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

Strategy for the development of a multimodal/intermodal transport network in the Danube corridor

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Executive summary

This report summarizes the findings of the three deliverables: Deliverable D.T2.1.1, Report on multimodal infra- and suprastructure facilities and services, Deliverable D.T2.1.2, Report on multimodal/intermodal market perspectives and Deliverable D.T2.1.3, Gap analysis.

Inland ports play a significant role in the multimodal transport chains as they represent intermodal nodes and junctions of multiple transport modes. In addition, inland ports are connected with logistics centres, industrial areas, agricultural areas or large consumption centres such as urban zones. In this respect, inland ports can assume the following roles or any combination thereof:

- multimodal hub for multimodal core network corridors;
- platform for the region's trade and industry;
- connecting point between the long-distance freight transport and last mile of urban freight transport (city logistics).

Compared to road transport, intermodal services need to deal with specific challenges. A most notable barrier for intermodal transport in comparison to single mode transport are the additional actions that need to be taken with the cargo – transshipment in intermodal terminals, sometimes even buffer storage and the last-mile transports which, in many cases, need to be performed by truck. This frequently results in higher door-to-door costs and comparatively longer transit times, especially in cases where cargo origin or its final destination is not close to inland waterway ports. Apart from these widely applicable barriers to further development of intermodalism on the Danube, there is a number of barriers which are specific for the region. Such barriers include, but are not limited to:

- geographical distribution of seaports in and around Danube countries;
- long distance (leading to very long transit times) of highly developed industrial and consumption centres and logistic hubs from the seaport of Constanta;
- railway competition from seaports not connected with the Danube.
- insufficiently developed railway infrastructure connecting the seaport of Constanta with inland ports;
- navigational hindrances on the Danube: shallow sections, low water, high waters, etc;
- lack of large urban agglomerations and consumption centres along the Danube before (downstream of) Belgrade;
- lower level of industrialization, especially of high-tech industries requiring containerization of cargo flows;
- low level of availability of intermodal infrastructure, suprastructure and equipment in many ports of the middle and lower Danube;
- lack of cooperation between modes and spatial planning organizations;

- lack of involvement of global logistic operators, shipping lines and global terminal operators to manage and operate intermodal terminals in the Danube ports, even though one of the world's largest terminal operators, DP World, became the first global player in Danube inland ports as it acquired the port operator in the Port of Novi Sad in Serbia and it plans to develop a container terminal there.

The analysis of multimodal facilities in various ports along the Danube demonstrated heavy disbalance in favour of the ports on the upper, and partly middle Danube. This is not just in terms of multimodal facilities, but also in terms of intermodal services connecting seaports and inland ports. The upper Danube and middle Danube ports, down to Budapest, benefit from their geographical position and relative nearness to North Sea ports and Adriatic ports, enabling them to harvest the benefits of economies of scale and use frequent rail shuttles to and from these seaports. Moreover, inland ports of the upper, and partly lower, Danube are physically closer to large industrial centres of high-tech products capable of generating containerized cargo flows of higher value goods and have excellent railway connections. Last, but not least, the high economic development of their host countries serves as a perfect generator of both inbound and outbound flows of goods suitable for containerization and therefore for intermodal supply chains. In terms of fully functional intermodal terminals in inland ports, only Enns, Vienna, Bratislava, Budapest, Belgrade and Giurgiulesti have such terminals. The one in Belgrade is heavily underused as there are no more barge shuttles from Constanta to feed it with containers. Moreover, it is not connected by railway with any of the seaports in the neighbourhood. Out of these terminals, only the one in Giurgiulesti is connected with the seaport of Constanta with a regular feeder line for containers. Intermodal (container) terminals in Enns, Vienna, Bratislava and Budapest are connected with various Adriatic and North Sea ports by regular rail shuttles.

In *Austria*, both analysed ports, Enns and Vienna, have functional and well-equipped intermodal (container) terminals. Although located in inland ports, both terminals function mostly as bi-modal terminals (rail and road), as only a small number of empty containers are transported by IWT as spot shipments. This is mostly to the fact that they are very far away from Constanta as the entry/exit seaport for overseas trade using inland waterway transportation, and because they have very developed railway infrastructure and regular connections with Adriatic and North Sea ports. Even though fully developed, port of Enns has proposed the elimination of railway bottlenecks and an improvement of railway capacities at the location of container terminal quay. On the other hand, Vienna has opted for the expansion of the port handling areas by reclaiming land from the waterfront.

