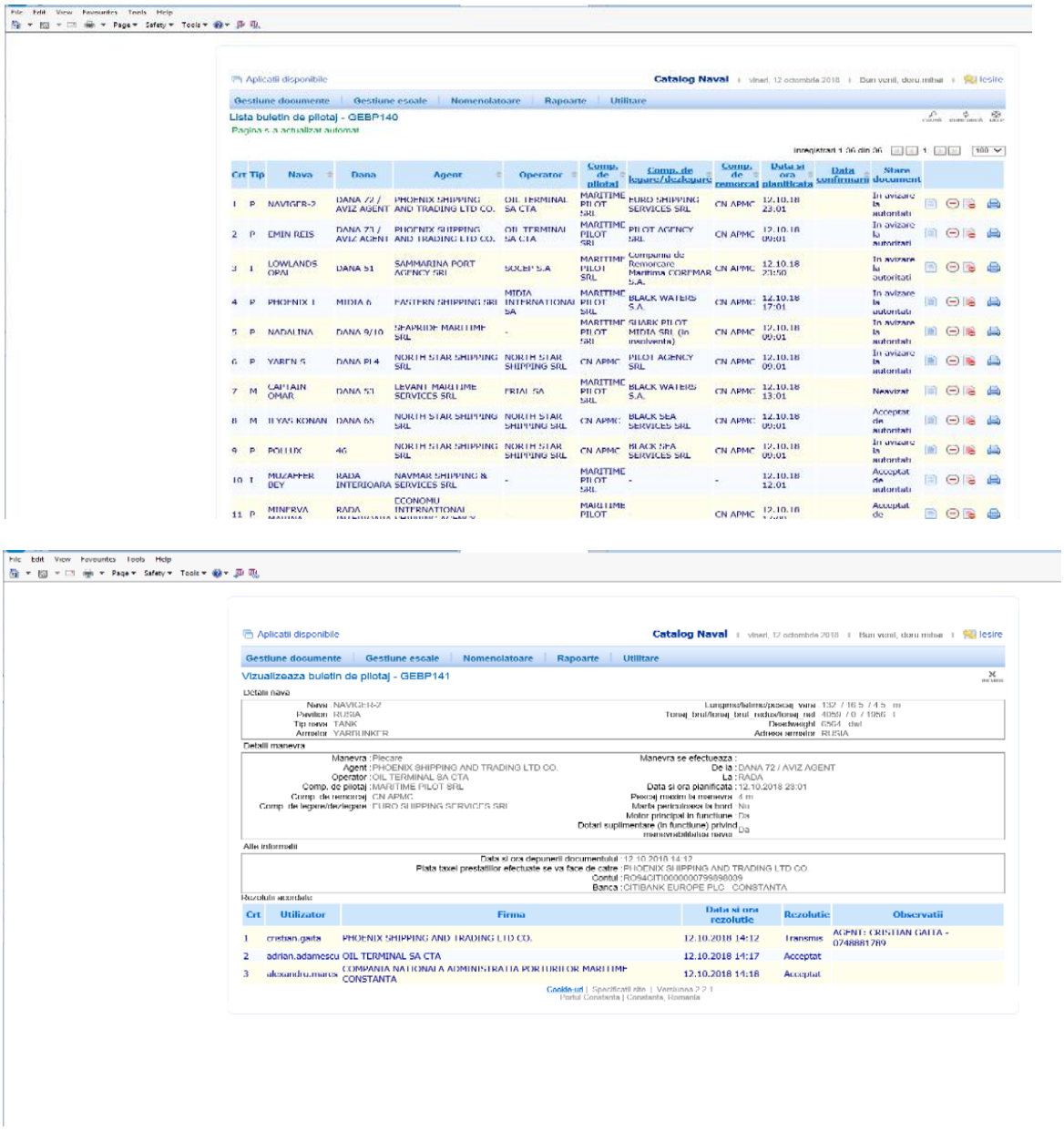
Due to development and sustainability cost, only the development of the new system can be recommended in long term because the heterogeneity of existing systems is too difficult to address in terms of complexity, security and sustainability.

As a sample of our stance we can show the comparison in figure 3.1.2.2 where some unintended information overlapping could be observed.



(a)

Fig. 3.1.2.2 (a) Possible redundancy between CNAPM and MSW (www.msw.ro)



(b)

Fig. 3.1.2.2 (b) Unintentional information redundancy between CNAPM and MSW (www.msw.ro) - mainly manual operation/no interconnection between different informational systems

Advantages over early PCS implementations

The advantage of late developments of complex PCS systems in the CNAPM situation (compared to the other ports in Table 3.1.2.1) is given by the opportunity to use mature technologies, specific to the introduction of Industry 4.0 as a conceptual element of port operation in the near future. It can be considered, in this case, that the technologies best suited to PCS development are those based on a combination of Open Source products and personalized development, following the trends

introduced by the companies that operate the largest data volumes globally (Table 3.1.2.2). MariaDB, MySQL, PostgreSQL databases and server-side scripting technologies like PHP, Java, Python, Scala, Ruby are recommended.

Table 3.1.2.2 Widely used programming languages/databases (mostly open source)

Websites	Popularity (unique visitors per month)[1]	Front-end (Client-side)	Back-end (Server-side)	Database	Notes
Google.com[2]	1,600,000,000	JavaScript	C, C++, Go,[3] Java, Python, PHP (HHVM)	Bigtable,[4] MariaDB[5]	The most used search engine in the world
Facebook.com	1,100,000,000	JavaScript	Hack, PHP (HHVM), Python, C++, Java, Erlang, D,[6] XHP,[7] Haskell[8]	MariaDB, MySQL,[9] HBase, Cassandra[10]	The most visited social networking site
YouTube.com	1,100,000,000	JavaScript	C, C++, Python, Java,[11] Go[12]	Vitess, BigTable, MariaDB[5][13]	The most visited video sharing site
Yahoo	750,000,000	JavaScript	PHP	PostgreSQL, HBase, Cassandra, MongoDB,[14]	Yahoo is presently[*when?*] transitioning to Node.js[15]
Amazon.com	500,000,000	JavaScript	Java, C++, Perl[16]	Oracle Database[17]	Popular internet shopping site
Wikipedia.org	475,000,000	JavaScript	PHP, Hack	MariaDB[18]	"MediaWiki" is programmed in PHP, runs on HHVM; free online encyclopedia
Twitter.com	290,000,000	JavaScript	C++, Java[19], Scala[20], Ruby	MySQL[21]	Popular social network.
Bing	285,000,000	JavaScript	C++, C#	Microsoft SQL Server, Cosmos	
eBay.com	285,000,000	JavaScript	Java,[22] JavaScript,[23] Scala[24]	Oracle Database	Online auction house
MSN.com	280,000,000	JavaScript	C#	Microsoft SQL Server	An email client, for simple use. Mostly known as "messenger".
Microsoft	270,000,000	JavaScript	C#	Microsoft SQL Server	One of the world's largest software companies.
Linkedin.com	260,000,000	JavaScript	Java, JavaScript,[25] Scala	Voldemort[26]	World's largest professional network.
Pinterest	250,000,000	JavaScript	Django,[27] Erlang	MySQL, Redis [28]	
WordPress.com	240,000,000	JavaScript	PHP	PostgreSQL, HBase, Cassandra, MongoDB,[29]	

In order to assure long term usage of PCS we need to take in consideration the **full software development life cycle model:** Requirement gathering and analysis, Design, Implementation or coding, Testing, Deployment and Maintenance.

Requirement gathering and analysis: A Requirement Specification document is created in the first phase and serves as a guideline for the next phase of the model. The testing team follows the Software Testing Life Cycle and starts the Test Planning phase after the requirements analysis is completed. This phase is mainly focused on the project managers and stake holders. Meetings with managers, stake holders and users are held in order to determine all the necessary requirements. There are general questions that get answered during a requirements gathering phase. After requirement gathering, these requirements are analysed for their validity and for the possibility of incorporating into the system.
Design: As a second step, System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture. The system design specifications serve as input for the next phase of the model. In this phase the testers come up with the Test strategy, where they mention what to test, how to test.
Implementation/Coding: On receiving system design documents, the work is divided in modules/units and actual coding is started. Since, in this phase the code is produced so it is the main focus for the developer. This is the longest phase of the software development life cycle.
Testing: After the code is developed it is tested against the requirements to make sure that the product is actually solving the needs addressed and gathered during the requirements phase. During this phase all types of functional testing like unit testing, integration testing, system testing, acceptance testing is done as well as non-functional testing.

Deployment: After successful testing the product is delivered/deployed to the customer for their use. As soon as the product is given to the customers they will first do the beta testing. If any changes are required or if any bugs are detected, then they will report it to the engineering team. Once those changes are made or the bugs are fixed then the final deployment will happen.
Maintenance: Once the customers start using the developed system then the actual problems come up and need to be solved from time to time using a long term, well controlled versioning system.

Expertise gathering from previous implementations: case study visit – Port of Antwerp

As in DAPhNE project goals description, PCS manages, optimizes and automates port and logistics processes through a single submission of data and connecting transport and logistics chains. It enables intelligent and secure exchange of information between port community members.
The primary goal of activity 5.3 Port IT Community System within the Work Package 5: Port Development of the DAPHNE project was to define a realistic approach for specifying, developing and implementing a PCS (Port Community System) which is adequate for ports on the Danube. A study visit to a port in the Rhine region was organized to Port of Antwerp on June 22nd 2017, to collect valuable information based on over 30 years of experience in development and operation of a port community system. The main purpose of the study visit was to gain information and knowledge about the APCS from the presentations and dialogue between the consortium members and the Port of Antwerp representatives, identifying efficient solutions for the smaller scale ports, as well as identifying which functionalities would simply not be feasible or cost effective. As a results, there are a lot of principles to be used in further implementation of PCS in the Port of Constanta area like the structuring PCS operations in **four main functionalities** (Cargo&Logistics, Hazardous cargo, Customs and Nautical) taking into consideration modern demands for technical and security aspects like: **Secure** data transmission, Sender and receiver **authorization**, High **availability** (99.5% uptime), Preference for **web** application (**cloud** based solution, no installation of software for clients is required), **Single sign-on** and federated authorization, SAML **token** used for access and transfer of authorization information.

The technical approach, cloud based, will further enable the CNAPM services to be delivered as eServices, part free and part sold in paid format.

Module functionalities

Core module is the central part of PCS architecture due to its two main functions: **user management and data layer interactions**. This module will cover the user authorization and authentication as its primary function. The single sign-on feature is mandatory because it enables using the same account for all modules and parts of the Port Community System so that users don't need to use and maintain multiple accounts for the same datasets (e.g. username/email, name, last name, contact information, profile picture, etc.). This will simplify the usage of the system as a whole and will increase the adoption and retention rates of all actors within the port community. This includes assigning user roles, individual access rights, data access rights, etc.
Every other module needs to poses a security token which will enable it to retrieve all the data it requires and is authorized to get and nothing more. The other modules shall handle the access rights and data access rights taking care of restricting the data that is visible to their users to the data that the user is authorized to access. The security must be periodically audited and data conformity needs to be approved.

Cargo module is intended to be the best method to manage the cargo operations as a whole and to assure the best tools for cargo manipulation, cargo editing, cargo reporting, including ERI Notification Message data (VES-ship to shore, CAR-shore to shore, PAS-authority to authority).
Tracking & Tracing module will have the primary role in the surveillance and the information provision about the traffic from/to and within the port for the port authority and for other authorized stakeholders (i.e. customs, ship owners, etc.). This will allow all authorized members of the port community to get a detailed picture of the traffic situation. The AIS data from the T&T module can be used for planning purposes for berth management and potentially for billing (automatic calculation of times spent on berth, automatic registration of entrance time or any other relevant information that can be calculated automatically from the location data that is available in the AIS. However, due to inherent errors that could be generated by AIS architecture and data structure the information for T&T must be checked against other types of data (form contents, arrival notices, custom declarations, etc.)
Statistics module will assure the data collection for monitoring, efficiency improving and further planning of all harbour activity. The data could be used for decision making, being suitable for AI machine learning and future automation. One of most important feature here is the ability to design the custom filters and reports able to fit the real needs of improving the ordinary activity not only to create the standard report template.
Berth management module is one of the most important processes in any ports. Danube project partners' ports are of course no exception. Therefore, the berth management module is considered a mandatory inclusion in the Constanta harbour PCS using a timetable and live visualization of the berths. As previously mentioned, AIS might not be a reliable enough solution to automatically detect which part of the berth is occupied by a vessel. Using the expertise from Port of Antwerp and taking in consideration the dimension and heterogeneity of Port of Constanta, it is mandatory to use a camera surveillance system (CCTV) that could be integrated when designing the PCS. Depending on the positioning of the cameras and the quality of the video feed it might be possible to identify information about the location of a vessel on the berth without the need for human visual inspection on the berth itself. In order to increase the level of automation an electronic booking system would ease the process of berth management allowing ships to reserve their place at the berth if available.
Billing module is intended to cut the time and complexity of billing processes. Thus, there is a great demand for this kind of automation because of the effects generated on entire port economy. However, only part of this billing system can be implemented in the Port of Constanta due to high heterogeneity of billing processes induced by the fiscal authorities and national Romanian law. We presume the easy applicability in the area of CNAPM owned processes. Meanwhile, with a proper policy of billing, other services and activities from different parties could be added as a new functionality for the billing module. For this reason, the billing module architecture must be flexible to future market needs.
Storage allocation module intention is to optimize storage space allocation for increased overall efficiency. This can include packaging phase, warehouses management, inventories evidence and storage reporting availability. It is mandatory to assure near real-time storage area synopsis to optimize the traffic and storage spaces in the Port of Constanţa.
Interface towards other transport modes is a very important linking module between inland transport facilities and harbour activity. Due to overall complexity, this module can be implemented only using data exchange with existent systems on rail and road. Ideally, any large port will start the optimization processes taking in consideration the interactions between multimodal transportation actors.

In our pre-feasibility study we take in consideration the systems developed by the “Informatica feroviară” with the system https://imcomm.infofer.ro as shown in figure 3.1.2.3. On the other part, this module could lead the other types of information and transport modes in future steps due to a flexible design with data exchange as main commitment for module development.

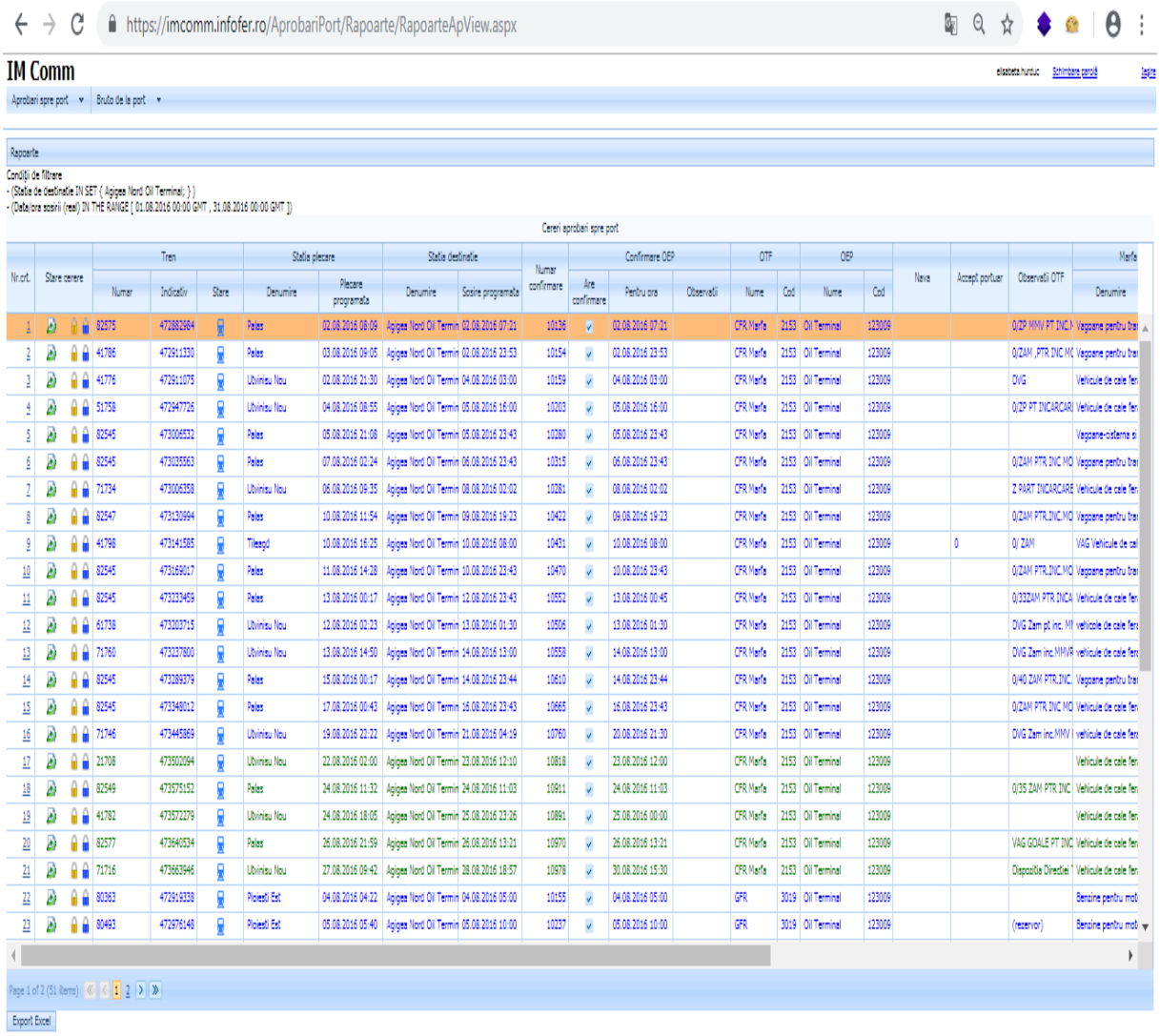


Fig. 3.1.2.3 IMCOMM System for Romanian railroads https://imcomm.infofer.ro

The synoptic architecture of the PCS is explained in accordance with the provisions of the Danube Ports Network, output 5.2 - Model architecture for Port Community System (PCS), developed by RGO Communications Ltd., version 4.0 of 13/06/2018 (Figure 3.1.2.4).