In *Slovakia*, container terminal in Bratislava operates in a more or less similar way as Enns and Vienna terminals, although it has less railway connections with North Sea and Adriatic ports. There are no regular barge feeder lines to/from any seaports. Proposed corrective measures include the reconstruction of quay line, expansion of parking space for trucks, etc.

In *Hungary*, container terminal in Budapest also functions in a similar manner as those in Austria and Slovakia, although it is interesting to note that in 2020 first trains with containers arrived all the way from China to Mahart Container Centre in

Budapest. Occasionally, empty containers are shipped by barge to different ports. The plan to develop the container transport (and therefore intermodality) further, includes corrective actions on improving the railway connections towards the container terminal.

Croatia has very favourable access to the Adriatic Sea and all its seaports, thus enabling the geographical shift of spatial concentration of containerized cargoes to the west of the country, closer to the sea and, for example, the large container terminal in the seaport of Rijeka. Any containers that originate (or have destination in) from the eastern part of the country (with the Danube being its eastern border) are hauled in and out of the region much faster either by rail or by truck. Therefore, very little demand for intermodal transport of containers via the Danube and Croatian inland port of Vukovar has been observed to date. Largely due to these reasons, the port of Vukovar does not have a dedicated container terminal on its own, although it can handle containers with the existing equipment. Their proposal for the development of the intermodal network includes the need for the new space for port expansion where new container terminal could be built, construction of the additional vertical quay, railway infrastructure for handling full block trains, etc.

Serbia is in a very specific situation as it has an unusual dispersion of (generally limited) containerized cargo flows through various bi-modal terminals, whereas some of them are located very close to either Sava or Danube waterway, but without physical access to them. The capital of Belgrade, for example, until recently had at least 4 intermodal terminals – 3 existing and 1 planned, whereas only one, in the Port of Belgrade, is the closest to a real tri-modal terminal with physical and equipped access to water, but it has no regular barge or rail shuttles to any of the seaports Serbia uses for its imports or exports. Such dispersion of containerized cargo flows prevents the spatial concentration and the consequent formation of the economies of scale in any of the existing or planned intermodal terminals. Corrective measures towards the development of intermodal network involve relocation of the existing port located in the city centre.

Apart from a number of container terminals in the seaport of Constanta, with a large number of regular maritime lines throughout the globe, *Romania* has no intermodal terminals in inland ports. Nevertheless, there is one terminal under development in the Port of Galati. However, there are no regular barge or rail shuttles for containers in any of the Romanian inland ports, including Galati. Recommended strategic actions for the port of Galati include the completion of the multimodal terminal currently under construction and modernization of the existing railway connections so that they could handle higher speed trains. As for Constanta, strategic recommendations include improvement of rail connections and creation of additional storage facilities

As regards to *Bulgaria*, one of its important inland ports is Ruse where containers are handled on an ad-hoc basis, very rarely in the last five years. Multipurpose terminal Ruse East is a terminal that handles various types of cargo and is equipped to handle containers from ship to shore and vice-versa, upon demand. Bulgaria has proposed a measure of construction of an intermodal terminal in the area of Ruse, that would serve as a dry port for the seaport of Varna, as well as modernisation of the existing railway track connecting Ruse and Varna, and construction of an additional one.

Moldova has one intermodal terminal in the port of Giurgulesti where containers are served, mostly originating from and being destined to the seaport of Constanta. There is a regular feeder line between these ports, transporting containers.

In *Ukraine*, Port of Reni is capable of handling containers at the multipurpose terminal, while the Port of Izmail has a container terminal with determined handling facilities. However, no container flows have been recorded in these two ports in the last five years, while any earlier container transports were rare and on a spot basis.

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3 Abbreviations

Abbreviation	Explanation
IWT	Inland Waterways Transport
IWW	Inland waterways
PA	Port Authority
DR	Danube Region

4 Introduction

4.1 Scope of the report

The report provides an assessment of the existing multimodal/intermodal facilities in terms of infrastructure and superstructure with their status quo. In addition, this report contains an inventory of existing intermodal services in ports (the portfolio of services for intermodal units such as containers and semi-trailers) and rail/IWT/road shuttles between seaports and intermodal (or container) terminals located in inland ports on the Danube.

Only selected ports were analysed in details, including the ports of:

- Enns,
- Vienna,
- Bratislava,
- Budapest,
- Vukovar,
- Belgrade,
- Ruse
- Galati,
- Giurgiulesti (partly – for as long as inputs were obtained from partners),
- Izmail (partly – for as long as inputs were obtained from partners),
- Constanta.

4.2 Strategic potential of inland and seaports as intermodal nodes

4.2.1 Rationale for development of ports as intermodal nodes

Both sea and inland ports serve as intermodal nodes, primarily due to their naturally convenient position at the intersection of at least two different modes of transport – water on the one side, and land (rail, road or both) on the other. However, not just the physical preconditions and transport connections make one port an intermodal node. To be an efficient intermodal node, a port needs to have adequate land plots in a port, relevant terminal infrastructure, suprastructure, facilities and equipment, accompanied by "soft" elements such as digitalized planning and operations management systems or software.

Typical intermodal terminal performs the following basic services:

- Loading/unloading of intermodal units between different transport modes (ship to wagon, ship to truck, wagon to truck, etc.);
- Inbound/outbound inspections, such as document checks, security, physical conditions of intermodal units such as containers, dangerous cargo handling, etc.
- Internal transshipments within the terminal;
- Inbound/outbound ship/train/truck checks;

- Transit storage for intermodal loading units (container yard, trailer parking space, etc.).

In addition, intermodal terminals may offer a myriad of additional value added services, depending on the demand or in a quest to increase their competitiveness. These services include, inter alia, the following ones:

- Storage for intermodal loading units;
- Forwarding and ship agency services;
- Customs services;
- Hauling in/out by trucks;
- Repair and maintenance of containers, trailers, etc;
- Power supply for reefers (containers and semitrailers);
- Stuffing and stripping, etc.

Although seaports and inland ports share a large scope of similar functions and spatial and operational features, they are very different in terms of trade patterns. Their differences in handling intermodal cargo flows are the most apparent ones, apart from the physical differences in sizes and types of vessels they handle. The more distant from seaports, the more notable this difference becomes for inland ports. Unlike inland ports on the, for example, Rhine River, inland ports on the Danube rarely handle intermodal cargoes over water, that is, cargoes hauled in and out by barges (or motor cargo vessels). This is due to the extremely large distances of inland ports from the only seaport (Constanta) generating significant overseas containerized cargo flows. In most of the cases, those Danube ports that handle intermodal cargoes at all, they handle either land-to-land intermodal cargo (mostly carried by railway, such as in case of Enns, Vienna, Bratislava, etc.) or they handle empty containers, such as port of Budapest. Most of empties are collected in a determined port by trucks or by rail, and they are shipped by barge to an agreed destination port (sea or inland).

Compared to road transport, intermodal services need to deal with specific challenges. A most notable barrier for intermodal transport in comparison to single mode transport are the additional actions that need to be taken with the cargo – transshipment in intermodal terminals, sometimes even buffer storage and the last-mile transports which, in many cases, need to be performed by truck. This frequently results in higher door-to-door costs and comparatively longer transit times, especially in cases where cargo origin or its final destination is not close to inland waterway ports.

However, good planning of supply chains and better synchronization of different modes can, in many cases, lead to reduction of overall transport costs, apart from the obvious environmental benefits. This is even more feasible if the shipper or receiver is not aware that his or her cargo is transported by intermodal transport. Furthermore, the overall cost of intermodal transport, as well as the total transit time, need to be competitive in comparison to a single mode transport, where possible and applicable.

There is a number of factors that have significant influence to shippers' decision on opting for intermodal transport:

- multiple agents included in the process (truck companies, port and terminal operators, rail operators and seagoing and inland waterway vessel operators),
- necessary cargo consolidation and securing of return cargoes (avoiding the large share of empty returns) in order to ensure minimum critical volumes necessary for economical operation of barges and trains,
- the need to apply different purchasing or stock schemes that may also alter the production schemes, due to longer transit times.

Intermodal transport greatly depends on the decisions of shippers. In order to ensure that the shippers are willing to choose intermodal transport as an option, good balance between the costs involved in the overall supply chain on the one hand, and reliability, punctuality and flexibility in cargo delivery on the other hand, needs to be established. In addition, there is a growing trend of requiring shippers to report the environmental footprint of their supply chains, which is likely to trigger additional consideration of intermodal transport as an option for shippers' supply chains. Nevertheless, a shift to intermodal transport is more likely to occur if there is an economic benefit on a corporate level.