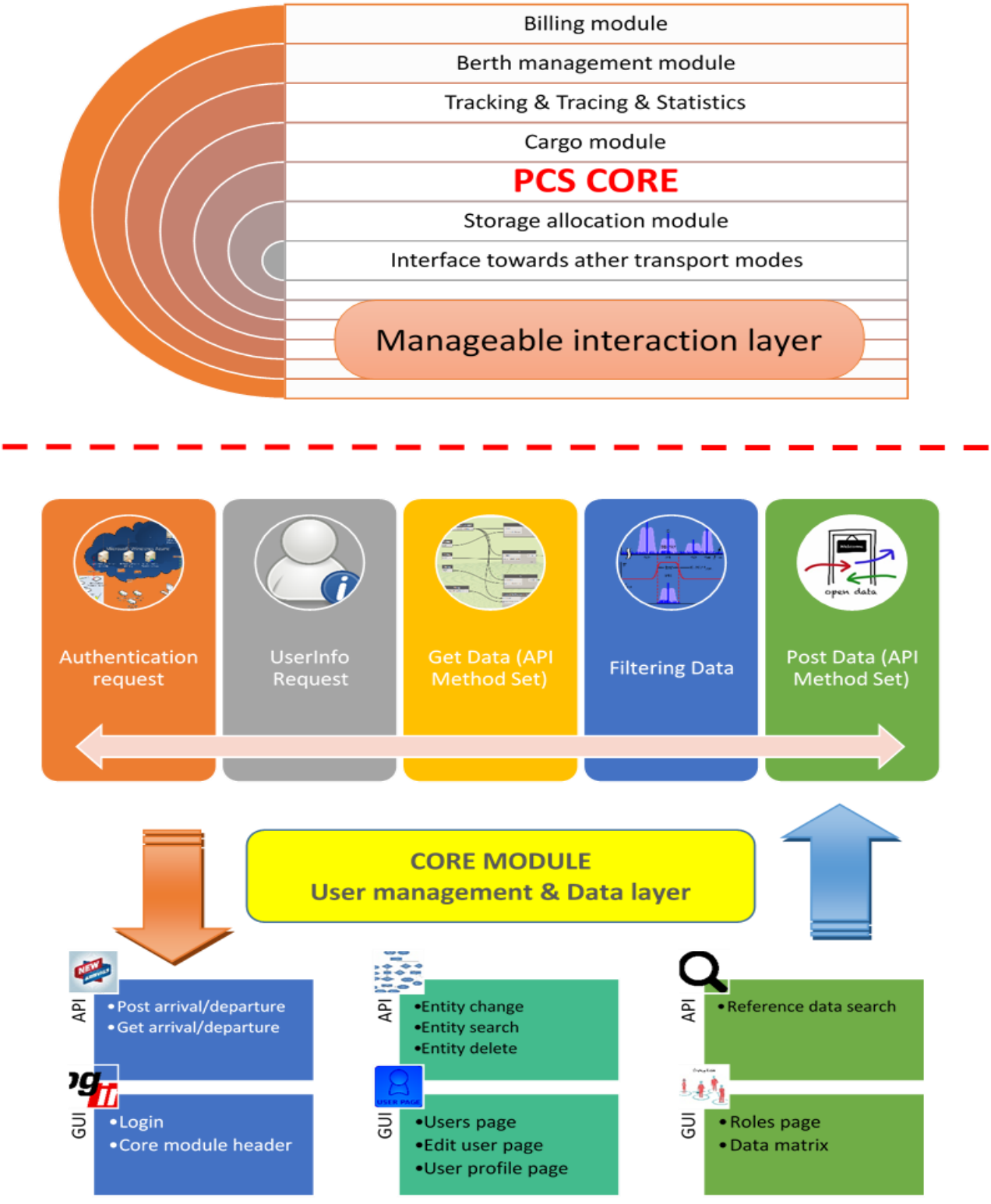
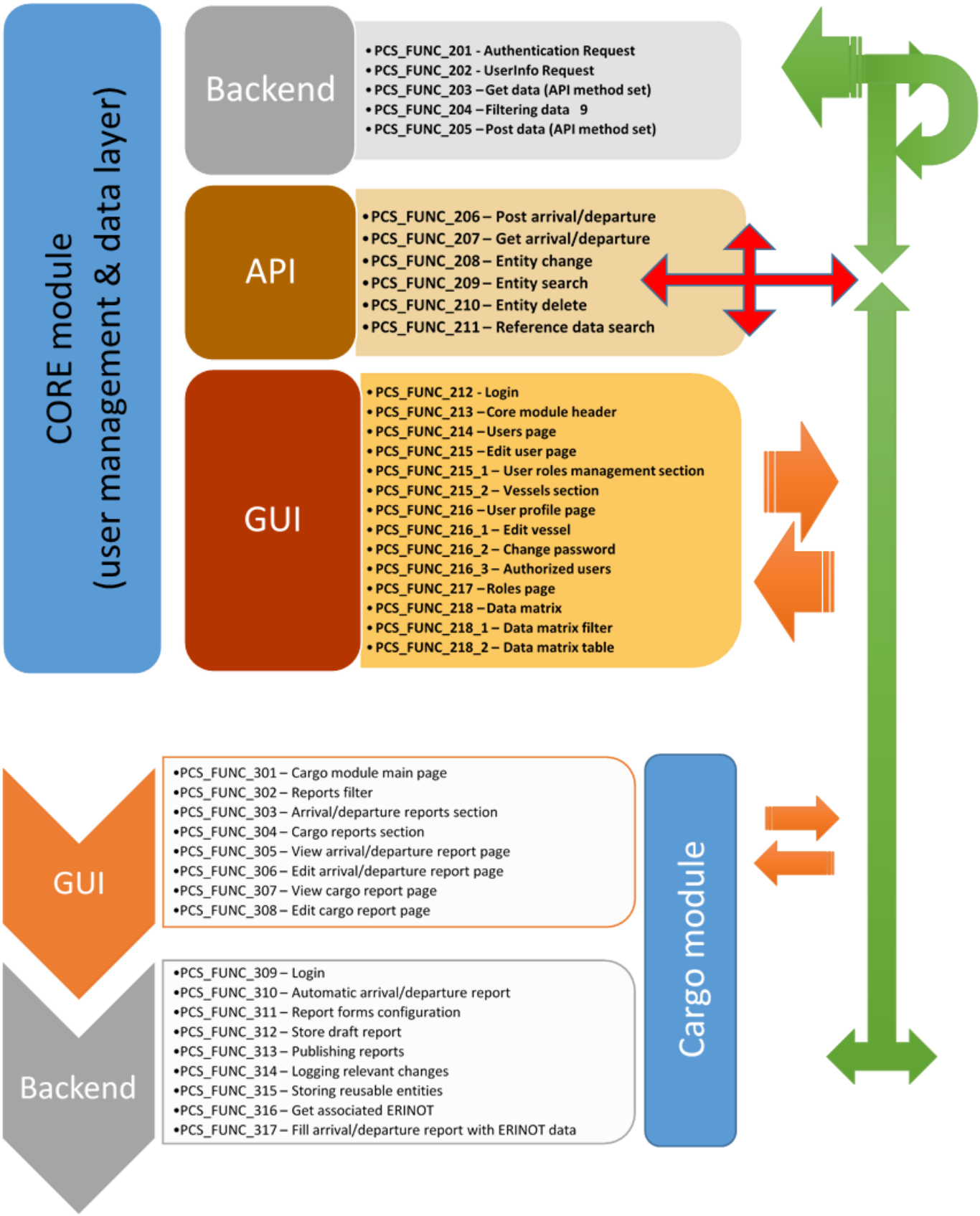
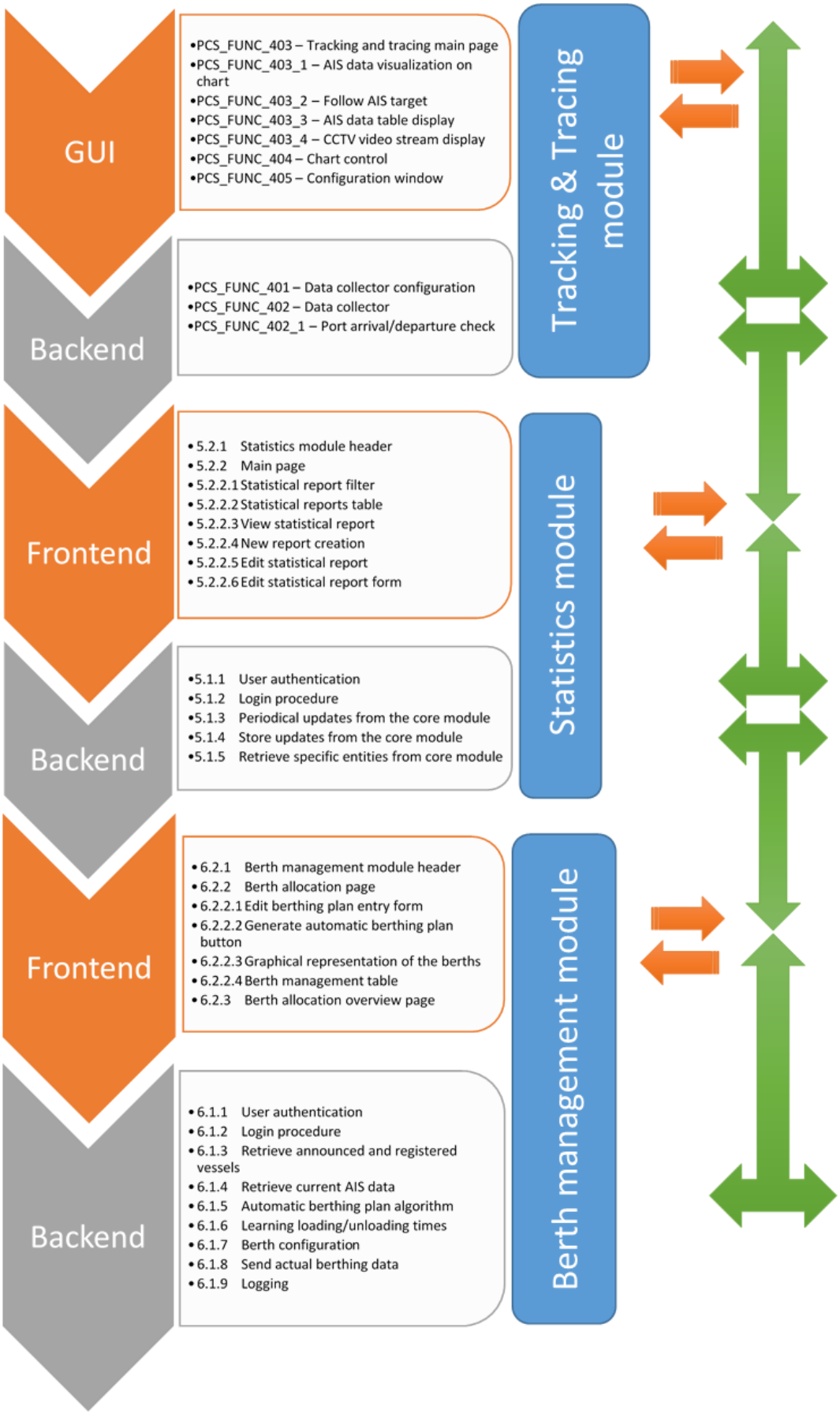
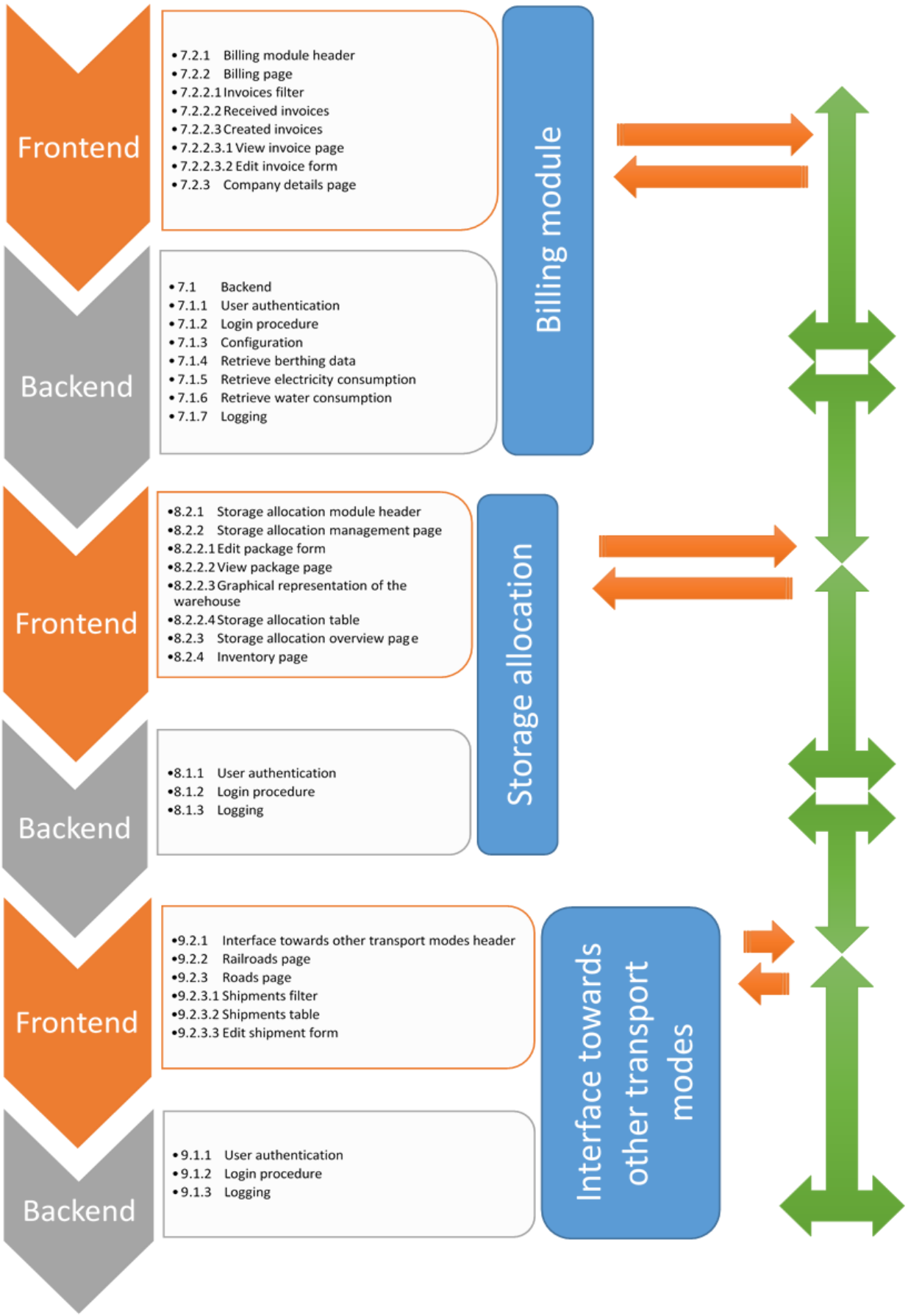


Fig. 3.1.2.4 Synoptic Architecture of PCS. Central mode - management enhanced information


CORE module
(user management & data layer)
Backend
• PCS_FUNC_201 - Authentication Request
• PCS_FUNC_202 - UserInfo Request
• PCS_FUNC_203 – Get data (API method set)
• PCS_FUNC_204 – Filtering data 9
• PCS_FUNC_205 – Post data (API method set)
API
• PCS_FUNC_206 – Post arrival/departure
• PCS_FUNC_207 – Get arrival/departure
• PCS_FUNC_208 – Entity change
• PCS_FUNC_209 – Entity search
• PCS_FUNC_210 – Entity delete
• PCS_FUNC_211 – Reference data search
GUI
• PCS_FUNC_212 - Login
• PCS_FUNC_213 – Core module header
• PCS_FUNC_214 – Users page
• PCS_FUNC_215 – Edit user page
• PCS_FUNC_215_1 – User roles management section
• PCS_FUNC_215_2 – Vessels section
• PCS_FUNC_216 – User profile page
• PCS_FUNC_216_1 – Edit vessel
• PCS_FUNC_216_2 – Change password
• PCS_FUNC_216_3 – Authorized users
• PCS_FUNC_217 – Roles page
• PCS_FUNC_218 – Data matrix
• PCS_FUNC_218_1 – Data matrix filter
• PCS_FUNC_218_2 – Data matrix table
GUI
•PCS_FUNC_301 – Cargo module main page
•PCS_FUNC_302 – Reports filter
•PCS_FUNC_303 – Arrival/departure reports section
•PCS_FUNC_304 – Cargo reports section
•PCS_FUNC_305 – View arrival/departure report page
•PCS_FUNC_306 – Edit arrival/departure report page
•PCS_FUNC_307 – View cargo report page
•PCS_FUNC_308 – Edit cargo report page
Backend
•PCS_FUNC_309 – Login
•PCS_FUNC_310 – Automatic arrival/departure report
•PCS_FUNC_311 – Report forms configuration
•PCS_FUNC_312 – Store draft report
•PCS_FUNC_313 – Publishing reports
•PCS_FUNC_314 – Logging relevant changes
•PCS_FUNC_315 – Storing reusable entities
•PCS_FUNC_316 – Get associated ERINOT
•PCS_FUNC_317 – Fill arrival/departure report with ERINOT data
Cargo module


GUI
•PCS_FUNC_403 – Tracking and tracing main page
•PCS_FUNC_403_1 – AIS data visualization on chart
•PCS_FUNC_403_2 – Follow AIS target
•PCS_FUNC_403_3 – AIS data table display
•PCS_FUNC_403_4 – CCTV video stream display
•PCS_FUNC_404 – Chart control
•PCS_FUNC_405 – Configuration window
Backend
•PCS_FUNC_401 – Data collector configuration
•PCS_FUNC_402 – Data collector
•PCS_FUNC_402_1 – Port arrival/departure check
Tracking & Tracing module
Frontend
• 5.2.1 Statistics module header
• 5.2.2 Main page
• 5.2.2.1 Statistical report filter
• 5.2.2.2 Statistical reports table
• 5.2.2.3 View statistical report
• 5.2.2.4 New report creation
• 5.2.2.5 Edit statistical report
• 5.2.2.6 Edit statistical report form
Backend
•5.1.1 User authentication
•5.1.2 Login procedure
•5.1.3 Periodical updates from the core module
•5.1.4 Store updates from the core module
•5.1.5 Retrieve specific entities from core module
Statistics module
Frontend
• 6.2.1 Berth management module header
• 6.2.2 Berth allocation page
• 6.2.2.1 Edit berthing plan entry form
• 6.2.2.2 Generate automatic berthing plan button
• 6.2.2.3 Graphical representation of the berths
• 6.2.2.4 Berth management table
• 6.2.3 Berth allocation overview page
Backend
• 6.1.1 User authentication
• 6.1.2 Login procedure
• 6.1.3 Retrieve announced and registered vessels
• 6.1.4 Retrieve current AIS data
• 6.1.5 Automatic berthing plan algorithm
• 6.1.6 Learning loading/unloading times
• 6.1.7 Berth configuration
• 6.1.8 Send actual berthing data
• 6.1.9 Logging
Berth management module


Frontend
• 7.2.1 Billing module header
• 7.2.2 Billing page
• 7.2.2.1 Invoices filter
• 7.2.2.2 Received invoices
• 7.2.2.3 Created invoices
• 7.2.2.3.1 View invoice page
• 7.2.2.3.2 Edit invoice form
• 7.2.3 Company details page
Backend
• 7.1 Backend
• 7.1.1 User authentication
• 7.1.2 Login procedure
• 7.1.3 Configuration
• 7.1.4 Retrieve berthing data
• 7.1.5 Retrieve electricity consumption
• 7.1.6 Retrieve water consumption
• 7.1.7 Logging
Billing module
Frontend
• 8.2.1 Storage allocation module header
• 8.2.2 Storage allocation management page
• 8.2.2.1 Edit package form
• 8.2.2.2 View package page
• 8.2.2.3 Graphical representation of the warehouse
• 8.2.2.4 Storage allocation table
• 8.2.3 Storage allocation overview page
• 8.2.4 Inventory page
Backend
• 8.1.1 User authentication
• 8.1.2 Login procedure
• 8.1.3 Logging
Storage allocation
Frontend
• 9.2.1 Interface towards other transport modes header
• 9.2.2 Railroads page
• 9.2.3 Roads page
• 9.2.3.1 Shipments filter
• 9.2.3.2 Shipments table
• 9.2.3.3 Edit shipment form
Backend
• 9.1.1 User authentication
• 9.1.2 Login procedure
• 9.1.3 Logging
Interface towards other transport modes

3.2 Institutional issues for implementation

The implementation of a PCS in Romanian ports is a complex and demanding process which requires the active participation of all stakeholders who will be connected to this platform so that Port Community Members (PCM) will participate in all stages of PCS implementation.

The entire PCS implementation process in Romanian ports must be based on adequate standards to ensure efficiency, simple and multiple data and document exchange and information security.

The development of a 12-step PCS is shown in the figure below.

Fig. 3.1.2.5 Stages of PCS implementation (source: www.epcsa.eu)

Step 1

Constanta Maritime Ports Administration should take steps to raise awareness among port community members to explain the PCS system, the benefits and advantages of using such a platform.

Step 2

Motivation of choosing to implement a PCS system:

- Reduction of port processes inefficiency - excessive bureaucracy;
- Access to electronic data;
- Integration and compliance with EU and national directives into a Single Window platform;
- Compatibility of information with other ports that have implemented a PCS system;
- Providing benefits for the entire port community by reducing bureaucracy and electronic access to data shared by all stakeholders;

• Business profitable facilities of the PCS system which are generating efficiency for all participating actors.

Step 3

In order to implement a PCS system within the port community, Constanta Maritime Ports Administration must develop the following actions:

• Convincing the harbour community carrying out activities within the harbor to streamline the implementation of a PCS;

• Assuming the role of project leader by attracting the responsibility to implement the PCS system in the interest of the port community and acting independently of one's own interests to promote the general interest;

• Identifying the financial resources to develop an appropriate model in line with the legitimate interests of all actors involved in the PCS system.

Step 4

• Constanta Maritime Ports Administration needs to act with **Constanta Port Business Association (CPOA)** alongside with other **available authorities** (at the time-frame of PCS Design Phase) to be "ambassadors" for promoting the concept and implementation of a PCS inside the port area.

• Through these "ambassadors", the authority will understand the needs and the way PCS helps them to improve and be more efficient in relation to Constanta Maritime Ports Administration.

Step 5

• Establishment of a permanent communication during the implementation of the PCS system, monitoring the progress in implementation, with participation of all actors involved in the port community.

• A two-way communication is needed, requesting opinions from each actor.

Step 6

• Identifying the needs of each actor in the port community (depending on the activities they carry out) and granting access rights to the PCS platform.

• Identifying the existing processes within each port community actor and reporting the specifics in order to highlight the benefits of a simplified electronic approach to using the PCS platform.

Step 7

Integrating into the PCS functionalities generated by the needs of the port community:

• Functionalities needed by each actor of the port community.

• Satisfying all interested parties/economic operators and port authorities involved

Step 8

For implementation of the PCS, the legal framework in which the system will have to work should consider - for example: data protection rules, maritime laws and directives, customs procedures, national and international regulations, as well as legislations and directives:

- International
- European
- National

Step 9

The organizational model of PCS system should be (but not limited to):

- public - private or public or private partnership type

Emphasis will be focused on:

- financing mode
- governance mode

Stage 10

Constanta Maritime Ports Administration should identify those community stakeholders which play a key role in their development teams, in order to establish solutions for the implementation of the CFP in line with the needs of the identified representative groups.

- Identifying experts to set up working groups for each type of port community actor;
- Analysing activities and process management (identifying which processes rely on other to determine the order of their implementation and to limit delays)

Stage 11

It is recommended to use the previous experience in implementing CFPs in other ports for:

- Not starting from ground zero.
- Sharing the knowledge and experience gained in implementation.
- Asking for advice and know-how where necessary.

Step 12

For implementing and using a PCS system as well as a sustainable PCS operator, it is imperative to identify the following needs:

- income streams - most port communication systems use mixed revenue streams centered around:
  - annual or monthly subscription fee for differentiated services or for all services
  - tax per load unit (tonnage, customs declaration, TUE, barrel, ship, hour, etc.) per service charge or per EDI transaction fee
  - participant fee
- ways of development and evolution along the process;
- updating systems in accordance with international, EU and national regulations and directives.

3.3 Expected results

The main benefits for CNAPM resulted from PCS implementation will consist in improved informational data flow and a shortage of internal administrative procedures which will allow, as direct consequence, general cost reduction and increased activity efficiency. There are several other improvement and advantages derived from overall increase of traffic due to berth activity improvement, cargo optimized flow, improved storage management, advanced statistics and future AI assisted decision as well as a better interface with rail and road transportation. CNAPM will benefit from all this main advantages when correlated with long term effect: there are great expectances to increase the value and the financial flow with direct implication on national al EU economy.

Specific potential benefits of implementing a Port Community Systems (PCS) platform have been identified as a result of the research. The potential benefits identified are outlined below:

1. **Integration with other similar systems in the European Union and beyond.** These are in correlation with the logistic chain services, primarily providing visibility and data security elements. In case of a container that is shipped through an intermediate port, the integration of a PCS can improve visibility and data access:

(1) The type of cargo exists in the container which is being transported

(2) In case of transhipment, identifying the place of transhipment, the next ship carrying the container, the changes for the following real-time shipping route.

(3) In case of losing the link with the cargo, which are the other possibilities of addressing the transport. All of these data will lead to a better estimation of container delivery to the delivery port.

Although container routing information could be obtained through direct bilateral links with carriers, carriers should be connected to the destination port PCS, which is an unrealistic assumption from our view point.

We believe that it should be advantageous to collect this data through PCS. This would increase the attractiveness of the integrated trade bands, provided that the major ports of transhipment are aggregated (other ports with PCS implemented: Rotterdam, Barcelona, Shanghai, etc.).

2. **Interfacing with Maritime Single Window.** The Port Community System may include a functional interface for MSW so that stakeholders can report directly to MSW using the PCS interface. The integrated PCS platform can provide an alternative for infrastructure (horizontal) with respect to EMSA/SafeSeaNet specific reporting (as opposed to vertical integration by MSW).

3. **Big Data Applications.** A PCS platform is a rich source based on various data typologies. The advantage given by the "network effect" or "network effect" (increasing the amount of information with the number of squares) will thus be possible, also ensuring the possibility to make the data anonymous. Large business data can be extracted from business data, but also from statistical analysis, useful for processing by authorities at different levels (port authorities, local governments, national government).

4. **From the perspective of the sender/recipient/owner of the goods.** If a freight carrier or a cargo owner manages/directs the cargo to a certain number of ports, he will manage the routing of

the cargo to the ports themselves, provided he/she connects to the PCS of that port. An integrated PCS will make it possible to provide (1) container status information and dispensing the container from a single source; (2) viable integration of the bank with regard to payment messages; (3) speeding up the release of containers, especially if Area 1 on PCS integration outside the EU is resolved.

5. **From the perspective of the shipping company - shipping line.** The perspective of the shipping company is centered on the idea of transmitting information once, unlike transmission to each port (EU). For example, the list of dangerous goods on board is the same at the port of departure and at the port of arrival. In addition, terminal information can only be transmitted one time only, assuming that an integrated PCS can take care to remove or add container data items because the physical containers are removed from the ship and/or loaded onto the ship. The shipping company will also benefit from the operational efficiency of vessel agents working on behalf of the shipping company.