The PLATINA 2 project elaborated a conceptual framework for modal choice (Figure 1). The framework demonstrates that the transport quality and transport costs are directly influenced by the location, network quality, legal framework, economic and external factors. In addition to this, the PLATINA 2 project revealed that the critical selection criterion for transport mode is the total door-to-door cost. Nevertheless, shippers are willing to temporarily accept higher transport costs if the mid- or long-term economic advantages are proven.

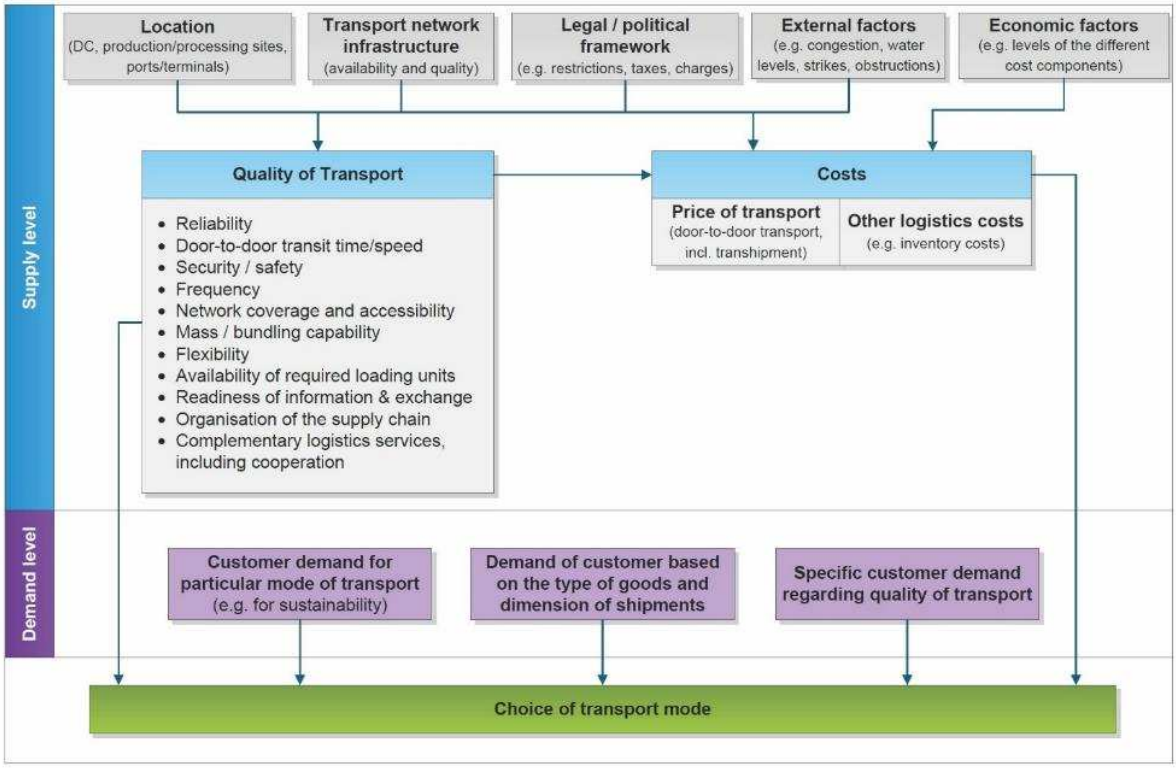

Figure 1: Conceptual scheme for modal choice[1]

It needs to be emphasized that barge or rail service frequency of only once a week with the same (or longer) transit time as in case of road transport is not acceptable for shippers. This is due to the act that when a barge or rail departure is missed, the next departure is six days later. This can result in serious consequences such as detention/demurrage costs which would increase the total costs. The higher the departure frequency, the less negative consequences caused by delays. A daily rail service is considered to be the perfect alternative for direct trucking. However, in many Danube countries, such cargo volume, especially of containers, is no more than wishful thinking at this moment. Logically, the higher number of containers, the greater possibilities for more frequent barge or rail services.

According to the "Platform for multimodality and logistics in inland ports[2]", the minimum setup for a train or barge service (depending of course on the distance of the maritime ports) is two departures per week in every direction. Filling the fixed capacity with adequate volumes is often only possible when volumes of different shippers are bundled, requiring for a neutral service (barge or rail shuttles open for all parties).