6. **Backbone network.** Acting like "physical Internet" for older PCS concepts (1995-2010), it is possible today to extend the concept taking into consideration the future developments in communication technology using cloud computing and end-to-end security paradigm. We can further extend the principle to apply to every other secure network infrastructure with increased degree of communication redundancy. All the backbone benefits are related to the introduction of information and decision-making capacity in the PCS as we stated previously in this chapter. The PCS modules will assure the data collection for monitoring, efficiency improving and further planning of all harbour activity. The data could be used for decision making, being suitable for AI machine learning and future automation. In the case of container transport, possible applications include rerouting containers from the origin to the destination in response to unforeseen events in the network (e.g. cancellation of the service in question) or in the context of Synchromodal operations, where costs and environmental impact are decision variables within the container resale network. For example, an integrated European PCS can help to choose the hinterland connection not only at the destination port itself. The e-Compliance consortium (http://www.e-compliance-project.eu/media/1541/d5_1_portsystem.pdf) considered the shipping line perspective to be the most promising in the context of the project. To some extent, the cargo owner /consignee, freight forwarder perspective has also been considered promising, however limited due to the fact that only a minority of these stakeholder's deal with the PCSs directly. The Integration with the systems outside of the EC has been considered interesting and promising with respect to customs and terminals and global pipeline functionality for the cargo owners.

However, regarding the applicability of European Maritime Single Window environment and repealing Directive 2010/65/EU and the corresponding national law no. 162/15 May 2013 regarding reporting formalities applicable to ships arriving in and/or departing from Romanian ports there is a Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a European Maritime Single Window environment and repealing Directive 2010/65/EU- COM/2018/278 final - 2018/0139 (COD). For sustainable PCS implementation we need to take in pre-feasibility study the main goal of EU legislation proposal (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018PC0278):

> *Maritime transport operators face a wide range of legal reporting requirements each time a ship arrives in or leaves a port (a port call). The fact that reporting requirements are not harmonised, either between different policy areas within Member States or between Member States, results in a heavy administrative burden on such operators. Over two million port*

calls are made annually in the EU. Shipping sector staff currently spend an annual total of about 4.6 million hours on reporting.
The European Council highlighted the problem in its 2017 Valletta declaration on maritime policy and in the Council Conclusions of 8 June 2017 2 on the priorities for the EU's maritime transport policy up to 2020. It underlined the need to reduce the administrative burden on maritime transport by providing for simplified, digitalised and harmonised reporting procedures for ships. It reiterated this message in its Conclusions of 5 December 2017 on digitalising transport 3. Maritime transport operators also voice strong concerns about the situation.
The problem was analysed in an evaluation of the 2010/65/EU Reporting Formalities Directive, conducted as part of the fitness check on EU maritime transport policy carried out in 2016-2017. This evaluation confirmed the analysis of the problem.

The purpose of this proposal is to address the current non-harmonised reporting environment for ships. The proposed new European Maritime Single Window environment brings together, in a coordinated and harmonised way, all reporting associated with a port call. This, in turn, will also improve interoperability and interconnection between the relevant systems, thus enabling data to be shared and reused more efficiently, as appropriate.

The freight forwarder can obtain a decision support system through virtual port systems (ETA at different ports, hinterland options available at those ports at the time the container is released) because an integrated PCS can offer the needed automation.
The backbone network has the high potential for more efficient routing and positioning of empty containers because (a) shipping companies inform the carrier where to deliver the empty container and (b) different shipping companies can redirect containers as a loan.

3.4 Investment costs estimated by reference to similar investment objectives

Port Community Systems (PCS) is a complex platform with a variety of integrated logic subsystems that coordinate the work of a large port community as well as and of their partners.

The system itself is primarily intended to focus and centralize the multitude of documents and information that will serve to optimize port activities.

Port Community Systems can include various structured organizational solutions in the form of various hardware/software applications to meet the needs of stakeholders, to maximize physical infrastructure and manage port operations as a whole.

The development and introduction of such a PCS platform is a very complex activity, necessary to be distributed to a number of stakeholders with partial interests in the functioning of the PCS.

This requires the prioritization of PCS internal sub-projects: it is almost impossible to ensure an adequate quality when all the PCS functionality is implemented at one time.

A correct approach by ICT management would require PCS to be first described in detail and divided into several sub-projects (modules).

Companies need to know the costs they generate in their business to make sure that the cost-cutting methods are properly managed and that the success of an initiative to introduce a PCS system is properly ensured.

Therefore, when introducing the PCS, it is important to distinguish between "right" and "wrong" when deciding to invest in an ICT system such as PCS.

There are three types of investment in ICT, namely:

1. Replacement investments - the technology that replaces the human contribution (chosen purely for economic reasons).
2. Additional investment - their goal is to improve the productivity and efficiency of employees by doing their work in new ways.
3. Innovative investments - they establish a new competitiveness by changing the existing ways of doing the activities carried out at a certain point in time.

Investments in a PCS system are complex because they cover all three investment categories described above. The PCS system is already replacing existing technologies, improving productivity but also introducing new services and creating new customers and business markets.

Several methodologies could be used to assess the investment in a PCS:

1. Traditional Return Investment (ROI) technology measures the improvements of PCS implementation resulting from process automation.
2. The combined value of improving the company's performance, not only from the resulting savings but also from the decrease in the number of iterations (processes). A typical example would be the time spent by automating processes and tasks in the PCS, with the time savings being devoted to resolving critical and complex issues elsewhere in the company.
3. Accelerating the time dependency value for other PCS users, customers and stakeholders willing to contribute to the new improved PCS. The move is supported by the low cost of sharing information and improving the flow of information.
4. Innovation assessment whose purpose is to predict the value of the new PCS system as a direct result. In the case of PCS, it can attract other stakeholders, increase the level of branding as a portrait image and therefore, indirectly increase the number of companies/clients involved, both local and international.

PCS is not usually introduced from a single iteration, requiring a safe approach that requires splitting PCS internal projects into different categories.

Each development of key PCS operations should be evaluated in direct financial terms. However, short-term benefits from a financial perspective cannot show the true potential of the introduction of the PCS. Moreover, derived benefits are not usually just financial, and it is very difficult to anticipate them in advance, which is in direct contradiction with the requirements for managing the measurable projects.

The usual solution is to use feasibility studies aiming at finding the best performing alternatives at the lowest possible risk levels.

An investment in PCS involves an investment in the way port community is organized and is closely linked to the overall management of maritime systems.

Due to the complexity and number of stakeholders involved, the direct economic efficiency of a PCS is difficult to assess. However, we propose a development modules scheduler (figure 3.4.1) based on services and activities in chapter 3.1.1.

Derivative costs and benefits attributed to other parties cannot easily be converted into figures. An important part of the benefits is related to the entire port community and cannot be expressed in monetary terms.

Cost-benefit analysis is best suited to profit-oriented companies, and in the case of PCS, the biggest challenge is to select the measures used to assign quantitative and qualitative identifiers.

A standard set of cost-benefit key indicators can be used to assess the efficiency of investments implemented in PCS infrastructure:

- VN - net present value of the PCS infrastructure
- VB - the current accumulated value of the benefits derived from new investments in the PCS infrastructure
- VC - the updated cost of new investments in the PCS infrastructure
- CB - cost-benefit ratio = VB/VC
- The net investment benefit PCS = VB – VC

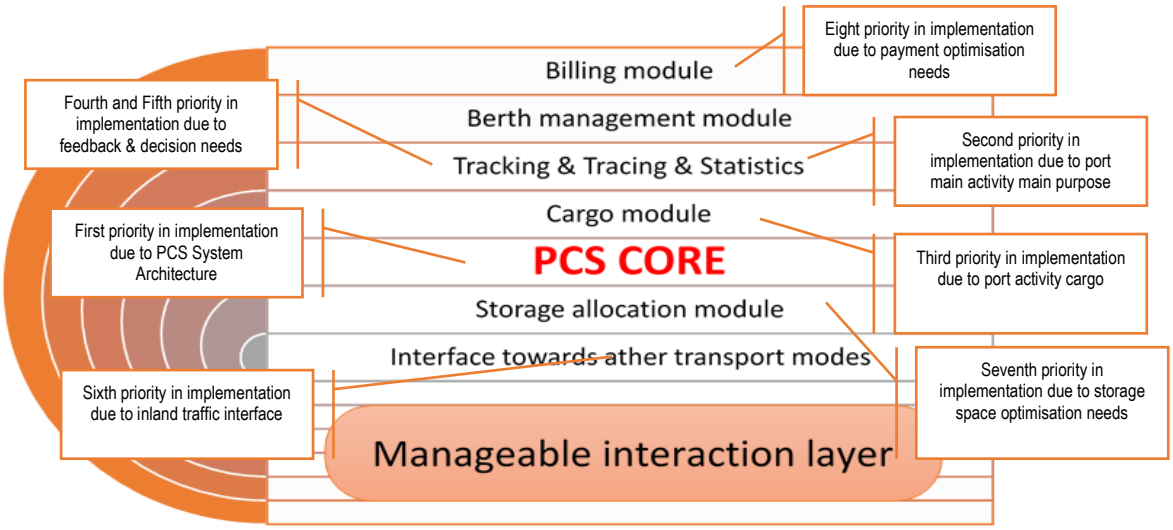


Fig. 3.4.1 A proposed order for module development during PCS implementation phase in Port of Constanta

3.5 Exploitation and maintenance costs estimated by reference to similar investment objectives

Port Community Systems (PCS) is a complex platform with a wide variety of integrated logical subsystems that coordinate the work of a complex port community and of their partners.

Depending on the integration scenarios, the basic version of the PCS platform that may be implemented, along with the number of modules required to be integrated (in terms of stakeholder needs), is different for every scenario.

Costs of running the PCS platform:

• Under warranty - Given the complexity of a PCS, the provider must offer one or more years of warranty to cover any malfunctions/errors that are still unknown in the development and deployment stages of the PCS platform. During this time, all errors occurring in the development of the platform, in the implementation and production phases are supported by the software manufacturer. If there are correct contractual relationships established between the supplier and the customer, the feed-back received by the vendor during this period can improve the performance of the installed platform.

• Outside of the warranty, hardware and/or software maintenance costs may incur to remedy some problems encountered during platform exploitation, as long as the customer pays for it.

Unexpected costs may arise at the time of initial deployment, changes/additions to the platform, costs induced by legislative changes, changes in document and electronic document format, or the need to implement additional platform developments by adding new modules at the request of port operators, or imposed by EU directives.

In conclusion, without having stakeholder financial data in the management of the IT compartment, as well as the degree of the functionality of the modules to be implemented, according to the scenario based on the agreement between Constanta Maritime Ports Administration and other port authorities and port companies, it is difficult to estimate the costs of operating and maintaining such a complex system.

We believe that only in the elaboration of the Feasibility Study, a study that can be developed on the basis of the three scenarios identified in this paper (scenarios presented in the next chapter), the authority can estimate the overall cost of operating and maintaining such a complex system for the chosen scenario.

3.6 Preliminary analysis on economic and financial issues

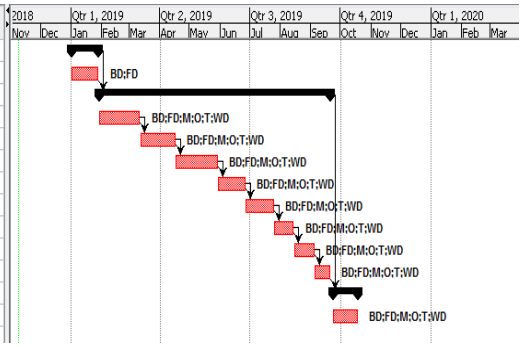
There are various principles and methods able to solve the needs of software cost estimation. Some approaches use meta-heuristic algorithms (https://pdfs.semanticscholar.org/8c84/5b5d2f98671c83d7a6d746c299309935f5fd.pdf) and other are based on fuzzy rough set (http://www.jestr.org/downloads/Volume9Issue4/fulltext31942016.pdf). Another resources for our estimation was the www.geminisols.com and www.ibm.com/watson. Differences between values are negligible when reported to the general dataset.

In order to provide realistic results on the economic and financial aspects, the analysis started from a technical-economic efficient simulation using the following minimal hypothesis for simulating the development effort:

• Development team consisting of: backend developer (BD), frontend developer (FD), project manager (M), product owner (O), web designer (WD), tester (T).

• WD, O and M are allotted 50% use, the rest is allotted 100%.

	Name	Duration	Start	Finish	Predecessors	Resource Names
1	**Elaboration**	20 days	**1/1/19 8:00 AM**	**1/28/19 5:00 PM**		
2	Analysis & Design	20 days	1/1/19 8:00 AM	1/28/19 5:00 PM		BD;FD
3	**Construction**	169 days	**1/29/19 8:00 AM**	**9/20/19 5:00 PM**	1	
4	Core	30 days	1/29/19 8:00 AM	3/11/19 5:00 PM		BD;FD;M;O;T;WD
5	Cargo	26 days	3/12/19 8:00 AM	4/16/19 5:00 PM	4	BD;FD;M;O;T;WD
6	Tracking	31 days	4/17/19 8:00 AM	5/29/19 5:00 PM	5	BD;FD;M;O;T;WD
7	Stats	20 days	5/30/19 8:00 AM	6/26/19 5:00 PM	6	BD;FD;M;O;T;WD
8	Berthing	21 days	6/27/19 8:00 AM	7/25/19 5:00 PM	7	BD;FD;M;O;T;WD
9	Billing	14 days	7/26/19 8:00 AM	8/14/19 5:00 PM	8	BD;FD;M;O;T;WD
10	Storage	15 days	8/15/19 8:00 AM	9/4/19 5:00 PM	9	BD;FD;M;O;T;WD
11	Transport	12 days	9/5/19 8:00 AM	9/20/19 5:00 PM	10	BD;FD;M;O;T;WD
12	**Transition**	20 days	**9/23/19 8:00 AM**	**10/18/19 5:00 PM**	3	
13	Beta Testing	20 days	9/23/19 8:00 AM	10/18/19 5:00 PM		BD;FD;M;O;T;WD



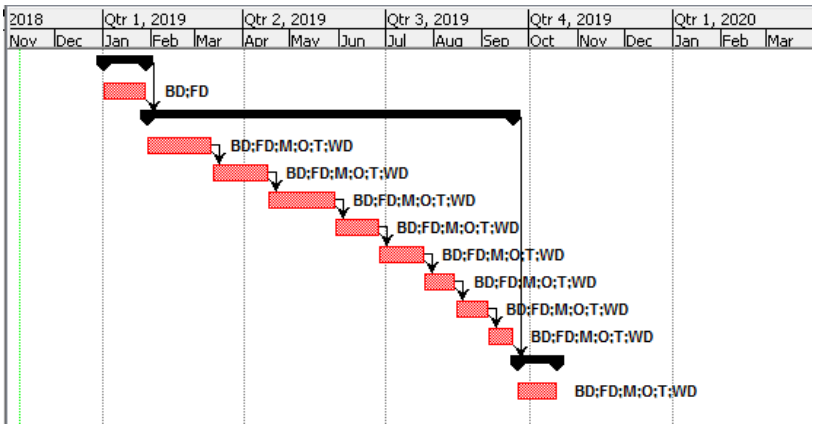


Fig. 3.6.1 Synoptic aspects of development effort planning

The synoptic aspects presented in the figure took into account an average scenario with the starting point of simulation on January 1st 2019.

The resulting total effort was 891 man-days (likely estimation).
Practical conditions may lead to variations in different limits, depending on the beneficiary availability and the heterogeneity of the situation on the spot (for example, variations of ~ 20% may occur as a result of changing/updating the situation in situ).

Table 3.6.1 Development Estimate (Efficiency Criterion: Optimal Techno-Economic Cost Report)

Development team consisting of: backend developer (BD), frontend developer (FD), project manager (PM), product owner (PO), web designer (WD), tester (T)						
Requirement	**Min *)**	**Max *)**	**Likely *)**	**Comments**	**Assumptions**	**Calendar days**
PCS CORE MODULE (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
Authentication Request	1	2	1			
UserInfo Request	1	2	1		UserInfo from OpenID provider contains user roles, vessels, org, name, email	

Get data (API method set)	1	2	1			
Filtering data	1	5	2	Includes field-level authorization		
Post data (API method set)	2	3	2			
Post arrival/departure	2	10	5	Includes implementing the event bus		
Get arrival/departure	1	2	1			
Entity change	1	2	1			
Entity search	2	5	2	Includes generic filtering & ordering		
Entity delete	1	2	1	Logical deletion preserves data		
Reference data search	1	2	1	see Assumptions	MDM solution exists & we have access MDM supports localization	
	14	**37**	**18**			
Login	1	1	1			
Core module header	2	3	2	includes GUI localization	GUI should be only translated to RO & EN	
Users page	2	3	2			
Edit user page	1	2	1			
User roles management section	1	2	1			
Vessels section	2	3	2			
User profile page	2	3	2			
Edit vessel	1	2	1			
Change password	1	5	2	Includes interacting w/ authorization server	Authorization server support changing password	
Authorized users	2	3	2			
Roles page	1	5	2	Includes interacting w/ authorization server	Authorization server support adding roles	
Data matrix	1	2	1			
Data matrix filter	1	2	1			
Data matrix table	2	5	2			
	20	**41**	**22**			
	7	**16**	**8**			
	41	**94**	**48**			**30**
CARGO MODULE (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
Cargo module main page	1	2	1			
Reports filter	1	2	1			
Arrival/departure reports section	1	2	1			
Cargo reports section	1	2	1			
View arrival/departure report page	2	5	3	Includes generating PDF & audit		
Edit arrival/departure report page	2	5	3			
View cargo report page	2	5	3			
Edit cargo report page	2	5	3			
Login	1	2	1			
Fill arrival/departure report with ERINOT data	2	5	3	For manual entry	Manual data entry There is no national ERI system available	

	15	**35**	**20**			
Automatic arrival/departure report	1	3	2	Includes responding to events		
Report forms configuration	2	5	2			
Store draft report	1	2	1			
Publishing reports	1	2	1			
Logging relevant changes	1	3	2	Does not include a log UI		
Storing reusable entities	1	2	1	Not sure which are the reusable entities		
Get associated ERINOT	1	1	1		There is no national ERI system available	
	8	**18**	**10**			
	5	**11**	**6**			
	28	**64**	**36**			**26**
TRACKING and TRACING MODULE (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
Data collector configuration	1	2	1			
Data collector	5	30	10	Includes communication with AIS source	There is some sort of high-level API/protocol to communicate with the AIS server	
Port arrival/departure check	1	2	1			
	7	**34**	**12**			
Tracking and tracing main page	1	5	2	Integrate with the WMS, multiple layers, center map		
AIS data visualization on chart	3	10	5			
Follow AIS target	1	3	2			
AIS data table display	3	10	5			
CCTV video stream display	3	10	5			
Chart control	1	5	3			
Configuration window	1	5	2			
	13	**48**	**24**			
	4	**16**	**7**			
	24	**98**	**43**			**31**
STATISTICS MODULE (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
User authentication	1	1	1			
Login procedure	1	1	1			
Periodical updates from the core module	2	4	3			
Store updates from the core module	1	5	2			
Retrieve specific entities from core module	1	5	2	Not sure how we can use the user's token, security-wise	Authenticate the process, not the data owner	
	6	**16**	**9**			
Statistics module header	1	2	1			
Main page	1	2	1			
Statistical report filter	1	2	1			
Statistical reports table	1	3	2			
View statistical report	4	15	5	Includes export to PDF, CSV, Excel		
New report creation	1	1	1			

Edit statistical report	1	2	1			
Edit statistical report form	2	5	3			
	12	**32**	**15**			
	4	**10**	**5**			
	22	**58**	**29**			**20**
BERTH MANAGEMENT MODULE (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
User authentication	1	1	1			
Login procedure	1	1	1			
Retrieve announced and registered vessels	1	2	1			
Retrieve current AIS data	1	2	1			
Automatic berthing plan algorithm	2	20	3	Depending on optimization algorithm		
Learning loading/unloading times	2	20	3	Depending on optimization algorithm		
Berth configuration	1	5	2			
Send actual berthing data	2	5	2			
Logging	1	2	1			
	12	**58**	**15**			
Berth management module header	1	1	1			
Berth allocation page	2	5	3			
Edit berthing plan entry form	1	2	1			
Generate automatic berthing plan button	0	0	0			
Graphical representation of the berths	2	5	3			
Berth management table	2	5	3			
Berth allocation overview page	1	3	2			
	9	**21**	**13**			
	4	**16**	**6**			
	25	**95**	**34**			**21**
BILLING MODULE (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
User authentication	1	1	1			
Login procedure	1	1	1			
Configuration	1	3	2			
Retrieve berthing data	1	2	1			
Retrieve electricity consumption	1	5	2	Not sure how to calculate consumption		
Retrieve water consumption	1	5	2	Not sure how to calculate consumption		
Logging	1	2	1			
	7	**19**	**10**			
Billing module header	1	2	1			
Billing page	1	3	1			
Invoices filter	1	2	1			
Received invoices	1	2	1			
Created invoices	1	2	1			

View invoice page	1	3	1			
Edit invoice form	2	5	3	Includes attachments		
Company details page	1	2	1			
	9	**21**	**10**			
	3	**8**	**4**			
	19	**48**	**24**			**14**
STORAGE ALLOCATION (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
User authentication	1	1	1			
Login procedure	1	1	1			
Logging	1	2	1			
	3	**4**	**3**			
Storage allocation module header	1	2	1			
Storage allocation management page	1	2	1			
Edit package form	2	4	2			
View package page	2	5	3			
Graphical representation of the warehouse	2	5	2			
Storage allocation table	1	2	1			
Storage allocation overview page	1	2	1			
Inventory page	1	2	1			
	11	**24**	**12**			
	2,8	5,6	3			
	16,8	**33,6**	**18**			**15**
INTERFACE TOWARDS OTHER TRANSPORT MODES (WD, O and M are allotted 50% use, BD, FD and T allotted 100%)						
User authentication	1	1	1			
Login procedure	1	1	1			
Store shipment	1	2	1			
Get shipments	1	2	1			
	4	**6**	**4**			
Interface towards other transport modes header	1	2	1			
Railroads page	1	2	1			
Roads page	1	2	1			
Shipments filter	1	2	1			
Shipments table	1	2	1			
Edit shipment form	1	2	1			
	6	**12**	**6**			
	2	**4**	**2**			
	12	**22**	**12**			**12**

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Table 3.6.2 Total development effort (in man-days)

DAPhNE - PCS											
Name	**Man-days**	**Start**	**End**	**Resources**	**Total Effort**	**BD**	**FD**	**M**	**O**	**T**	**WD**
Elaboration	20	2019-01-01	2019-01-28								
Analysis & Design	20	2019-01-01	2019-01-28	BD;FD	40	20	20				
Construction	169	2019-01-29	2019-09-20								
Core	30	2019-01-29	2019-03-11	BD;FD;M;O;T;WD	135	30	30	*15*	*15*	*30*	*15*
Cargo	26	2019-12-03	2019-04-16	BD;FD;M;O;T;WD	117	26	26	*13*	*13*	*26*	*13*
Tracking	31	2019-04-17	2019-05-29	BD;FD;M;O;T;WD	140	32	32	*15*	*14*	*32*	*15*
Stats	20	2019-05-30	2019-06-26	BD;FD;M;O;T;WD	90	20	20	*10*	*10*	*20*	*10*
Berthing	21	2019-06-27	2019-07-25	BD;FD;M;O;T;WD	95	21	21	*10*	*11*	*21*	*11*
Billing	14	2019-07-26	2019-08-14	BD;FD;M;O;T;WD	63	14	14	*7*	*7*	*14*	*7*
Storage	15	2019-08-15	2019-09-04	BD;FD;M;O;T;WD	68	15	15	*8*	*8*	*15*	*7*
Transport	12	2019-09-05	2019-09-20	BD;FD;M;O;T;WD	54	12	12	6	6	12	6
Transition	20	2019-09-23	2019-10-18								
Beta Testing	20	2019-09-23	2019-10-18	BD;FD;M;O;T;WD	90	20	20	10	10	20	10
TOTAL					**891**	210	210	94	94	190	94

Total: 891 man-days

General structure of costs during Port of Constanta PCS development phase

Direct costs are those directly linked to doing the work of the project, this could include hiring specialized contractors, buying software licenses or commissioning your new building. Direct costs are broadly classified as those directly associated with a single area (such as a department or a project). In PCS project management, direct costs are expenses billed exclusively to a specific goal. They can also include project team wages, the costs of resources to produce physical products, energy for equipment, and money spent to address any project-specific risks.
Indirect costs are not specifically linked to PCS project but are the cost of doing business overall. Examples are general running costs (heating, lighting, office space rental), unless PCS development project gets its own offices hired specially (or is entirely outsourced). Indirect costs cannot be associated with a specific cost center and are instead incurred by a number of projects simultaneously, sometimes in varying amounts. In PCS project management, quality control, security costs, and utilities can be usually classified as indirect costs since they are shared across a number of projects and are not directly billable to any one project.
Fixed costs are everything that is a one-off charge. These fees are not linked to how long PCS development project goes on for. So if you need to pay to secure a specialist software engineer, or you are paying for a day of different consultancy to help you start the project up the best way, those are fixed costs.
Variable costs are the opposite of fixed costs - charges that change with the length of your project. It's more expensive to pay staff salaries over a 12-month project than a 6 month one. Machine hire over 8 weeks is more than for 3 weeks, some considerations are available for software licenses.

Sunk costs are costs that have already been incurred. They could be made up of any of the types of cost above but the point is that they have happened. The money has already been spent. These costs are often forgotten in business cases, but they are essential to know about. Stopping/continuing decisions are often (wrongly) based on sunk costs.

Beyond the broad classifications of direct and indirect costs, project expenses fall into more specific categories. Common types of expenses include:

- Labour: The cost of human effort expended towards project objectives.
- Materials: The cost of resources needed to create products.
- Equipment: The cost of buying and maintaining equipment used in project work.
- Services: The cost of external work that a company seeks for any given project (vendors, contractors, etc.).
- Software: Non-physical computer resources.
- Hardware: Physical computer resources.
- Facilities: The cost of renting or using specialized equipment, services, or locations.
- Contingency costs: Costs added to the project budget to address specific risks.

Development costs average per hour for Port of Constanta PCS in Eastern Europe

In terms of development cost average per hour Western and Eastern Europe differ a lot in terms of software development rates. The region includes such countries as Ukraine, Poland, Romania, Moldova, Estonia, Hungary, etc. These developing economies have already got a high level of education and noticeable contributions to IT industry, but their salaries remain relatively low. If you outsource your project to a software development company it will cost you around **$25-$45 per hour**. If you hire a middle/senior dedicated developer the average figure will be between $20 – $32 per hour, depending on the skill set of a particular offshore developer. Currently, at European level, Ukraine, Belarus, and Russia are the top outsourcing locations of this region, leaving Czech Republic, Poland, Hungary, Romania and Baltic countries far behind based on quality to price ratio.

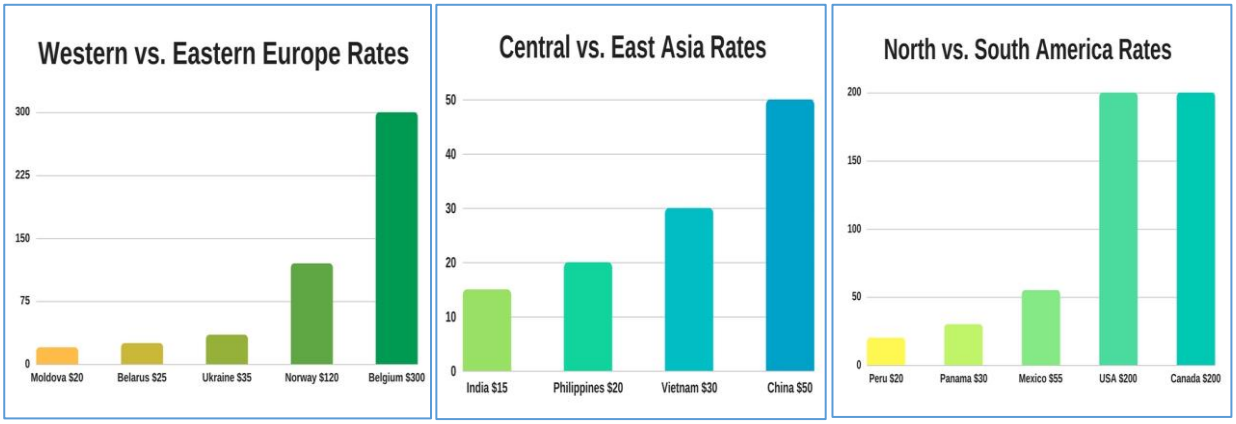


Fig. 3.6.2 Software Development Costs Guide 2018 – worldwide comparison
(Source: https://qubit-labs.com/average-hourly-rates-offshore-development-services-software-development-costs-guide-2018/)

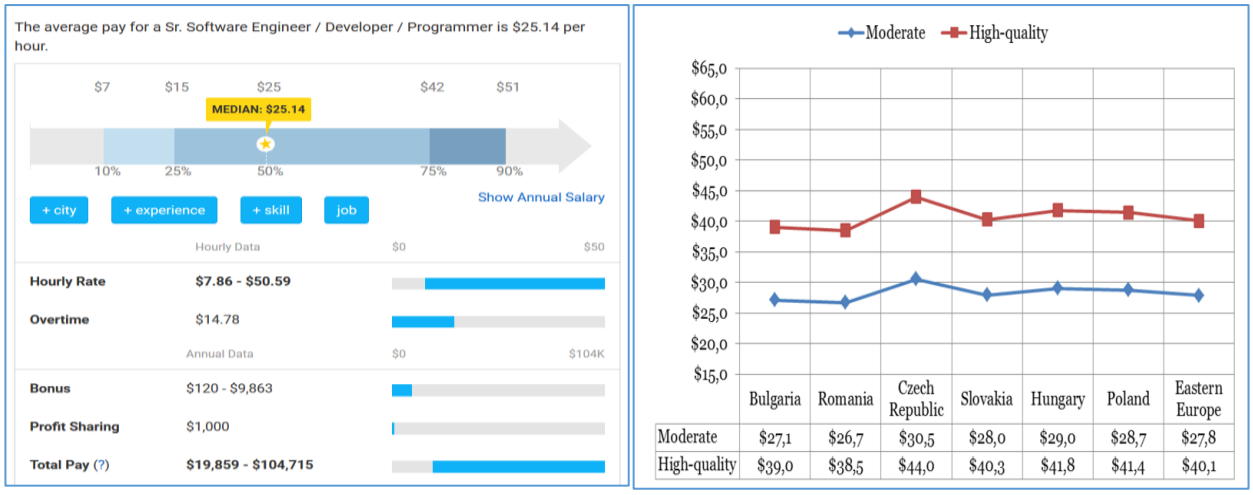


Fig. 3.6.3 Average payment per hour in Romania for Sr. Software Engineer/Developer/Programmer
(Source left: https://www.payscale.com/research/RO/Job=Sr._Software_Engineer_%2f_Developer_%2f_Programmer/Salary)
(Source right: https://yalantis.com/blog/cost-services-europe-market-research)

Using the resources from above we can take in consideration an average value for programming hour of 40 $/hour in Romanian software development market.

However, the general cost of PCS development will include several other costs than development cost per hour. The future feasibility study can estimate the total cost of PCS development taking in consideration a lot of variables in terms of cost and expenses in that proper time-frame.

Reliable operation and PCS Security scenarios

In 2011 European Union Agency for Network and Information Security (ENISA) published *Cyber Security Aspects in the Maritime Sector* as the first EU report ever on cyber security challenges in the Maritime Sector. This principal analysis highlights essential key insights, as well as existing initiatives, as a baseline for cyber security (https://www.enisa.europa.eu/publications/cyber-security-aspects-in-the-maritime-sector-1/at_download/fullReport). Finally, high-level recommendations are given for addressing these risks, Cyber threats are a growing menace, spreading to all industry sectors relying on ICT systems. The report statues about deliberate disruptions of critical automation systems, such as Stuxnet, prove that cyber-attacks have a significant impact on critical infrastructures. Disruption of these ICT capabilities may have disastrous consequences for the EU Member States' governments and social wellbeing. The need to ensure ICT robustness against cyber-attacks is thus a key challenge at national and pan-European level.

Some key findings of the report:

- Maritime cyber security awareness is currently low, to non-existent. Member States are thus highly recommended to undertake targeted maritime sector awareness raising campaigns and cyber security training of shipping companies, port authorities, national cyber security offices, etc.

- Due to the high ICT complexity, it is a major challenge to ensure adequate maritime cyber security. A common strategy and development of good practices for the technology development and implementation of ICT systems would therefore ensure “security by design” for all critical maritime ICT components.
- As current maritime regulations and policies consider only physical aspects of security and safety, policy makers should add cyber security aspects to them.
- We strongly recommend a holistic, risk-based approach; assessment of maritime specific cyber risks, as well as identification of all critical assets within this sector.
- As maritime governance is fragmented between different levels (i.e. international, European, national), the International Maritime Organisation together with the EU Commission and the Member States should align to international and EU policies in this sector.
- Better information exchange and statistics on cyber security can help insurers to improve their actuarial models, reduce their own risks, and thus offering better contractual insurance conditions for the maritime
- sector. Information exchange platforms, such as CPNI.NL, should be also considered by Member States to better communications.

Several recent incidents were reported during September 2018 (https://www.ara.cat/economia/port-Barcelona-pateix-ciberatac_0_2091990961.html). The Port of Barcelona incident (20 September) did not affect ship movements in and out of the harbour, and a local newspaper reported that it impacted only land operations, such as loading or unloading of boats, although the Port denied there was a serious disruption to customers.
Two days after the initial attack, the Port of Barcelona said that only internal IT systems were affected, but did not offer other details. Another medium-sized port was the target five days later (25 September) – Port of San Diego (https://www.portofsandiego.org/press-releases/general-press-releases/port-san-diego-issues-statement-cybersecurity-incident). Back in July, there was a ransomware attack that was initially reported as an infection affecting the Long Beach Port, which was later tracked down and isolated to the port terminal of the China Ocean Shipping Company (COSCO), and later the company's internal network, one of the world's largest shipping firms (https://www.presstelegram.com/2018/07/24/long-beach-port-terminal-hit-by-ransomware-attack/). Last year, when the NotPetya ransomware outbreak started to spread, one of the first companies to report issues was Maersk, the world's largest cargo shipping company. Maersk's poor security practice cost the company over $300 million in damages, and the company's IT staff had to reinstall 4,000 servers, 45,000 PCs, and 2,500 applications in ten days (http://files.shareholder.com/downloads/ABEA-3GG91Y/5003227609x0x954061/7EB88BAD-F1AE-4E86-9B95-FF32017D31F9/APMM_Interim_Report_Q2_2017.pdf)
There are general considerations issued by the port of Barcelona regarding Cyber Security conduit. Ironically several days later the port experienced a cyber-attack.

Victims often try to keep successful hacks a secret. The reason for this is that the maritime companies value their reputation more than the money they actually lose. Also, cyber criminals are stealthy and in many cases companies are unaware they have been hacked.

Ninety percent of the world’s freight goes by sea. Each hack can cost millions of dollars to ship owners, and in some circumstances even wrack the national economy. Breaking into key container terminals, criminals can bring down the operation of regional and national supply chains. E.g., the

British government has revealed that cyber-attacks cost the UK oil and gas industry about 400 million pounds ($672 million) a year (https://www.kaspersky.com/blog/maritime-cyber-security/8796/).

Due to increased demand of Cyber Security expertise all over the world and taking care of the Black Sea Basin special interest we can conclude the needed characteristics in one stance: “Secure by Design”. As security approaches we can include Security Operations Center (SOC) with various components (Security information and event management (SIEM), Governance, risk and compliance (GRC), Intrusion detection systems (IDS), Intrusion prevention system (IPS), Unified threat management (UTM), etc. It is mandatory for a future feasibility study to further address the security issues in Port of Constanta PCS.

Some active vulnerabilities can be found in the following list:

https://www.pentestpartners.com/security-blog/container-theft-the-legal-system-and-poor-maritime-security/
https://www.pentestpartners.com/security-blog/hacking-ais/
https://www.pentestpartners.com/security-blog/hacking-serial-networks-on-ships/
https://www.pentestpartners.com/security-blog/crashing-ships-by-hacking-nmea-sentences/
https://www.pentestpartners.com/security-blog/tactical-advice-for-maritime-cyber-security-top-10/
https://www.pentestpartners.com/security-blog/hacking-maritime-iftfcc-messaging-for-invoice-fraud/
https://www.pentestpartners.com/security-blog/tracking-hacking-ships-with-shodan-ais/
https://www.pentestpartners.com/security-blog/sinking-bulk-carrier-ships-by-hacking-hsms/
https://www.pentestpartners.com/security-blog/making-prawn-espressos-or-hacking-ships-by-deciphering-baplie-edifact-messaging/
https://www.pentestpartners.com/security-blog/sinking-container-ships-by-hacking-load-plan-software/

4 Feasible solutions for achieving the investment objective

4.1 Proposing a limited number of scenarios/options to be analysed in the Feasibility Study phase (minimum two)

The concept of integrating the PCS platform involves data and documents exchange relating to shipping and inland water transport, such as data related to voyage or cargo information, which allows data transfer between ports, thus excluding the need to report the same information several times to different PCS platforms.

There are different organizational and technical models of possible integration configurations.

International Association of Ports & Harbours (IAPH) made a Port Community Systems (PCS) benchmark survey in 2011 (http://www.porttraininglivorno.eu/?q=en/content/port-community-systems-benchmark-survey-part-one) and after interrogating 13 PCSs from around the world (selected for the survey), they concluded that there are three main models:

1. Mono-Port System – where the PCS is managing one port and is dedicated to it
2. National system – the PCS covers all ports of a country
3. Multi-Port System – PCS covers more than one port on one or more IT infrastructures

In the table 4.1 all the ports with PCS implemented and selected for the survey are presented, from around the world.

From the study it results that:

- ✓ Mono-Port System was implemented in only 4 countries;
- ✓ National systems cover all ports of a country, only one PCS is concerned and it is a public company in Japan;
- ✓ Multi-Port systems are the most common ones found in 6 countries that implemented such systems. The range start from 2 ports to 28 and they are mostly operated by private companies. The number of users is directly related to the number of ports managed by PCS.

Starting from this report we will consider three subsequent cases of organization and technical elements needed to integrate the PCS platform, ranging from information exchange, length of specific messages and data structure, to a full integration into a single multi-port platform.

Figures 4.1, 4.2 and 4.3 present the main cases of integration projects.

Table 4.1 The 13 PCS selected for survey from different ports in the world (source: http://www.porttraininglivorno.eu/?q=en/content/port-community-systems-benchmark-survey-part-one)

Name of system	Name of company	Port	Web page
AP+	Soget SA	Le Havre (France)	www.soget.fr
AP+	Marseille Gyptis International SA	Marseille (France)	www.gyptis.fr
Container Logistics I nformation Service (Colins)	Ministry of Land, Infrastructure Transport and Tourism(MLIT)	Japan	www.mlit.go.jp
DAKOSY	DAKOSY	Hamburg (Germany)	http://www.dakosy.de
Destin8 (previously also known as FCP80 and then FCPS)	Maritime Cargo Processing plc (MCP plc)	Felixstowe (United Kingdom)	www.mcpplc.com
HiTS ver.3	Hakata Port Terminal Co.,Ltd.	Fukuoka (Japan)	http://www.hakatako-futo.co.jp
MAINSYS	Israel Ports Development & Assets Company Ltd (IPC)	Israel	http://eng.israports.co.il
NACCS (Air Naccs and Sea Naccs)	NACCS (Nippon Automated Cargo and Port Consolidated System, Inc.)	Japan	http://www.naccs.jp/
Nagoya United Terminal System (NUTS)	Nagoya Harbor Transportation Association Container Terminal Department	Nagoya (Japan)	www.nutsweb.com
Porthus.net *1986-2007 – Seagha 2007- Porthus.net*	Port-I-Com	Antwerp (Belgium)	www.porticom.be
Port-MIS PLISM	KL-Net Corp	Seoul (South Corea)	www.klnet.co.kr
Portbase	Portbase	Rotterdam (the Netherlands)	http://www.portbase.com
Portic	PORTIC BARCELONA S.A	Barcelona (Spain)	www.Portic.net

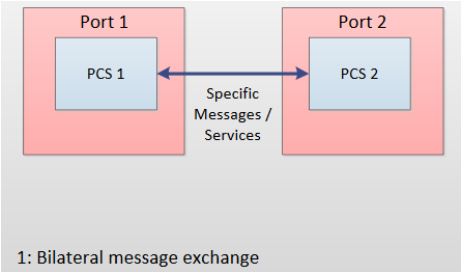


Figure 4.1 PCS Platform Integration in Scenario 1

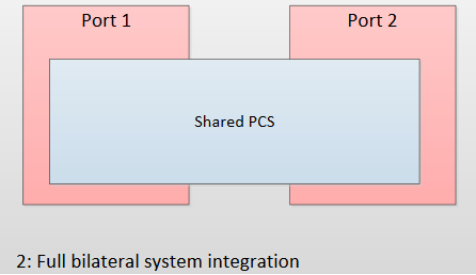


Figure 4.2 PCS Platform Integration in Scenario 2

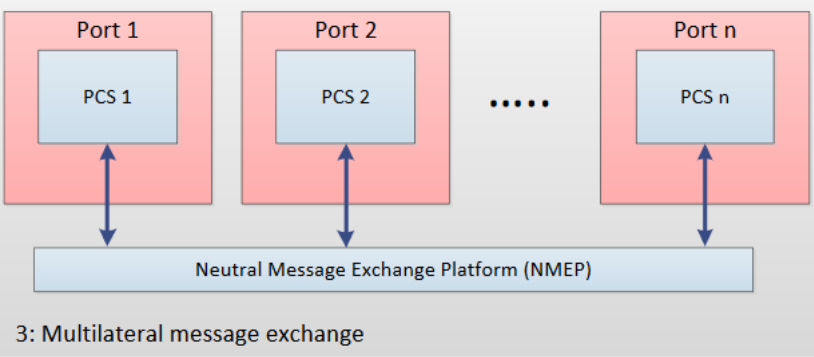


Figure 4.3 PCS Platform Integration in Scenario 3

For scenarios shown in the figures above we considered:

Scenario 1 – considers the implementation of an identical PCS platform with a port that already has the PCS system implemented (referred to as Port 2) and with which Constanta Port (referred to as Port 1) develops most of the commercial trading – to facilitate reporting and data sharing between the two ports. This scenario is based on a solution that is tailored to the individual needs of the two ports. The solution can be applied to ports of any size, located in any geographical area.

Scenario 2 – considers the implementation of an identical PCS platform with a port that already has the PCS system implemented (referred to as the Port 2) and with which Constanta Port (referred to as Port 1) develops most of the commercial trading – to facilitate reporting and data sharing between the two ports. This scenario is based on a solution that is suited to **the needs of small ports** without PCS currently implemented, but whose needs are met by implementing a PCS simultaneously in the two or more ports. It basically relies on the extension of a PCS that can simultaneously serve two ports under the same administrative entity (i.e. Constanta, Midia, Mangalia).

Scenario 3 – considers the implementation of a custom made PCS platform for Constanta Port (referred to as Port 1) that develops trade with more ports which already have PCS systems (referred to as Port 2, Port 3, etc.) in order to facilitate reporting and data sharing between these ports. This scenario is based on a solution that is tailored to the needs of all ports for compatibility of data exchange.

The solution considers that Constanta Port - Port 1 - uses a PCS scalable platform and compatible to other PCS ports, provided that Port 2, Port 3, ..., Port n follow the agreed access and data sharing rules, as well as the structure for data transmission.

Scenarios were born from a general view point, because only in the Feasibility Study and based on volume information and detailed statistical analysis on the extent of trade carried out by Romanian ports with certain EU or non-EU ports provided by Constanta Maritime Ports Administration, we will be able to customize generic ports numbered 2, 3, ..., n with ports that can clearly be nominated and that have already implemented or have under implementation a PCS system.

For each of the three scenarios, the SWOT analysis is further presented.

Tab. 4.2 SWOT Analysis – SCENARIO 1

SCENARIO 1 – TWO-WAY MESSAGE EXCHANGE	
Strengths:	Easy solution, achievable in short term, personalized data sharing agreements, no problems with data ownership will arise in case of system disputes or different functional and technical requirements. The solution is tailored to ports individual needs, with control mechanisms development, the alignment of objectives can be achieved by default, benefiting from the skills of other stakeholders, precisely because of the system's flexibility for integrating them. Existing infrastructure could be relatively easily integrated into bilateral links.
Weaknesses:	System development or adjustments that may be required depend on the manufacturer. When necessary to exchange messages with several PCSs, the risk that a port authority might need different technical and contractual solutions arises, which will generate a limited strategic vision (that is a single solution vision), without such a standard. The need to negotiate bilateral prices in case of a complex port platform with different actors operating in a very competitive environment. Not applicable for small PCS-free ports
Opportunities:	Formatting the message layout facilitates extension to other partners. Future developments can easily be adopted.
Threats:	If the two parties involved do not have similar levels of technological advancement or market power, one of the partners may be disadvantaged. Developments and events around port platforms may have a strong (negative) impact on bilateral messaging systems.