1 Group of authors (2014), PLATINA 2, Deliverable D1.3, Comparison of Modal Shift Studies

2 https://ec.europa.eu/transport/sites/transport/files/modes/inland/doc/2015-07-logistics-inland-ports-platform-long-position-paper.pdf accessed 16.08.2022.

Establishing intermodal transport service in any supply chain requires a careful trade-off between somewhat conflicting requirements: allowing for additional time and flexibility in supply chain operations in order to maximize the opportunities of economies of scale (cargo bundling) on the one hand, and minimization of operational costs on the other hand. In practice, this means that containers will have longer dwell times and that assets will have lower utilization rate. This trade-off is sometimes referred to as being lean and agile simultaneously.

Inland ports play a significant role in the multimodal transport chains as they represent intermodal nodes and junctions of multiple transport modes. In addition, inland ports are connected with logistics centres, industrial areas, agricultural areas or large consumption centres such as urban zones. In this respect, inland ports can assume the following roles or any combination thereof:

- multimodal hub for multimodal core network corridors;
- platform for the region's trade and industry;
- connecting point between the long-distance freight transport and last mile of urban freight transport (city logistics).

One of the necessary pre-conditions for development of intermodal transport along the Danube is a developed railway network and the functional and efficient cooperation between inland waterway transportation players (ship and port operators) and railway infrastructure managers and operators. This is necessary due to limited coverage of the Danube waterway network. Such collaboration between rail and inland waterway sector can offer sustainable transport solutions through their interconnections in inland ports.

Multimodal hub for multimodal Comprehensive Network Corridors: inland ports serve as efficient transshipment nodes on inland waterway sections of the multimodal Core Network Corridors. They are linking the maritime transport leg and the continental transport modes (rail, road and IWT) and serve as “spoke” ports for seaport hubs. Inland ports with railway connection benefit from the extension of their reach further into the hinterland where there is no waterway network. Inland ports in the Rhine area often combine barge and rail liner shuttles in the door-to-door supply chains. However, similar examples do not exist on the Danube since those ports having intermodal terminals in their port areas use mostly railway transportation as there are no regular barge shuttles from any seaports on the Danube (or even at the North Sea coast) towards any of the inland ports. Intermodal terminals in the Danube inland ports serve as multimodal hubs, but only as bi-modal hubs, connecting rail to road and vice-versa. Moreover, such ports and terminals usually offer customs clearance on the spot, further haulage towards the final destination and a large variety of other logistic and value added services. Unfortunately, no such terminals with regular rail shuttle services exist anywhere downstream from Budapest. In fact, Danube ports that do have regular rail shuttle services from seaports, can offer rail transport only to/from North Sea ports (Rotterdam, Antwerp, Hamburg, etc.), and not a single one maintains regular rail shuttles to/from the seaport of Constanta as the natural and logical “gate” for all Danube inland ports.

Platform for the region's trade and industry: inland ports function as nodal points for regional economies. Apart from the benefits of spatial concentration of transport and logistic services, inland ports are very attractive location for business and industries, as their proximity and a scope of relevant services have a positive impact on the competitiveness of such businesses and industries.

Connecting point between the long-distance freight transport and last mile of urban freight transport (city logistics): inland ports located in the capital cities of the Danube countries or other major cities are convenient for the development of the sustainable last-mile transports and city logistics. Cargo bundling, innovation and smart solutions can contribute to reduction of the environmental footprint of city logistics. Although road transport remains the most popular mode used in urban freight logistics, there are several examples of intermodal urban freight logistics using rail or waterways for the "last mile" transport such as applied in Paris, Amsterdam and Utrecht. However, no such initiatives are sufficiently developed in the Danube cities with ports.

4.2.2 Barriers for development of inland ports as intermodal centres

In order to understand the scarcity of intermodal transports and intermodal facilities in Danube ports, basic characteristics of transport flows in the Danube countries need to be understood. Apart from that, barriers for intermodal transportation need to be identified.