Tab. 4.3 SWOT Analysis – SCENARIO 2

SCENARIO 2 –FULL INTEGRATED BILATERAL SYSTEM	
Strengths:	Common effort, long-term reduction of transaction costs, increase of social capital, control opportunity, strong commitment, savings. Suitable for accommodation to the needs of each port and stakeholder. Suitable for small ports without PCS, because the needs of these ports can be met by implementing/expanding an already existing PCS.
Weaknesses:	Requires a lot of confidence, time for implementation, firm commitment of all stakeholders, structured procedures.
Opportunities:	Very good coordination between involved authorities. Easy exchange of good practices between ports with connected PCSs, and the possibility to consolidate port governance structures.
Threats:	The possibility that any PCS problems in a port, due to a common platform, can cause problems in both ports at the same time. Once the systems have been merged, it would be very difficult to return to the previous situation that is of two ports, each with its own PCS. Changes made to any port operations will result in a change in the common system. Ports are dependent on each other (both positively and negatively).

Tab. 4.4 SWOT Analysis – SCENARIO 3

SCENARIO 3 – PERSONALISED PCS WITH HIGH ADAPTABILITY	
Strengths:	Relatively light solution. Stakeholders will work on the same platform, which reduces the bureaucratic effort, so that financial savings can be made for each party involved. The parties involved as well as future ones must comply with the agreed rules and the form of the message transmission structure. The solution is scalable and it could accommodate a large number of other systems that can be integrated.
Weaknesses:	Funding sources must be clearly defined; The platform needs to be specific, agreed by all stakeholders, firstly funded and built, which will require a firm commitment from the core platform users. The platform must meet the needs of the majority of users, which is difficult because the PCS platform differs due to its modules. The platform must be in line with technological developments, legislation changes, and the needs of its users.
Opportunities:	The platform is scalable and can be increased once new members are recruited. Data sharing and a common vision of technological approaches could lead to harmonized trade practices between stakeholders.

Threats:	Making compromises for any interested party in terms of security can compromise the system as a whole; Incomplete information loaded and delivered to the system may affect the operations of the entire platform, given the interested parties who access the data. The technical fall of the platform interrupts the exchange of information for all participating actors.

4.2 Identification of potential sources for public investment financing: own funds, bank loans, state budget/local budget, external guaranteed or contracted state loans, non-reimbursable external funds, other legally constituted sources

Financing sources that can be attracted for acquiring and implementing a modern ICT system, namely the Port Community System (PCS) to serve Constanta Maritime Ports Administration as leader, along with other state authorities and members of the Port Communities - Constanta - Midia and Mangalia, are diverse.

Thus, the following may be taken into account:

1. The Financing Mechanism for Connecting Europe Facility (CEF). The program supports the implementation of projects of European interest aimed at developing and building new infrastructures and services, as well as modernizing existing infrastructures and services in the field of transport, telecommunications and energy sectors (https://ec.europa.eu/inea/en/connecting-Europe-facility).
2. The transnational DANUBE program 2014-2020 (http://www.mdrap.ro/dezvoltare-regionala/-4970/-7572/-7498)
3. The Capacity Building Development Operational Program (PODCA), which has as a general objective to create a more efficient and effective public administration in the context of national, social and economic development. Priority Axis 2: Improving the quality and efficiency of public service delivery, decentralization.
4. The Regional Operational Program 2014-2020 (https://www.fonduri-structurale.ro/Document_Files/fs2014-2020/00010115/rpk8i_POR%202014-2020%20-%20iulie%202014.pdf) which has as a general objective the growth of economic competitiveness and improving the living conditions of local and regional communities by supporting the development of business environment, infrastructure conditions and services, ensuring a sustainable development of regions capable of managing resources effectively, harnessing their innovation potential and assimilating technological progress.
5. Allocations from the state budget through line ministries.
6. Public Private Partnerships - establishing a partnership with different port operators may be considered.
7. Own financing sources and government-guaranteed bank loans.

4.3 Conclusions

Ports are continuously transforming themselves along their history, improving their infrastructures, handling capacities, regulations and organization models.

Usually, the evolution of ports is framed into "generations", and there are four different generations which can be defined according to the modernization, specialization and handling capacity levels (source Best Practice Guide on Single Windows, e-Maritime and Port Community System - Multimodal Innovation for Sustainable Maritime & Hinterland Transport European Project INTERREG IVC).

First-generation ports: Those ports where facilities, behaviour and strategy are concentrated in offering basic port services to vessels such as sheltered waters, nautical services and cargo handling services through generic port terminals and generic handling means.

Second-generation ports: Those ports where specialization in operations is of growing relevance, having strategies oriented to the specialization of terminals (containers, Ro-Ro, liquid bulk, dry bulk) and the use of optimized mechanical equipment for each operation, seeking also improvements in their management capacities within the port boundary.

Third-generation ports: Those ports where activities are not exclusively focused on providing services for vessel or cargo-handling services but they are enlarging their service in order to become effective logistics platforms for trade beyond the port boundary. Their strategy and premises are oriented also to serve the logistics chain, creating ancillary services for logistics activity zones, using integrated systems for data collection and processing and facilitating the operations among different transport modes.

Fourth-generation ports: Those ports that go beyond the third-generation considering other new aspects in logistics management, connectivity among transport modes, major added value services where information handling is a differentiating element in their services offering. These ports are characterized by diversification and internationalization of their activities, automation of activities, strong cooperation between the port community and complementary ports in view to increase their competitive advantages and to become a networked port, perfectly integrated in the logistics chain and in global supply chains where the handling and distribution of information is a cornerstone.

New (fifth) generation ports started emerging after 2010, when the ports started focusing even more on customers offering a deep IT integration with various stakeholders. IT solutions are increasingly used for prediction of different events and measuring performance. Very important characteristics of the fifth generation ports is an active involvement of the port and local community in planning and decision making processes. In addition, these ports are becoming full industrial centres (manufacturing, processing and logistic industries) with comprehensive intermodal transport handling and high-tech logistic as connecting hubs for

intermodal transport, offering advanced economic zones related services and logistic park functions. The customer-centric orientation of fifth generation ports is reflected by thorough analysis of the dynamic customers' needs focused to maintain the existing and attract new port users. Fifth generation ports have a common vision of being "a commercial oriented, integrated transport, logistic and information complex network"[1].

It is important to note that ***Constanța port has to aspire to be a fourth-generation port*** but this point will be mainly determined by the socio-economic conditions in which it runs its activities.

A port community system (PCS) can be defined as a platform for information exchanges linked to a port, and therefore geographically restricted, which primarily seeks to serve the interests of the various companies and entities linked to port activities. A relatively wide variety of companies are involved, including terminal operators, transport operators (maritime/oceanic, road and rail), freight forwarders, customs, cross border regulatory agencies and port authorities.

The main reason for creating port community systems is that port service users and customers need an increasing amount of information every day in order to innovate and to optimize their own processes.

The complexity of activities carried out in a maritime port, mainly given by the variety and heterogeneity of stakeholders representing the port community, as well as the large number of data, messages and documents exchanged between port community members, highlights the need to implement an integrated ICT system to maintain competitiveness and obtain superior service quality.

Administrative processes related to the arrival and departure of ships to and from the port (as well as the movement of ships inside the port to different operating terminals) generate numerous documents and certificates.

During the study, data from shipping arrival forms were analysed in order to identify recurrent data entries/exchanges.

The information structure and recurrence elements currently used in the port area generate physical redundancy, logical redundancy, as redundancy of pre-existing information systems also arises.

Analysing cargo traffic operated in the ports managed by Constanta Maritime Ports Administration, based on the statistical surveys provided by the National Institute of Statistics (http://statistici.insse.ro) and those available on Constanta Maritime Ports Administration Portal, that is the annual report for 2017, the increase in commodity traffic and continuous growth in the coming years was highlighted.

As Constanta Maritime Ports Administration holds the most important role as initiator of the port development and coordinator of the entire Port Community, it should ***consider the implementation of modern ICT - Port Community Systems (PCS) in the near future in order to optimize, manage and automate port processes.***

Constanta Maritime Ports Administration will need to assume the leading and integrating role of the Port Community Systems (PCS) within the Port Community to obtain logistical support alongside other state authorities (Romanian Naval Authority, Customs, Border Police, etc.) which manage different activities in the port, as well as all major port operators who carry their activities in the maritime area.

Constanta Administration of Maritime Ports will have to mainly consider the insurance of competitiveness of Romanian ports related to the global maritime and river market, and this is in correlation with ensuring safe and fast traffic of goods.

Romanian ports will be competitive once the bureaucracy of the documents circulating in the port community will be reduced, offering through Port Community Systems (PCS) implementation and use of an increased efficiency and speed in reporting port processes, with multiple benefits for all parties involved.

Constanta Maritime Port Administration represents a patrimonial manager responsible for the safe, sustainable and competitive development of the harbour through the implementation of Constanta Port Master Plan, which provide medium and long term expansion of operating terminals as well as an increase and improvement of the road and rail infrastructure, leading to a diversified and increased freight traffic.

Attracting new port operators, large container shipping companies to open their workplaces on port platforms in Constanta, Midia and Mangalia ports, primarily depends on the bureaucratic decrease of documents reporting on port processes, meaning to ensure the same conditions as in other major ports of the world that have already implemented Port Community Systems (PCS).

It is imperative to develop the road infrastructure by widening the access routes, creating large areas for parking lots to stop blocking access routes to terminals, areas which offer facilities for truck drivers in terms of accommodation conditions, meals and hygiene.

Verhoeven classified the hypothetical typology of port authorities in his paper "A review of Port Authority Functions" published in 2010. This typology was made combining the four port authority functional profiles (landlord function, regulator function, operator function and community manager function) and the geographical dimension (local, local + regional, local + regional +global) (see table 1 below). Three typologies of port authorities can be defined:

"Conservator" - Those port authorities which adopt a passive role. This kind of port authority is focused on being a good housekeeper and essentially sticks to a passive and mechanistic implementation of the three traditional port authority functions at local level.

"Facilitator" - Those port authorities which adopt an active role acting as mediator between economic and social interests, hence implementing the community manager

function. Facilitator port authorities also look beyond the port perimeter and try to engage in strategic regional partnerships.

"Entrepreneur" - Those port authorities which combine the main features of the facilitator with a more outspoken commercial attitude as investor, service provider and consultant on all three geographical levels. Due to his ambitious profile, it runs the highest risk facing problems caused by conflicts between the various functional levels.

Concerning these roles towards the ICT developments in/around ports it seems obvious that a conservator port authority will remain mainly passive in this area whereas facilitator or ***entrepreneur port authorities could play an active role leading the development and implementation of ICT tools and solutions***. Key remarkable skills of these kinds of port authorities can be pointed out for ICT developments in/around ports:

1. Mediation in commercial B2B relations with port operators (Terminals, Logistics Operators, shipping agents...) and port customers (shipping lines or shippers): in order to define solutions able to fit requirements for all of them and to involve them from the beginning of the project.
2. Investor: ICT developments need high investments; port authorities can support directly this investment (for entrepreneur PA) or as a co-investor (in case of facilitator PA)
3. Active application and enforcement of rules and regulations through cooperation with local, regional and national regulatory agencies. With this cooperation port authority can design new regulations or rules to foster ICT tools to overcome different bottlenecks in the port logistics supply chain.
4. Provide assistance to port community in the implementation of these regulations.
5. Provide services of general economic interest, as Port Community Systems.
6. The community manager function will be crucial in order to ensure the alignment of efforts in the development of ICT solutions and to identify, motivate and involve all public and private interested parties from the very beginning of the project.
7. Port authorities will have an active role promoting ICT solutions even as a leader and providing port community with the necessary training to implement these solutions.

Constanta Maritime Ports Administration main functions are focused on regulation and coordination of the port community. It could be said that port authority should be the central element that guarantees the efficiency of port traffic.

In this sense, ICT tools, such as Single Windows or Port Community Systems, are a resource of vital importance for effective and efficient performance of port activities. Consequently, facilitator or entrepreneurial port authorities need to treat ICT projects with the utmost priority due to requirements of new port governance models and increasing demands from public and private sector stakeholders for improvements in trade facilitation and performance.

We can consider that a port is like a virtual enterprise where an assortment of specialized companies comes together to provide one face to the customer.

Information and communications technologies (ICTs) tools have an important role in the governance and efficiency in the flow of goods at ports. A key element in the application of ICTs in ports is the interconnection of different actors of the supply chain that makes possible a better information flow.

Table 4.5 Typology of port authorities (source European Port Governance report)

TYPE FUNCTION	'Conservator'	'Facilitator'	'Entrepreneur'
Landlord	Passive real estate 'manager': - continuity and maintenance - development mainly left to others (government / private sector) - financial revenue from real estate on "tariff" basis	Active real estate 'broker': - continuity, maintenance and improvement - development broker and co-investor - includes urban and environmental real estate brokerage - financial revenue from real estate on commercial basis Mediator in commercial B2B relations between service providers and port customers Strategic partnerships with inland ports, dry ports and other seaports	Active real estate 'developer': - continuity, maintenance and improvement - direct investor - includes urban and environmental real estate development - financial revenue from real estate on commercial basis - financial revenue from non-core activities Direct commercial B2B negotiations with port customers – active pursuit of market niches Direct investments in inland ports, dry ports and other seaports
Regulator	Passive application and enforcement of rules and regulations mainly set by other agencies Financial revenue from regulator role on 'tariff' basis	Active application and enforcement of rules and regulations through co-operation with local, regional and national regulatory agencies + setting of own rules and regulations Provide assistance to port community to comply with rules and regulations Financial revenue from regulator role on 'tariff' basis with differential charging options for sustainability	Idem facilitator Idem facilitator + selling expertise and tools outside the port Financial revenue from regulator role on commercial basis
Operator	Mechanistic application of concession policy (license-issuing window)	Dynamic use of concession policy, in combination with real estate broker role 'Leader in dissatisfaction' as regards performance of private port services providers Provide services of general economic interest and specialised commercial services.	Dynamic use of concession policy, in combination with real estate development role Shareholder in private port service providers Provide services of general economic interest as well as commercial services. Provide services in other ports
Community Manager	Not actively developed	Economic dimension: - solve hinterland bottlenecks - provide training and education - provide IT services - promotion and marketing - lobbying	Idem facilitator type but economic dimension with more direct commercial involvement
GEOGRAPHICAL DIMENSION	**Local**	**Local + Regional**	**Local + Regional + Global**

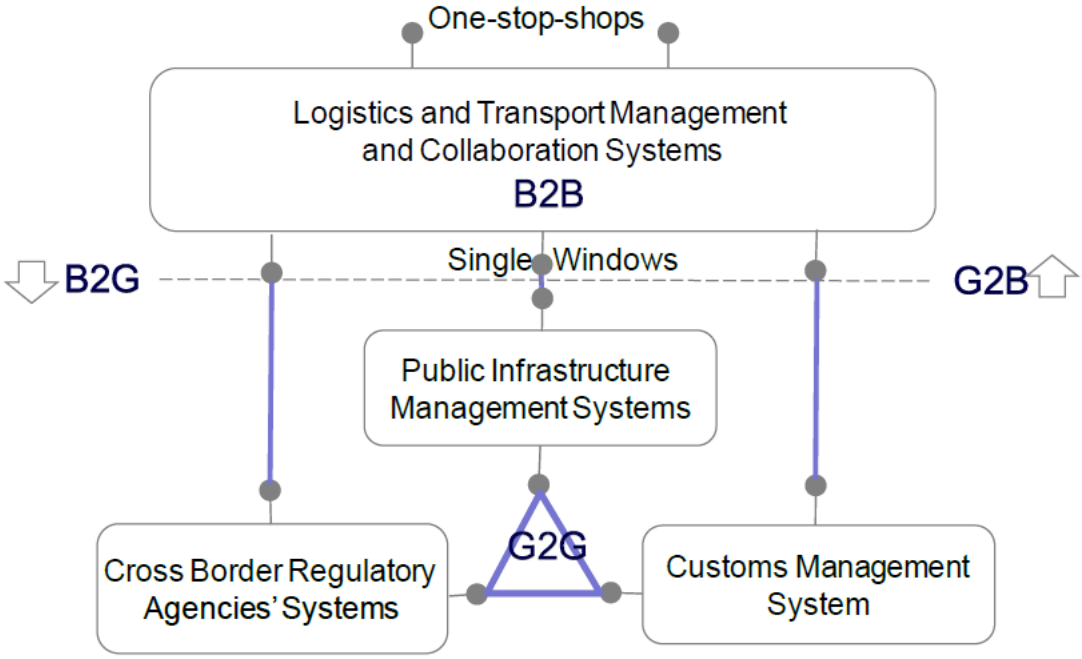


Figure 4.5 The Port as a Virtual Enterprise
(source: Trade Facilitation in the Integration Mesoamerican Corridor. Iberoamerican Development Bank, 2011)

ICT solutions are playing an increasing role in the design and implementation of trade and transport facilitation measures. These applications can reduce waiting times at border crossings and at ports, secure processing of data, simplify formalities, and provide timely information to transport operators.

Romanian Custom also has implemented a specific Single Window system for automation of the electronic customs the "e-customs" (https://www.customs.ro/info-publice/emcs/conectare-la-sistemul-informatic/emcs-ro-miscari-si-stocuri).

First, the New Computerized Transit System (NCTS)was implemented for the creation of a European electronic environment, consistent with the operational and legislative projects and developments already scheduled or underway in the areas of customs and indirect taxation (see figure 4.6).

Safety and security systems represented a first major step in the e-customs initiative. The safety and security systems are:

- Import Control System (ACS)
- Export Control System (ECS)
- Economic Operator's Registration and Identification system (EORI) and Authorized Economic Operator (AEO) – EORI and AEO were merged in Economic Operators Systems (EOS)
- Customs Risk Management System (CRMS)

The use of ICTs in areas such as Customs automation, electronic documentation and advance information in logistics is likely to continue to grow in the future years.

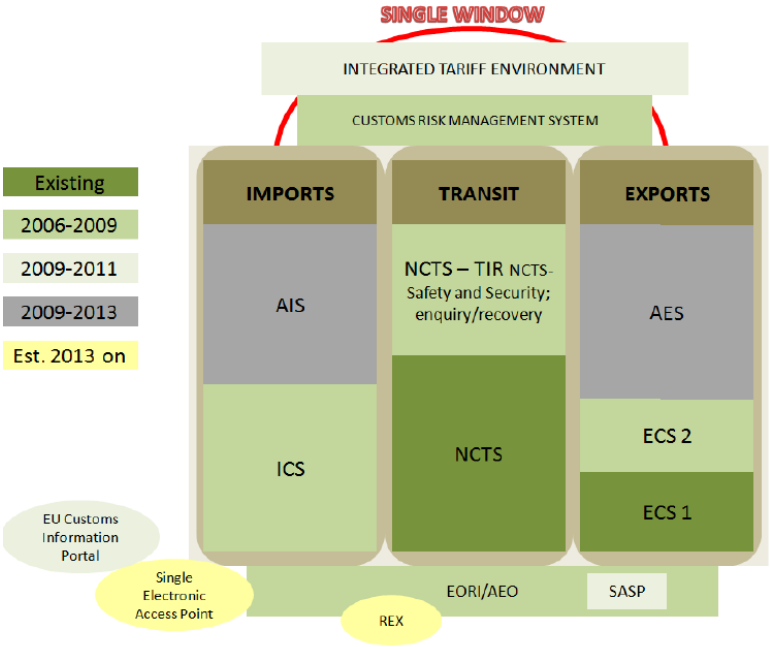


Figure 4.6 Map of software systems for custom authority
(Source: EUROPEAN COMMISSION - DIRECTORATE-GENERAL TAXATION AND CUSTOMS UNION)

Constanta Maritime Ports Administration must have in mind in the future to establish a good connectivity between Maritime Single Window and e-customs together with the Port Community System.

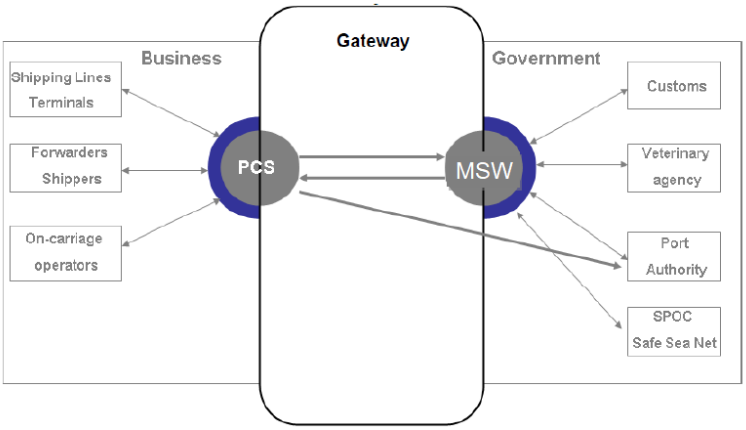


Figure 4.7. Schematic overview of Gateway to the National Single Window
(Source: White Paper "The role of Port Community Systems in the development of the Single Window" - EPSA, 2011)

Integration between PCS´s and the Maritime Single Window can create optimal benefits for all stakeholders involved.

The report "Transport Infrastructure, Transportation and Logistics in Romania" made by FLANDERS INVESTMENT & TRADE in December 2016, specifies that Romania enjoys a wide range of transportation options: road (86,080 km), rail (approximately 20.000 km in total, the 7th largest network in the EU, out of which 10,770 km in use), naval (32 ports – on the Black Sea, mainly through Constanta port, and along Danube River 1075 km) and air (14 airports), however the infrastructure is amongst the least developed in Europe.

Through European Infrastructure Programs, Romania will benefit from a modernization and extension of its road, rail and naval capabilities in the framework of development of the Trans-European Transport Network (TEN-T) and the Pan-European Transport Corridors in terms of network completion. Availability of EC funding from the structural funds (Cohesion Fund, European Regional Development Fund and Connecting Europe Facility) and Private-Public Partnership will support the development of Romania's infrastructure.

Recently the Romanian Government adopted the Transport Infrastructure Master Plan (MPGT) and also Constanţa Master Plan as strategic document, prior condition for EU funding, setting priorities for the development of the transport sector in Romania for the next 20 years and identifying projects and policies that are required in order to meet the Romanian transport needs.

The goods transportation sector in Romania (including road, railway, maritime, inland waterways and air transportation segments) increased in the first 10 months of 2018 with more than 10% since 2017.

Constanta Maritime Ports Administration will also have to obtain the logistic support from CFR Infrastructure through Railway Computerisation in order to ensure the integration of ICT modules already developed and implemented through CFR Computerisation and to assume the role of leader and integrator of the Port Community Systems (PCS), within the Port Community.

Informatica Feroviară (Railway Informatics) is working to strengthen its position as the most important player in Romania for mission critical application software, integrator and provider of IT services with maximum availability for rail transport.

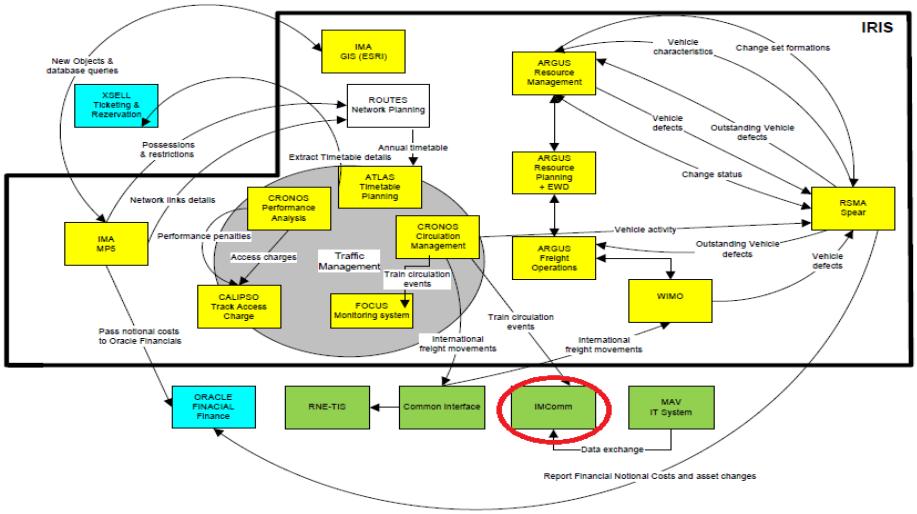


Figure 4.8 IT system of CFR – Logical View
(source: www.infofer.ro)

Constanta Administration of Maritime Ports and also Port Users uses an exchange messages application of CFR systems, named ***IM –Comm*** (see figure 4.8). The IM-Comm it is a multilingual IT tool dedicated for ad-hoc and instant freight trains (see figure 4.9).

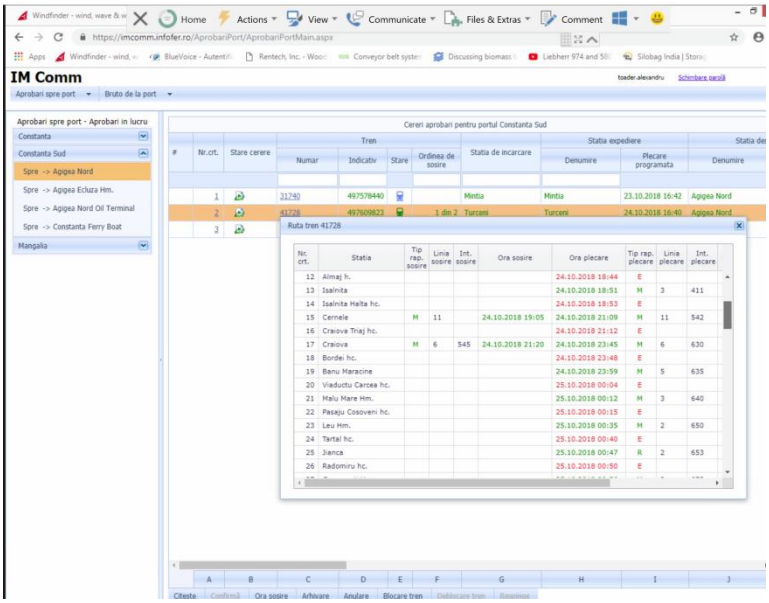


Figure 4.9. IM-Comm interface communications
(source: CN AMPC)

Constanta Maritime Ports Administration must have in mind also to establish a good connectivity between ***IM-Comm interface communications from railway system*** together with the ***Port Community System (PCS)*** and also the ***Maritime Single Window*** interface and ***"e-customs"***.

The ***integration of all the ICT modules*** specified above is necessary to be ready to be implemented, into the future ***Port Community System (PCS)*** to make this "gateway" for "National Single Window".

PCS could form the Gateway to a National Single Window where the objectives of Government, business and ports are realised.

The definition of **"gateway"** also indicates that the physical border is no longer that important.

For example, the physical gate can be extended to another air, sea or inland port and Customs procedures can be performed before the exiting that gate and therefore acting in a national framework.

For a good ***tracking of goods carried by trucks*** and the correlation of goods accompanying documents with ***the future Port Community Systems (PCS) interface***, ***it is necessary to implement an automated tracking and reporting system*** on these goods, a system to be managed by road operators and which could lead to introducing portable terminals for truck drivers, equipped with GPS and electronic signature of the reporting documents to the port authority.

The resulting benefits will be multiple and in addition to the anticipated evidence of goods arriving in the port, both the streamlining of road transport to terminals and the increase of taxes and duties collected into the state budget will be ensured.

In conclusion we consider that Constanța Administration of Maritime Ports will have to mainly consider the insurance of competitiveness of Romanian ports related to the global maritime and river market, and must act like an "entrepreneur port authority" and play an active role leading the development and implementation of PCS to lead Constanța port to become "a fourth-generation port" in the next 5 years.

For Constanța Maritime Ports Administration, it would be useful if it became a member of an international port association that has implemented Port Community Systems, namely **The International Port Community Systems Association (IPCSA).**

4.4 Recommendations for the development of feasible technical economical scenarios/options selected for further analysis in the Feasibility Study

For the future Feasibility Study, first we recommend CNAPMC to makes a matrix of their needs and Port Community User needs regarding the future PCS project, like in the figure 4.10, that we propose.

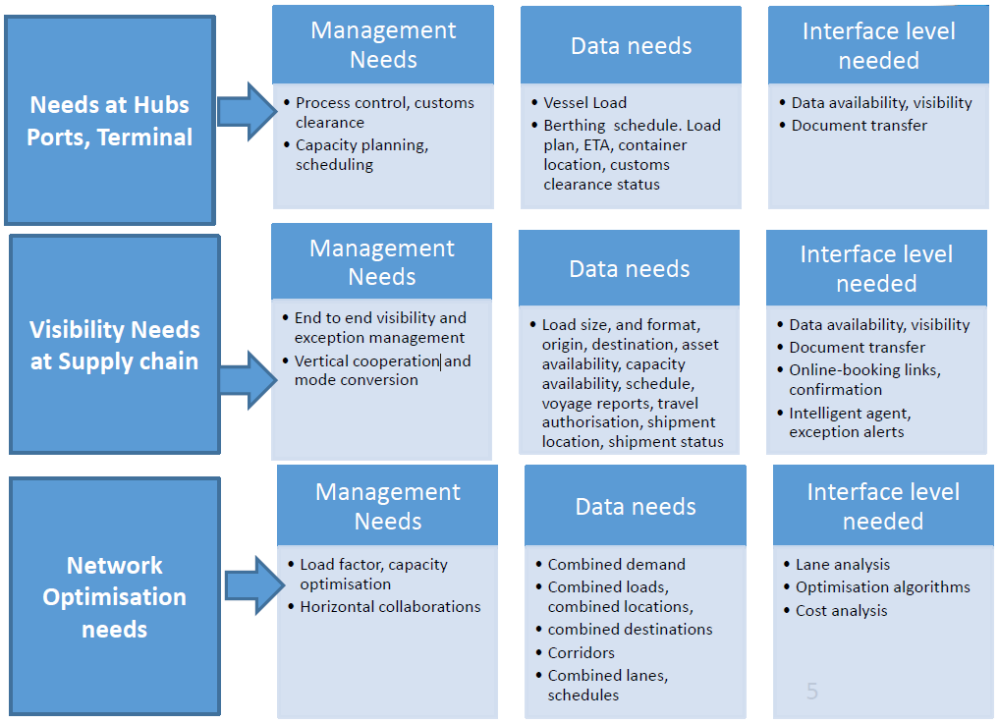


Figure 4.10. Matrix of business needs

Constanţa Maritime Ports Administration needs to organize a meeting with each Port Community User for discussions.

Meeting would typically be organized for high-level representatives from all relevant trade related organizations and governmental authorities and agencies to discuss the PCS concept.

The object of such a meeting is to reach an agreement on the project concept and to launch a feasibility study.

The meeting should establish a Project Management Group made up of senior representatives of the key agencies who will be directly involved in implementing and utilizing this kind of ICT solutions.

The meeting should also set up a Task Force composed of appropriate technical and management representatives of key stakeholders, to take charge of carrying out the organizational and implementation work required for the project.

The Feasibility Study should determine:

- Potential scope of the ICT solution
- Level and type of demand
- Possible scenarios for implementation
- Potential for and nature of a pilot implementation
- Resources required (financial, human, technical, etc),
- Potential benefits and risks
- Time frame
- Implementation and management strategy

For each of the three scenarios identified in point 4.1, in the Feasibility Study, it is recommended to make a work-matrix with interviews and questionnaires distributed along stakeholders which should be carried out in order to make the correct mapping and completion of the SWOT analysis previously presented.

The information matrix can lead to the development of a specific structure or architecture of the PCS system involving each scenario, having in mind also the “Matrix of business needs” (presented in figure 4.10), for all Port Community Users.

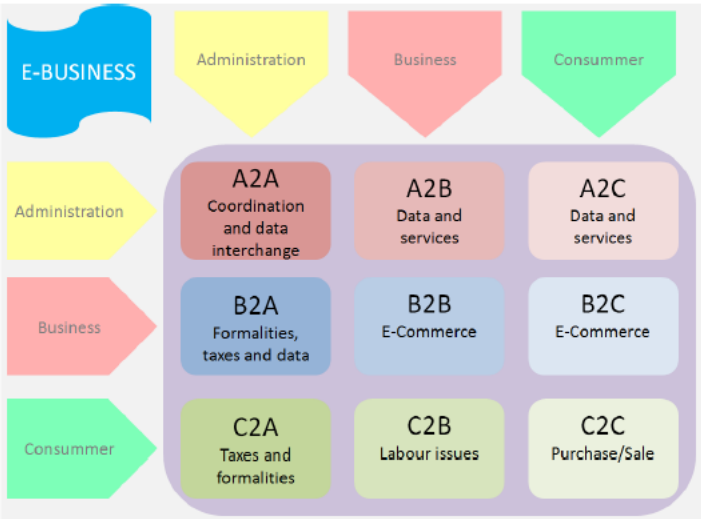


Figure 4.11 E-business matrix

The scenarios must propose more efficient and secure solutions for the different transactions, administrative formalities and all the procedures arising from Business-to-Business (B2B), Business-to-Administration and vice versa (B2A/A2B), Administration-to-Administration (A2A) and Business-to-Consumer (B2C) relationships (see figure 4.11).

The Feasibility Study can develop new solutions or new proposal scenarios or make use of features already implemented which can be proposed in order to deal with these aforementioned needs.

"Multimodal Innovation for Sustainable Maritime & Hinterland Transport", Project code: 0778R2 PORT INTEGRATION, gives some recommendations in this way. The complexity and the current ICT structure of both international trade and consequently transport provide a number of challenges that must be taken into consideration:

- ❖ Companies operating in EU are governed by established procedures, often national or even local in both business and relationships and interactions with public administrations.
- ❖ The current integration degree of EU offers resistance to overall changes in the Member States, mainly on issues related to authorities and public bodies. The cultural factor plays an important role in the case of Europe.
- ❖ Often EU regulations which unify criteria concerning transport issues must be interpreted under the particular regulation in each Member State and any change requires a period of assimilation.
- ❖ Sometimes Regulations in different areas at European level conflict with the guidelines established by huge enterprises that operate globally. That is why many initiatives such as e-maritime cannot be built apart from international rules (e-navigation) designed by international organizations.
- ❖ Trends in a business level will be set by the market. The existence of international standards leads to valid compatible solutions.

Concerning maritime and inland waterways freight transport, the White Paper points out the necessary promotion of interoperable systems (already running or new platforms and systems) in order to simplify, improve and make it more efficient. Moreover, issues referring to security, safety, environment and cooperation play a key factor in the future (e-freight and e-maritime concepts).

Based on the ITADE project (UN 2011) some general steps can be followed to design and implement the PCS similar with all ICT projects (see figure 4.12).

A. - Architecture Vision
- Create joint vision, strategy, objectives, and goals
- Establish the necessary environment for stakeholders' coordination and collaboration throughout ICT project lifecycle
- Make sure that major stakeholders are committed to make the project a success
- Develop a Master Plan

B. - Business Architecture
- Analyze existing business processes
- Identify bottlenecks

Figure 4.12 ICT Project Phases
(source: "Single Window Implementation Framework" - UN 2011)

C. - Information System Architecture
- Data Architecture
- Simplify, harmonize and standardize data used in the business processes
- Develop a data model
- Develop the structures for electronic messages
- Application Architecture
- Define the major application system necessary to process the data and support business processes

- Formulate a basis for estimating resources needed for implementing, deploying, and operating the ICT System
- Legislative Architecture
- Create the required legal environment for the operation of the System

D. - Technology architecture - To design hardware and software architecture of the System this will be the basis for implementation

E. - Opportunities and Solutions - Resource plan for implementing, deploying, and operating the System

F. - Migration Planning - Prepare the implementation and ensure that the management and implementation of individual sub-systems will be coordinated with the high-level master plan

G. - Implementation Governance - Establish a framework for monitoring the implementation, deployment, and operation of the System sub-systems so that their conformance with the defined specifications, plan, policies, and recommendations can be ensured.

H.-Architecture Change Management - Identify areas where changes should be introduced to provide:
a) the maximization of business value from the System implementation
b) the alignment of implementation approach with relevant emerging technologies and business requirements

Consideration of the future Feasibility Study

- The findings of the feasibility study will have to be considered and approved by the Task Force and eventually submitted for consideration by the Project Management Group.
- Sufficient time should be allowed for this process, as it is essential to have the maximum input and agreement before the report is finalized.

After the study has been accepted by the Task Force and Project Management Group, and a preferred ***Port Community System*** option and the accompanying implementation option chosen, these decisions should be presented to the wider government and trade community.

B COMPONENT DRAWINGS

PCS architecture includes three major components, namely:

1. A core base containing all information coming from companies operating on the port platform – that is all stakeholders, as well as information from port authorities that govern the port community.
2. A platform with all common facilities for the services provided.
3. A specific service platform.

For example, see Figure 4.13 with adjacent additions.

Fig. 4.13 PCS architecture (source https://www.portbase.com/en/port-community-system/)

Each service includes several specific processes. These processes describe the necessary message exchange and the interaction between parties. This involves messaging between systems (system messages) and messages between people (notifications).

The platform will ensure that running processes are in accordance with established rules.

The major advantage is that stakeholders will need to provide data only once and will have access to user-specific data based on certain operating rights and passwords.

PCS services focus on all port sectors: containers, general cargo, dry bulk and liquid bulk. All links in the supply chain can easily and efficiently exchange information:

- shipping agents
- barge operators
- shipbrokers
- customs
- carriers
- exporters
- port authorities
- importers
- companies
- Rail infrastructure managers
- terminals
- Food and Products Authority
- Road operators

We present 2 (two) models of ports that have implemented Port Community Systems:

1. Rotterdam
2. Antwerp

Example 1

Below is the adaptation of port services provided by PCS according to Rotterdam - Netherlands port model.

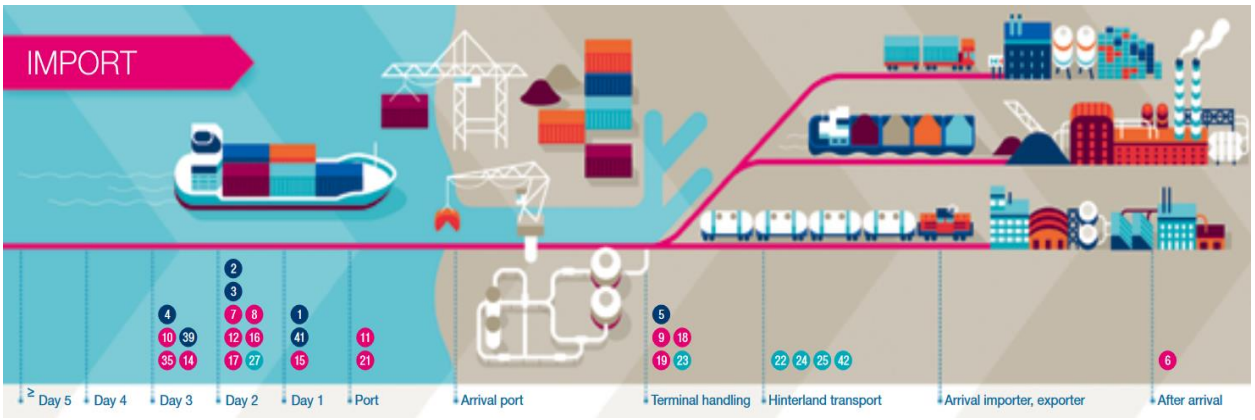


Fig. 4.14. Import cargo routing

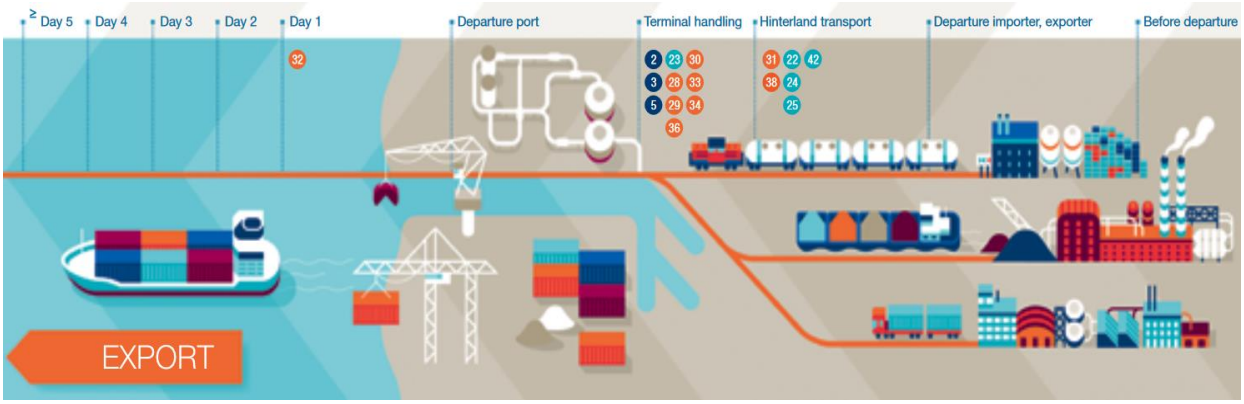


Fig. 4.15. Export cargo routing

Fig. 4.16 Types of services provided by PCS according to Rotterdam - Netherlands port model

Source:https://www.portbase.com/wp-content/uploads/2016/12/43653_Service-Selector_Digitaal_GB.pdf

Table 4.6 Classification of port services

Port services	
Barge Planning Service for pre-notifying barges (lighter agreements) and container cargo (discharge/loading lists) at terminals, including status feedback from the terminal.	**22**
Cargo Declaration Export Bulk/Containers Service for submitting your summary declarations for cargo loaded in the container sector, general cargo and bulk sector	**32**
Cargo Declaration Import Service for submitting summary declarations to be discharged (SAL) to Customs.	**14**
Cargo Declaration Status Report Provides an overview at all times of your summary declarations for which no new declarations have yet been submitted. This gives you the opportunity to quickly take care of settlement.	**6**
Cargo Information Improved service, allowing all movement details of visiting sea-go- ing vessels and loading details of containers on board to be consulted 24/7. You no longer need to phone the shipping agent or ship-broker to generate new declarations and make the transport planning.	**8**
Clearance NCTS Export Containers By using this service, container terminals can easily release NCTS documents for outgoing cargo (T1 and T2) electronically at Customs.	**36**
Declaration Food & Consumer Products Service for submitting Common Veterinary Entry Documents (CVED) to the Romanian Food and Consumer Product Safety Authority (NVWA).	**15**
Discharge Confirmation Report Your summary of containers actually unloaded at the sea terminal compared to those pre-notified. This allows you to quickly complete your declarations.	**9**
Discharge Information Practical and low-threshold service for all communication around a (liquid) bulk carrier to be discharged. BL details, stowage position and weight actually discharged are visible to the relevant parties at a glance.	**10**
Discharge List Service for submitting discharge lists to terminals.	**11**
Discharge Difference List Summary for Customs of the containers actually discharged compared to those shown on the manifest	**18**

Exit Summary Declaration	**33**
Service to submit an Exit Summary Declaration (EXS) for outgoing cargo for which the safety and security data are not (or no longer) available to Customs in any other way.	

Port services	
Hinterland Container Notification Road	**42**
A single service for pre-notifying containers for all hinterland modalities (truck, rail, barge) to sea terminals, inland terminals and depots.	
Notification Ship's Stores	**41**
A practical service for easily complying with the new Customs requirement of electronically submitting your vessel's store list.	
Notification Maritime Single Window	**3**
Service for port authorities to submit all information about visits to vessels and dangerous goods to SafeSeaNet	
Notification Verified Gross Mass	**38**
Using a single gateway, you can easily notify shipping companies of the verifi ed gross mass (VGM) of export containers	
Notification Waste Disposal	**1**
Service to report waste on board of a vessel to the Harbour Master.	
Pre-arrival Cargo Declaration Import	**21**
Makes it easy for deep-sea container shipping companies to submit an Entry Summary Declaration (ENS) to Customs.	
Rail Planning	**25**
Pre-notify train compositions (bulk and containers) and cargo (discharge/loading lists of containers) to terminals, including status feedback from terminals.	
Seaport Statistics	**35**
This service supplies the Port of Constanta Authority, the Port of Mangalia, National Institute of Statistics Romania (CBS) and shipbrokers with reliable statistics about ship movements and cargo on a monthly basis.	
Statement Harbour Dues Mangalia	**5**
Service to submit statement of harbour dues to Port of Mangalia	
Statement Harbour Dues Constanta/Midia	**5**
Service to submit statement of harbour dues to Port of Constanța/Port of Midia	
Track & Trace Export	**34**
Service which allows the user to track and trace export containers online: from the moment they arrive at the terminal to their departure on board of a vessel.	
Transit Declaration	**17**
Make quick and simple transit declarations (generate T-documents). You can then automatically notify the terminal of the associated Movement Reference Number (MRN). As a result, the haulier does not require any paper customs documentation.	
Vessel Notification 1.0 & 2.0	**4**
Service to submit the vessel notification to the Harbour Master and Customs	
Veterinary Inspection Process	**19**
Optimally plan veterinary inspections at inspection stations in the port	
Wagonload Information System	**24**
Service to track and trace dangerous goods in railway yards and siding tracks. In case of calamity the correct and complete data are available to emergency services	
Inland Port Dues	**23**

Portal for skippers to submit their season ticket applications for the declaration of inland port dues. Patrol vessels (RPA) can report the vessels identified to the Port of Constanţa Authority.	
Inspection Portal	**7**
From initial request all the way to release: you can gain a complete picture of all scan and physical inspections of import cargoes taking place at the behest of Customs in all the Romanian ports.	
Loading List	**28**
Easily submit your list of containers to be loaded to the terminal.	
Notification Arrival ECS Cargo	**30**
Container terminals can easily notify Customs of the arrival of export cargo (arrival at exit).	

Port services	
Notification Arrival Export Containers	**29**
Bulk and general cargo terminals can easily notify Customs that ECS goods have reached the exit location (arrival at exit).	
Notification Crew and Passengers	**39**
The most practical solution for submitting crew and passenger lists electronically to the Harbour police	
Notification Dangerous Goods	**2**
Service for reporting dangerous goods on board a sea-going vessel to the Harbour Master.	
Notification Export Documentation	**31**
Service to pre-notify customs document numbers to terminals related to export cargo (both ECS notification and T1/T2 documents).	
Notification Import Documentation	**16**
Service to pre-notify customs document numbers related to import cargo.	
Notification Local Clearance 2.0	**12**
Notify Customs that goods are being taken to an entrepôt. You can automatically inform the terminal at the same time. As a result, the road haulier does not need any paper customs documentation	

Table 4.7 Classification of basic port services by target group

Services	Target group																	
	Agents	Barge operators	Customs	Empty depots	Exporters	Food & Consumer Product Safety Authority	Forwarders	Importers	Inspection stations	Port authorities	Rail infrastructure operator/ -operators/ -hauliers	Danube Channels Authority	Road hauliers	Naval Authority	Seaport police	Skippers	Shipbrokers/Shipping companies	Terminals
Barge Planning		C		C														C
Cargo Declaration Export Bulk	B		B															B

Cargo Declaration Export Containers	C		C														C	
Cargo Declaration Import	A		A														A	
Cargo Declaration Status Report	A		A														A	
Cargo Information							C	C									C	
Clearance NCTS Export Containers			C															C
Declaration Food & Consumer Products	C					C	C	C									C	
Discharge Confirmation Report																	C	C
Discharge Information	B						B											B
Discharge List																	C	C
Discharge Difference List			C															
Exit Summary Declaration	C		C				C											
Hinterland Container Notification Road				C									C					C
Inland Ports Dues										A						A		
Inspection Portal			A														A	A
Loading List																	C	C
Notification Arrival ECS Cargo	A		A															A
Notification Arrival Export Containers	C		C															C

Notification Crew and Passengers	A													A	A		A	
Notification Dangerous Goods	A									A							A	
Notification Export Documentation		C			C		C				C		C					C
Notification Import Documentation		C					C	C			C		C					C
Notification Local Clearance 2.0			C				C	C										
Notification Ship's Stores	A																A	
Notification Single Window										A								
Notification Verified Gross Mass					C		C										C	
Notification Waste Disposal	A									A							A	
Pre-arrival Cargo Declaration Import	A		A														A	
Rail Planning											A							A
Seaport Statistics	A									A							A	
Statement Harbour Dues Mangalia	A									A							A	
Statement Harbour Dues Constanţa/Midia	A									A							A	
Track & Trace Export		C			C		C				C		C				C	C
Transit Declaration	A		A		A		A	A		A							A	
User Management	A	A	A	A	A	A	A	A	A	A	A		A			A	A	A

Vessel Notification 1.0 and 2.0	A		A							A							A	
Veterinary Inspection Process						C	C	C	C								C	
Wagonload Information System											A							

A - Includes all segments
B - Contains only dry and liquid bulk/break bulk
C - Contains container service

Example no. 2

2. Port of Antwerp

The Antwerp PCS is a cooperation system between:

- Antwerp Port Authority
- Alfaport Antwerpen -Federation of Port Companies and Logistic Service Providers
- private IT-sector (Descartes – Porthus)

The Port Community System gathers the network of existing systems and IT solutions that services electronic messages and information between:

-G2G
-B2G
-B2B

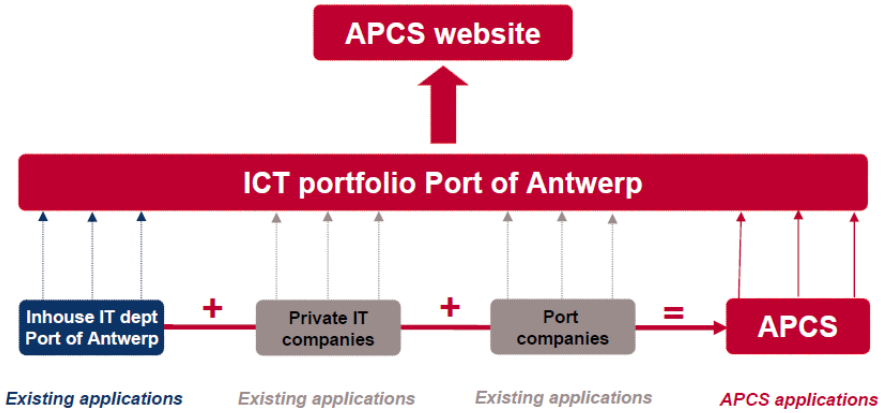


Figure 4.17 Structure of ICT portfolio of Antwerp Port Community System (APCS)

This portfolio has been developed by:

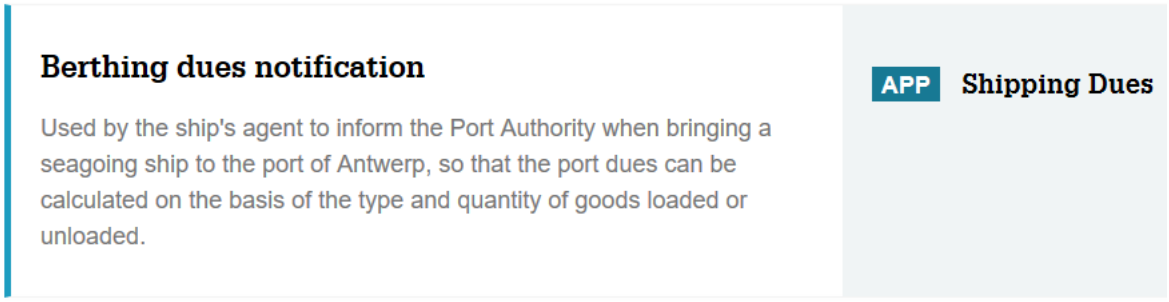
- Port of Antwerp in-house IT department
- Private ICT companies
- Individual port companies and service providers

PCS distinguishes 4 basic port processes:

1. The nautical process
2. The notification of dangerous cargo
3. The customs process
4. Cargo transportation process

Now we explain each module process below:

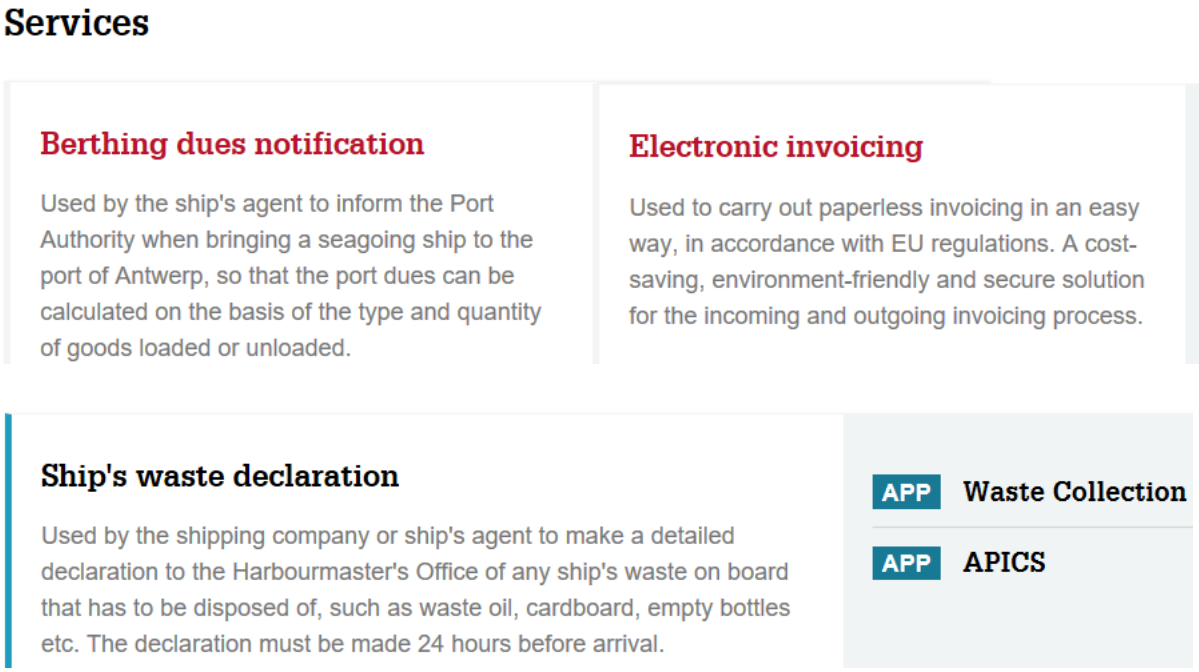
The nautical process
(https://www.c-point.be/en/services/?search[service_category][0]=Nautical)



Berthing dues notification Used by the ship's agent to inform the Port Authority when bringing a seagoing ship to the port of Antwerp, so that the port dues can be calculated on the basis of the type and quantity of goods loaded or unloaded. Berthing dues are charged for all seagoing ships calling at the port of Antwerp. This message is used by the ship's agent to specify the type and quantity of goods loaded and unloaded in the port.

SHIPPING DUES is a web application used by ship's agents for berthing declarations.

All ship's agents who are required to declare the quantities of goods loaded and unloaded during a ship's stay in port must register on this web application. Once they have registered, the agent can consult the information on the ship and its stay in port in SHIPPING DUES for the seagoing ships for which they have to make berthing declarations. As soon as the Port Authority has received the loading and unloading information from the freight handlers it is available in SHIPPING DUES. The ship's agent compares this with his own information and if necessary makes corrections or additions, and then sends the declaration to the Port Authority using the application. The Port Dues department checks the declaration and then draws up the invoice in SHIPPING DUES.



Ship's waste declaration

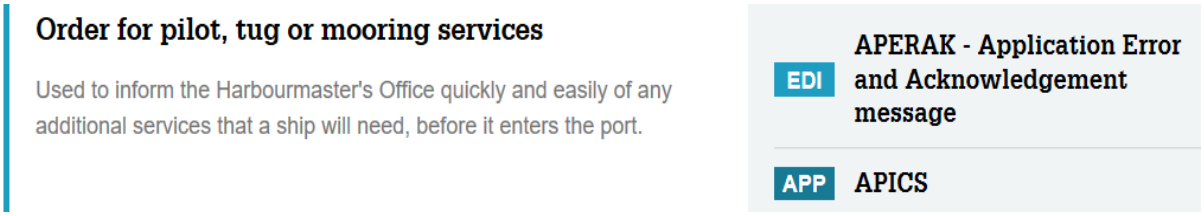
The ship's agent or shipping company is legally obliged to send a detailed declaration of the ship's waste on board to the Harbourmaster's Office 24 hours before arrival.

WASTE COLLECTION is a web application in which waste collection facilities must report how much and what types of waste they have collected from a seagoing ship.

With **APICS**, all the coordinating departments and services have correct, up-to-date information for handling the flow of seagoing ships and barge traffic.

Ship's agents and forwarders, pilotage and tugging companies, shipping police and customs, port dues officials, and other logistics players in the supply chain all make intensive use of the APICS desk. This is the external section of APICS.

In addition, APICS has become the main tool for shipping traffic controllers, lock operators, dock masters and port state control, harbourmasters and dangerous goods operatives.



Order for pilot, tug or mooring services

This message is used by the shipping company or ship's agent to inform the Harbourmaster's Office of any additional services that the ship will require before it can enter the port.

After registering, the shipping company or ship's agent can send the following information in APICS: port of arrival, name of ship, shipping company, previous port and next port of call. This can be followed by a BERMAN message specifying any additional services that may be required, e.g. sea, river or dock pilot, tugs on the Scheldt or in the docks, boatmen, fenders etc.

Companies that are not yet able to sent particular information or obligatory declarations electronically can make use of Port+.

The function of APERAK is:

To inform the sender of a message that the message has been received by the addressee's application but has been rejected due to errors

To inform the sender of a message that it has been correctly received by the addressee's application.

The receiving application does not to stop at the first error but analyses the entire message. It enables the sender to correct the message sooner and ensures that it is ultimately accepted. This time saving can benefit various players in the supply chain.

Electronic invoicing

The Port Authority makes invoicing and credit notes available online. A sustainable, efficient option.

APP Port Authority Invoices

Electronic invoicing

The Port Authority makes invoices and credit notes available to its customers online. A sustainable, efficient option.

Customers receive digital certified invoices and credit notes from the Port Authority's Invoicing application. The customers can consult these online and save them.

The ship's agents can call up an electronic ship's statement in a simple way, with all invoices and credit notes for the same port call combined in a clear way.

PORT AUTHORITY INVOICES is a web application that enables customers of the Port Authority to easily consult invoices and credit notes online. Once customers have registered in the application, paper versions of the invoices or credit notes are no longer sent. Also, the Port Authority's duplicate of the invoice or credit note is no longer printed but instead is archived electronically.

Berth reservation (seagoing ship)

Used obligatorily by the ship's agent or shipping company, to inform the Harbourmaster's Office of the preferred berth.

APP APICS

Berth reservation (seagoing ship)

The shipping company or ship's agent has to inform the Harbourmaster's Office of its preference for a berth at which to moor. This berth reservation is done using the BERMAN message.

After registration, the shipping company/ship's agent can enter the following information using a simple web application made available free of charge by the Port Authority:

Port of arrival
Name of ship
Shipping company
Previous and next ports of call

This is followed by a berth reservation (first berth required). The Harbourmaster's office checks whether this is possible and sends a confirmation.

Companies that are not yet able to send particular information or obligatory declarations electronically can make use of Port+, a reliable, professional and neutral service partner for port services and companies in and around the Scheldt ports.

Consult position

The Port Authority enables terminal and barge operators to consult the position of barges in the Barge Traffic System web application.

APP APICS

APP Barge Traffic System (BTS)

Consult position

Antwerp Port Authority offers terminal operators and barge operators the possibility to consult the position information for barges. Terminal operators can consult the position of any known barge, while barge operators can only consult the positions of their own barges.

The Port Authority receives barge position data through various channels, for a number of passage points in Flanders and the Netherlands. These position data are displayed on a map in the Barge Traffic System web application.

BARGE TRAFFIC SYSTEM (BTS) is a web application that has been used since 2007 to simplify management of barge container traffic in the port. This unique platform enables barge operators to request terminal berths in advance. It also enables barge and terminal operators to consult the positions of barges in Flanders and the Netherlands. Further, with BARGE TRAFFIC SYSTEM (BTS) barge operators can consult nautical messages concerning the port and give advance notice of their trip.

In order to ensure smooth traffic management in the port of Antwerp, BARGE TRAFFIC SYSTEM (BTS) is obligatory for all container terminals and for all barges that load or unload containers. Registration is optional for other barge operators, enabling them to consult the lock scheduling, position information and nautical messages.

Berth request (barge)

Used by the barge operator, in the Barge Traffic System (BTS), to request a handling slot with one or more terminals, for containers to be loaded or unloaded. Saves a whole lot of administration work for port visits.

EDI IFTSTA - International multimodal status report message

EDI IFTSAI - Forwarding and transport schedule and availability information message

APP Barge Traffic System (BTS)

Berth request (barge)

Container barges frequently call at more than one terminal during a single port visit. In order to reduce the amount of administration work, barge operators can request handling times for loading and unloading containers in a uniform way by means of the Barge Traffic System (BTS).

The Barge Traffic System web application acts as a unique planning system for container barges. A barge operator wishing to load or unload containers in the port uses this application to send berth requests to the terminals concerned. A conflict control system alerts the barge operator if the berth requests for different terminals are too close together in time. Once the terminal operator has drawn up its schedule it notifies the barge operator in a uniform way by means of BTS.

IFTSTA - International multimodal status report message

For who is it?
Shipping company or ship's agent (sender)
Shipper or forwarder (recipient)
Terminal (sender)
Shipping company or ship's agent (sender)
Antwerp Port Authority (sends the history of a seagoing ship)
Shipping company or ship's agent (receives the history of a ship)
Inland terminal (sends the status of a barge)
BTS (receives the status of a barge)
Content of the message

The IFTSTA message is extensive because it covers all the possibilities for reporting the physical status of consignments or materials. It therefore contains several repeating groups:

EQD group ("Equipment details")

For each item of material (e.g. a container), this makes it possible to provide information on dangerous substances, temperature, transport details such as inward and onward transport to and from the terminal, any damage, etc.

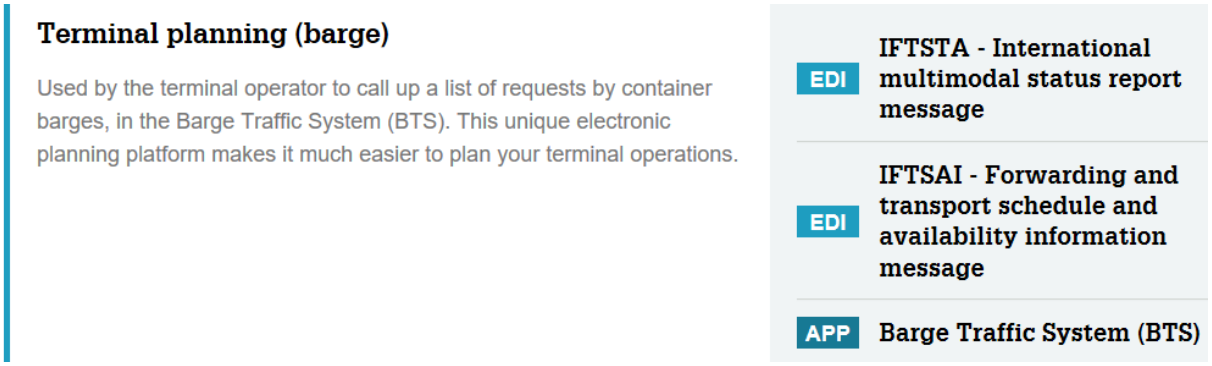
CNI group ("Consignment information")

For each consignment, this makes it possible to inform the parties involved concerning the transport details for the material, together with details of the goods such as weights, packaging method etc. Depending on what it is being used for a special MIG is issued to permit the implementation of the IFTSTA in the specific context.

IFTSAI - Forwarding and transport schedule and availability information message

Corporate systems can exchange XML messages with BTS by means of machine-to-machine communication.

For who is it?
Shipping company or ship's agent (sender)
Barge operator (sender)
Container terminal (receiver)
Antwerp Port Authority (receiver in BTS)
Antwerp Port Authority (sender in BTS)
Portal sites (receiver)
Content of the message
Information about the vessel
A list of ports to be called at.



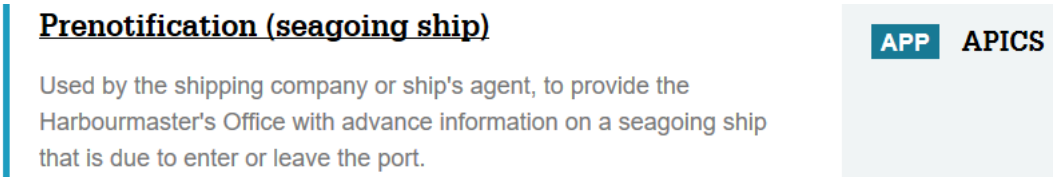
Terminal planning (barge)

Used by the terminal operator to call up a list of requests by container barges, in the Barge Traffic System (BTS). This unique electronic planning platform makes it much easier to plan your terminal operations.

Container barges frequently call at more than one terminal during a port visit. To simplify the administration for a port visit, a unique electronic planning platform, the Barge Traffic System (BTS), was set up in 2007.

The Barge Traffic System web application enables barge operators to request a berth reservation for one or more terminals in order to load or unload containers. A terminal that serves container barges in turn can use this application to approve, update or refuse berth requests. A conflict control system alerts the terminals if the estimated time of arrival is not feasible, taking into account the estimated handling time and the average time taken to get from one terminal to another. This makes scheduling easier for the terminal operator. If necessary the terminals can coordinate their schedules.

Corporate systems can exchange XML messages with BTS by means of machine-to-machine communication.



Prenotification (seagoing ship)

Used by the shipping company or ship's agent, to provide the Harbourmaster's Office with advance information on a seagoing ship that is due to enter or leave the port.

The shipping company or ship's agent is legally obliged to provide the Harbourmaster's Office with information concerning a seagoing ship that is due to enter or leave the port. This is done using the seagoing ship prenotification message.

After registering, the shipping company or ship's agent enters the following information electronically:

Port of arrival
Name of ship
Shipping company
Previous and next ports of call
Crew

Berth required or transit

Any particular aspects

When this prenotification is received the Harbourmaster's Office sends a port call number which is quoted in all subsequent messages for the duration of the call.

A departure request contains all the information concerning the last berth in the port area.

Companies that are not yet able to send data or obligatory declarations electronically can make use of Port+, a reliable, professional and neutral service partner for port services and companies in and around the Scheldt ports.

The notification of dangerous cargo

(https://www.c-point.be/en/services/?search[service_category][0]=Dangerous%20Goods)

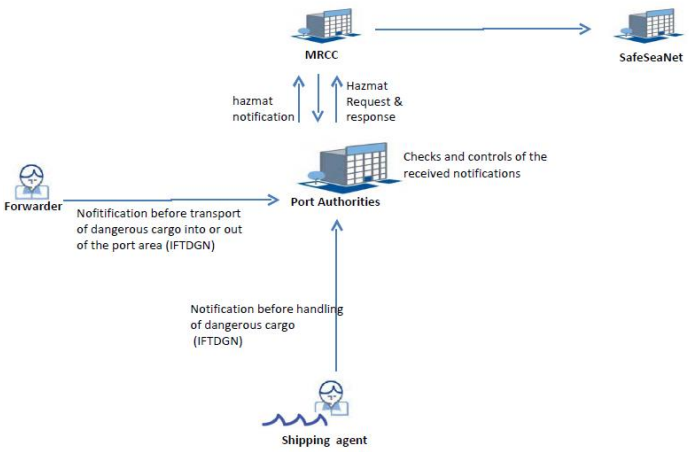


Figure 4. 18 Dangerous cargo notification process

Notification of dangerous goods

Used to notify the Harbourmaster's Office of the position of dangerous goods. This must be done at least 24 hours in advance.

EDI APERAK - Application Error and Acknowledgement message

EDI IFTDGN - Dangerous goods notification message

APP APICS

Notification of dangerous goods

Used to notify the Harbourmaster's Office of the position of dangerous goods. This must be done at least 24 hours in advance.

Handling of dangerous goods in the port of Antwerp is subject to various legislation. "Handling" covers various operations including carrying in and out of the port, loading,

unloading, transshipment, interim storage and keeping on board. It is important to know where dangerous goods are located within the port at every moment.

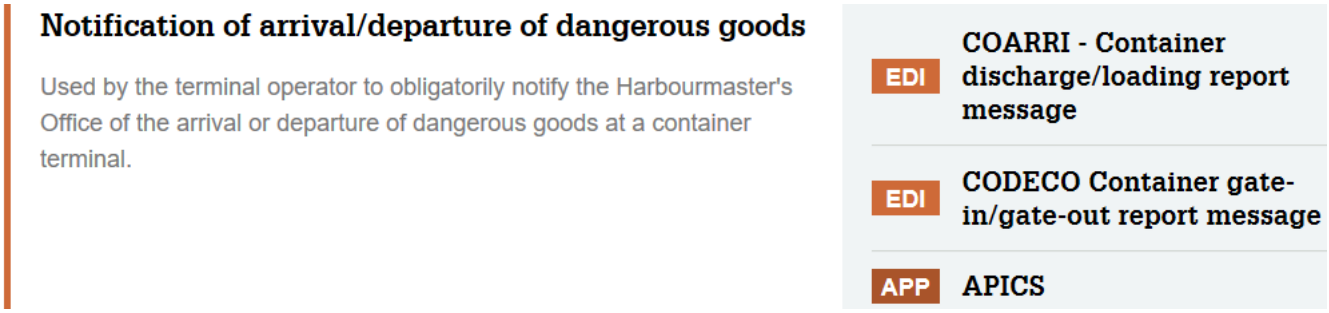
The ship's agent or forwarder notifies the dangerous goods to the Harbormaster's Office, and the latter uses the information to draw up a safety dossier.

The initial notification is done using the electronic IFTDGN message which contains all information concerning dangerous goods that are to be delivered to the terminal. This notification must be sent to the Harbormaster's Office not later than 24 hours before the dangerous goods are due to arrive in the port.

In case of import or remain on board, the message is sent by the ship's agent.

In case of export it is generally sent by the forwarder.

When the dangerous goods leave the terminal, the terminal operator gives notification of this with the exact time using the CODECO and COARRI messages.



Notification of arrival/departure of dangerous goods

Used by the terminal operator to obligatorily notify the Harbourmaster's Office of the arrival or departure of dangerous goods at a container terminal.

The information sent in the declarations by the forwarders and ship's agents is supplemented by means of an IFTDGN message with the actual handling times, using the information in the CODECO and COARRI messages sent by the terminal operators.

Each arrival or departure of goods on the container terminals is notified by the terminal operator to the Harbourmaster's Office by means of the following messages:

COARRI/unloading: unloading from a seagoing ship

COARRI/loading: loading on board a seagoing ship

CODECO/in: arrival on the terminal by truck, barge or rail

CODECO/out: departure from the terminal by truck, barge or rail

For who is it?

Port Authority

Terminal operator

CODECO Container gate-in/gate-out report message

Container terminal or container depot operator (sender)

Shipping company or ship's agent (recipient)

Belgian Customs (recipient for purposes of MASP/ECS/Arrival at exit)

The Port Authority (notification of arrival or departure of dangerous goods)

Content of the message

The message is mainly used for original input (create), but can also be used to replace certain other messages or even cancel them.

Message structure:

BGM (BeGinning of Message): Gate-IN, Gate-OUT or a logistical movement inside the terminal

Optionally, identification of the seagoing ship concerned (main transport)

Parties concerned (shipping company, ship's agent, container operator)

List of the moving containers, according to the previously specified code (weights, temperature, IMO class and UN number, seal number, indicator full or empty, damage codes, details of inland transport)

COARRI - Container discharge/loading report message

Container terminal (sender)

Shipping company or ship's agent (recipient)

Extra inbound

Unloaded containers can be collected more quickly by inland carriers

Greater visibility

Content of the message

The message can be used for original input (create), but can also be used to change a particular container or even delete it from the report.

Message structure:

BGM (BeGinning of Message): loading or unloading

Identification of the seagoing ship and the UL/Locode of the port of loading/unloading and the code for the loading/unloading location and a list of the parties involved (shipping company, ship's agent, container operator)

List of the containers loaded/unloaded and detailed information (weights, temperature, seal number, damage codes, IMO class and UN dangerous goods number, etc.)

For loading, the message specifies the location of the container (full or empty) on board: on deck or below deck or even the specific stowage location in the form “Bay/row/tier” (BBBRRTT).

SafeSeaNet message

Used by all EU countries plus Norway and Iceland to send and receive maritime information.

APP APICS

SafeSeaNet message

Used by all EU countries plus Norway and Iceland to send and receive maritime information.

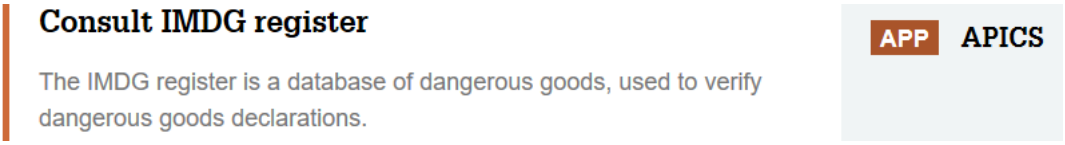
SafeSeaNet is a platform for exchanging maritime information on ships and their cargoes between the EU member states, Norway and Iceland. Each member country must be able to provide and call up maritime information by means of this platform. The aim of the platform is to ensure better and faster reaction to incidents and spills, and to permit early detection of risk vessels.

Each country that is a member of the network has a National Competent Authority (NCA). The NCAs communicate with SafeSeaNet by means of XML messages. Communication between each NCA and the LCAs (Local Competent Authority, such as Antwerp Port Authority) is also by XML messages sent over the Central Broker System (CBS). The LCA reports:

General ship and routing information

Which ships have dangerous goods aboard

In case of an incident: an electronic request for detailed information. APICS responds to such a request automatically with a detailed list of all cargo information including stowage positions, based on the IFTDGN declarations by the ship's agent/forwarder



Consult IMDG register

The IMDG register is a database of dangerous goods, used to verify dangerous goods declarations.

The IMDG register is the database of dangerous goods used by the Antwerp Port Information & Control System (APICS) as a reference file for checking dangerous goods declarations.

Users of the APICS desk can consult the database directly within the system. Non-users can search by UN number here in order to find out which provisions apply.

The customs process

(https://www.c-point.be/en/services/?search[service_category][0]=Customs)

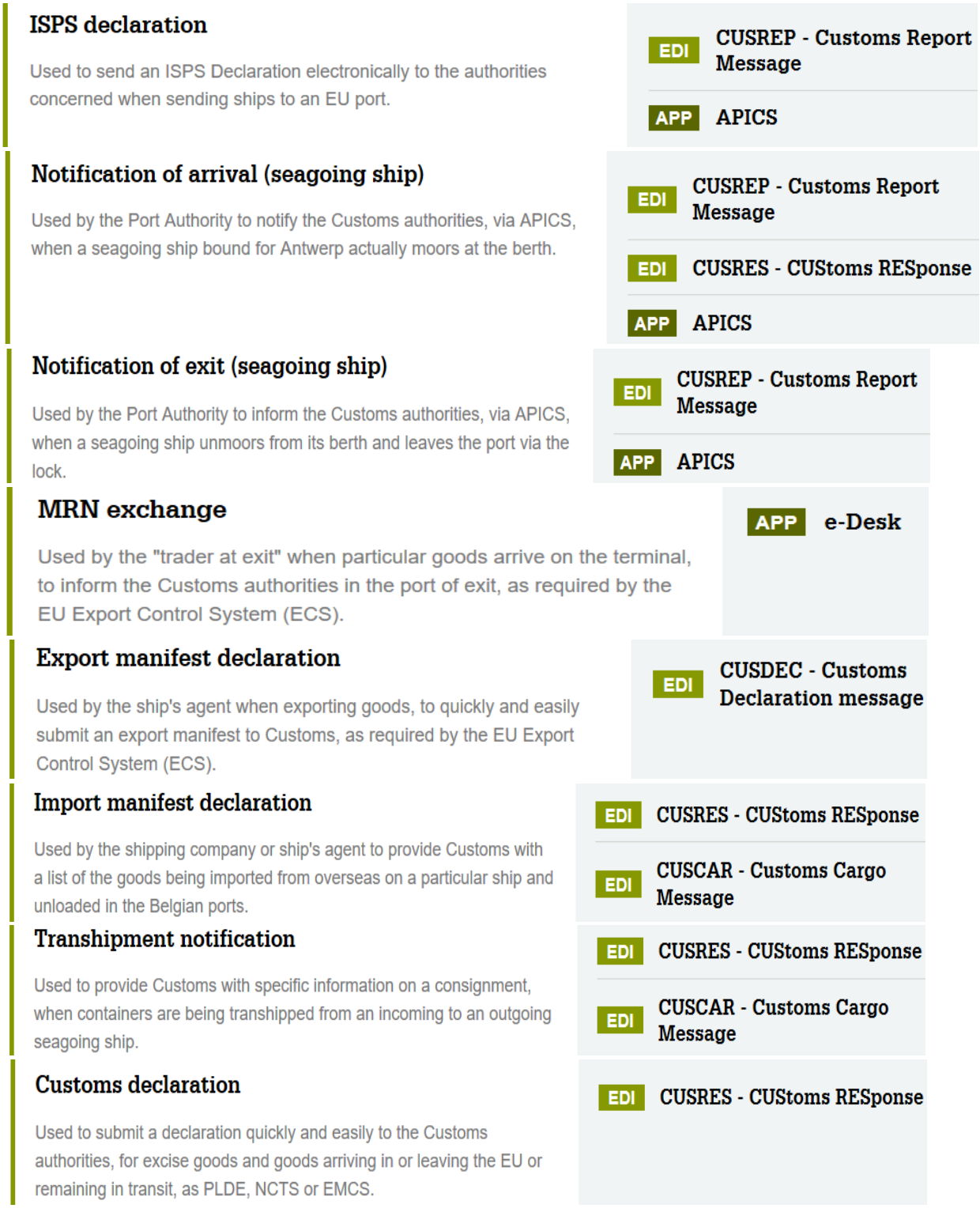
In Belgium, importers, exporters and customs brokers are required to fulfil their customs formalities with the aid of automated customs clearing systems.

EDI-messages:

CUSREP: customs conveyance report message

CUSCAR: customs cargo report message

CUSRES: customs response message
CUSDEC: customs declaration message



Danube Transnational Programme
DAPhNE

Notification of arrival of export consignment

Used by the "trader at exit" to notify the Customs office in the port of exit when the goods physically arrive at the terminal.

EDI	CODECO Container gate-in/gate-out report message
APP	e-Desk
APP	Cubix

Cargo transportation process
(https://www.c-point.be/en/services/?search[service_category][0]=Cargo%20%26%20Logistics)

Private companies IT-systems

Container business is mostly automatized, in the breakbulk sector there is still a lot of work to do

EDI messages: examples
IFTMAN: notice of arrival
CODECO: gate report
COREOR: container release
BAPLIE: stowage position
COPRAR: loading/discharge instruction
COARRI: loading/discharge report

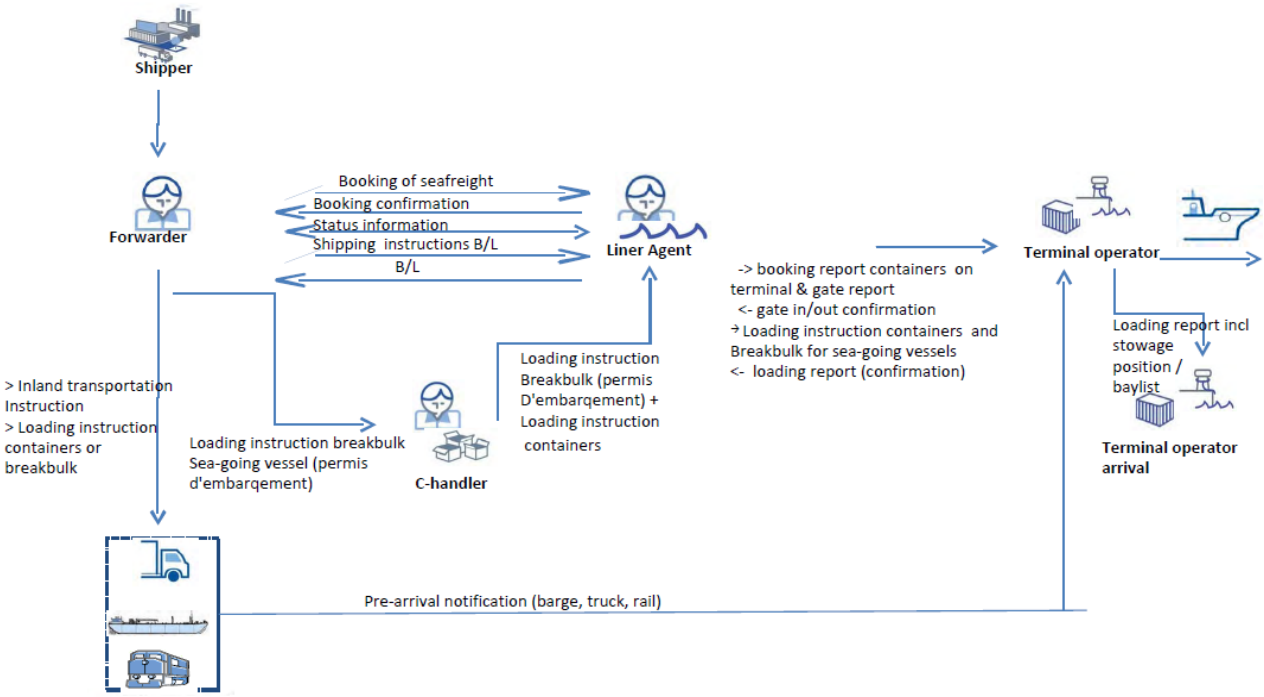


Figure 4.19 Cargo process in Antwerp

Container release

Used by the terminal operator to receive a PIN code for each container consignment that is unloaded and released, enabling the consignment to be collected by the carrier without loss of time.

Container booking notification

Used by the ship's agent to notify the terminal operator of the bookings accepted, from the beginning, so that the terminal operator can organise the gate handling.

EDI CODECO Container gate-in/gate-out report message

EDI COPARN Container announcement message

Transport booking (seagoing ship)

Used by the forwarder or shipper wishing to book sea transport, to quickly and easily send all the information concerning the consignment to the shipping company or ship's agent.

EDI IFTMBC– Booking Confirmation

EDI IFTMBF– Firm Booking

Electronic payments with Twikey

Twikey, the tool for electronic payments, makes payment with paper cheques a thing of the past, thus saving a whole lot of administration work for forwarders, ship's agents and banks.

Electronic invoicing

Used to carry out paperless invoicing in an easy way, in accordance with EU regulations. A cost-saving, environment-friendly and secure solution for the incoming and outgoing invoicing process.

EDI IFTFCC - Freight Costs and other Charges

EDI INVOIC – Invoice Message

APP Shipping Dues

Inland transport order

Used by the forwarder or ship's agent to send a transport order to a carrier electronically. The carrier in turn can send the order quickly and easily to the onboard computer on the barge or truck.

EDI IFTMIN – Instruction Message

APP Container Re-Use

Breakbulk loading/unloading order (inland transport)

Cubix is used by the forwarder to place an order with a terminal operator for shipment of conventional breakbulk that has to be loaded or unloaded.

EDI CUBSOR - CUBix Status and ORder message

APP Cubix

Breakbulk loading/unloading order (sea transport)

Cubix is used by the forwarder or ship's agent to place an order with a terminal operator, for breakbulk from a seagoing ship or with an overseas destination, to be loaded or unloaded in or out of a truck, rail wagon or barge.

EDI CUBSOR - CUBix Status and ORder message

APP Cubix

Container loading/unloading order (sea transport)

Used to send an order to a terminal operator for containers to be loaded into or unloaded from a seagoing ship, and to receive confirmation once it has been carried out, with effective information on the containers loaded/unloaded.

- EDI BAPLIE Bay-Plan Information
- EDI COARRI - Container discharge/loading report message
- EDI COPRAR Container discharge/loading order message

Container loading/unloading order (barge/rail transport)

Used to quickly and easily provide the terminal operator with all details of the loading or unloading order for a barge operator.

- EDI CODECO Container gate-in/gate-out report message
- EDI COPINO - Container pre-notification message

Notification of arrival of import consignment (seagoing ship)

Used by the shipping company to inform the forwarder or consignee immediately of the ETA of import goods and the arrangements for their collection, so that they can make the necessary preparations.

- EDI IFTMAN - Arrival Notice

Stowage position information

Used by the shipping company or terminal operator to exchange stowage plans with one another, with among other things the exact stowage position of the containers, weights and if applicable the class of dangerous goods.

- EDI BAPLIE Bay-Plan Information

Berth request (barge)

Used by the barge operator who has to load or unload containers, to send berth requests to the operators of terminals where it is wished to call, in the Barge Traffic System (BTS).

- EDI IFTSTA - International multimodal status report message
- EDI IFTSAI - Forwarding and transport schedule and availability information message
- APP Barge Traffic System (BTS)

Track & trace containers

Used by all the parties concerned, including the customer, to monitor the status of their container consignment.

- EDI COARRI - Container discharge/loading report message
- EDI CODECO Container gate-in/gate-out report message

Shipment instruction (B/L)

Used to provide the ship's agent with all the necessary information for drawing up the transport document, on the basis of the shipper's information, thanks to the electronic shipment instruction.

- EDI IFTMIN – Instruction Message

Pre-notification of delivery and collection of containers on the terminal (road or rail transport)

Used by the carrier to inform the terminal operator whenever a truck is to be loaded or unloaded, so that the terminal operator immediately knows which handling operations are needed for which truck at which moment.

EDI **IFTSTA - International multimodal status report message**

EDI **COPINO - Container pre-notification message**

Following the analysis of the PCS modules given by the two examples of Rotterdam port and Antwerp port, we consider that the operating mode in Antwerp is closer to that of Constanta port.

Below we proposed a comparison between the standard PCS modules and those modules implemented in the port of Antwerp, in correlation with the typology of documents circulating in Constanta port (see Table 4.8).

The table below summarizes the information from Chapter 2 regarding the types of documents circulating in the Constanţa Port Community as well as those given by the Port Community Systems Software specific modules as well as the PCS modules deployed in the port of Antwerp (APCS) – information on Chapter 4.4 from example 2.

Table 4.8. CNAPM information flow vs. Antwerp PCS general modules. Table is based on analysis from chapter 3.

APMC docs		Antwerp PCS - SPECIFIC APP	Antwerp PCS
Vessel's name/former names/ call sign/flag;		APICS/Berth reservation (seagoing ship)	
IMO number/MMSI number;		APICS	
Type of vessel/year of built;		APICS	
GRT, NRT, DWT, LOA, breadth;		APICS	
Maximum draft, arrival draft, intended departure draft;		APICS	
Owner's/Operator's/Charterer's name and address;		APICS/Berth reservation (seagoing ship)	
Agent's name and address;		APICS/Berth reservation (seagoing ship)	NAUTICAL
Master's full name;		APICS	
Number of crew (including master)/number of passengers;		APICS	
Purpose of call;		APICS	
Last port of call/next port of destination;		APICS/Berth reservation (seagoing ship)	
ETA/ETD		APICS/Berth reservation (seagoing ship)	

Maneuver acceptance		APICS/Berth reservation (seagoing ship)	
Pilotage form			
FAL - Declaration:			
Clearance Permit			
Loading Declaration			
IMO Declaration			
ETA/ETD;		APICS/Berth reservation (seagoing ship)	
Vessel's name/former names/ call sign/flag;		APICS/Berth reservation (seagoing ship)	
IMO number/MMSI number;		APICS/Berth reservation (seagoing ship)	
Type of vessel/year of built;		APICS/Berth reservation (seagoing ship)	
GRT, NRT, DWT, LOA, breadth;			
Maximum draft, arrival draft, intended departure draft;			
Owner's/Operator's/Charterer's name and address;		APICS/Berth reservation (seagoing ship)	
Agent's name and address;		APICS/Berth reservation (seagoing ship)	
Master's full name;		APICS/Berth reservation (seagoing ship)	CARGO LOGISTICS
Number of crew (including master)/number of passengers;			
Purpose of call;			
Last port of call/next port of destination;		APICS/Berth reservation (seagoing ship)	
Cargo on board, cargo to be discharged/loaded, quantities/hatch distribution. (if dangerous cargo, UN number/class in accordance with IMDG or IBC, BCH, IGC, INF Code must be specified);		Container booking notification	
Quantity of ballast to be discharged and provenance;		Breakbulk loading/unloading order (sea transport)	
Capacity of sludge/bilge tanks, Quantity of sludge/bilge;		Container loading/unloading order (sea transport)	
Dangerous Goods Manifest or Stowage Plan		Notification of dangerous goods	DANGEROUS GOODS

Certificate of Fitness for the Carriage of Liquefied Gases in Bulk(or International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)		IFTDGN - Dangerous goods notification message	
Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk (or International Certificate of Fitness for Carriage)		Notification of arrival/departure of dangerous goods	
Document of Compliance with the Special Requirements for Ships Carrying Dangerous Goods		Consult IMDG register	
International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (NLS Certificate)			
AIS		Berthing dues notification/APP Shipping Dues	NAUTICAL
Vessel's name/former names/ call sign/flag;		APICS/Berth reservation (seagoing ship)	
IMO number/MMSI number;			
Type of vessel/year of built;			
GRT, NRT, DWT, LOA, breadth;			
Maximum draft, arrival draft, intended departure draft;			
ETA/ETD;		Berthing dues notification/APP Shipping Dues	
Vessel's name/former names/ call sign/flag;			
IMO number/MMSI number;			
Type of vessel/year of built;			
Maneuver acceptance		Berthing dues notification/APP Shipping Dues	
Pilotage form		Berthing dues notification/APP Shipping Dues	
Daily operation report			
Connection IMCOMM railway module			
Missing information billing mode in Port Community		EDI: INVOIC – Invoice Message	Electronic invoicing
		Electronic invoicing	
ISPS declaration		APICS	CUSTOMS

		EDI: CUSREP - Customs Report Message	
Import manifest declaration		EDI: CUSRES - CUStoms RESponse	
		EDI: CUSCAR - Customs Cargo Message	
Export manifest declaration		EDI: CUSDEC - Customs Declaration message	
Notification of arrival (seagoing ship)		APICS	
		EDI: CUSREP - Customs Report Message	
		EDI: CUSRES - CUStoms RESponse	
Notification of exit (seagoing ship)		APICS	
		EDI: CUSREP - Customs Report Message	

From table 4.8 we conclude that PCS modules deployed in the port of Antwerp a very closer with the typology of documents circulating in Constanta port.

We recommend that for future Feasibility Study to have in mind PCS modules deployed in the port of Antwerp, when it is desired to develop customized PCS modules for Constanta port.

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Supplemental, the following documentation was used (some are included in references, some not) during pre-feasibility study. Total amount of pages: 1676. Other data sources were directly provided as hyperlinks in chapters.

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"Priorities for the EU's maritime transport policy until 2020: Competitiveness, Decarbonisation, Digitalisation to ensure global connectivity, an efficient internal market and a world-class maritime cluster	http://data.consilium.europa.eu/doc/document/ST-9976-2017-INIT/en/pdf	12
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