Unlike the Rhine, the Danube River is significantly longer and shallower. Whereas the first large upstream port, capable of generating intermodal cargo flows (mostly containers) is Belgrade (1168 from the mouth of the Danube River, or ca. 900 km from the seaport of Constanta) as the first upstream capital city, the last similar port on the Rhine is Basel, which is only 850 km from the Port of Rotterdam at the mouth of the Rhine River, as one of the many seaports serving as "gates" for the containerized cargo in the Rhine area, to and from Basel. On the other hand, the last upstream port (furthest from the river mouth) on the Danube is Kelheim, located staggering 2411 km away from the mouth of the Danube River, on the west coast of the Black Sea. This represents a significant disadvantage for the development of trimodal intermodal terminals in Danube ports, from the point of view of total transit time of a container from its origin to its final destination. For example, transit times in import direction (Far East → Europe) for typical regular liner vessel, sailing from, say, Shanghai to Constanta (as the only seaport with developed intermodal terminals and waterway connection with the Danube) is 20 to 25 days, depending on the ports of call along the route. If a final destination of an import container is, for example, Belgrade, the river transit time (upstream navigation) is 3 days if an inland (river) vessel is manned with enough crew to allow 24 hours navigation. If, however, a vessel is crewed with crew sufficient to allow only 14 hours operation, the river transit time to Belgrade increases to 5 days. This is in case a feeder vessel is a motor cargo vessel with its own cargo space. In case a pushed convoy is used, the transit time increases for one day in each of the above-mentioned cases. This may be increased by one day in case of rather frequent congestion at the border crossing with Serbia in Veliko Gradište and Bezdan, plus at least one day of waiting time in the seaport of Constanta needed for transshipment of containers from sea-going vessel to river vessel either directly (rare case) or via terminal. Finally, the average transit time on the river leg of the entire

voyage from the port of loading (transshipment) to the port of discharge can be anywhere between 5 and 10 days. This means that the total transit time from overseas port of origin to the river port of discharge can stretch from minimum 26 days to a more likely sum of 30-35 days.

Transit times from Constanta to various sample river ports along the Danube, in ideal conditions (no navigation hindrances of any kind) for a motor cargo vessel of 1350 tons carrying capacity are presented in the following table:

From Constanta to:	Belgrade	Budapest	Bratislava	Enns
Operation mode (A): 14 hrs	5	9	11	13
Operation mode (B): 24 hrs	3	6	7	8
Delays in transshipment port	1	1	1	1
Delays at borders	1	1	1	1
Total in case A	7	11	13	15
Total in case B	5	8	9	10

Table 1: Transit times from Constanta to sample upstream ports on the Danube

Apart from these long transit times, intermodal transport involving "the Danube option" is subject to fierce competition from railway transportation from competing seaports such as Rijeka, Koper, Trieste, Piraeus, and North Sea ports Amsterdam, Rotterdam, Antwerp and Hamburg, to name the most important ones. Railway operators offer regular daily to weekly services with so called "block" trains or "shuttle" trains from these ports to intermodal terminals located, inter alia, in many inland ports along the Danube. Transit times (by rail) from the aforementioned seaports to these intermodal terminals in Danube inland ports are very short – from 1 to 3 days in the worst case. In addition to this competitive advantage, shuttle trains from seaports run on regular basis, from several trains a day to several trains a month, depending on the inland port of destination. Details on such services are given in sections covering intermodal terminals in each country, where applicable.

For countries such as Austria, Slovakia, Croatia, Hungary and Serbia, intermodal transports involving even road transport from the seaports of Trieste, Koper, Rijeka and even Thessaloniki and Piraeus have commercial advantages over intermodal transport involving the Danube option. This is due to the flexibility of road transport and the speed of delivery of single containers.

Based on the analysis of existing intermodal facilities and services in the Danube inland ports, as well as on the information provided by Danube ports managers and operators, the following *main external (beyond ports) barriers* for development of Danube inland ports as true tri-modal nodes are *summarized*:

- Geographical distribution of seaports in and around Danube countries: the only seaport that has direct waterway connection is Constanta and it has no regular

container lines towards Danube inland ports. North Adriatic seaports are closer to Croatia, Serbia, Hungary, Slovakia and Austria, enabling shorter transit times of containers to/from their final origins/destination in the hinterland.

- Fierce railway competition from seaports not connected with the Danube: many inland ports have intermodal terminals which are connected by railway with major seaports in the North Adriatic and North Sea, offering regular rail shuttles for containers to/from those inland ports.
- Insufficiently developed railway infrastructure connecting the seaport of Constanta with inland ports in its captive hinterland (Danube countries).
- Non-existent regular liner shipping services on the Danube for the transport of containers to/from Constanta from/to Danube inland ports: after several attempts of maintaining container feeder lines from Constanta to Belgrade and Budapest (and back), currently no regular shipping lines exist or are planned in foreseeable future.
- Navigational hindrances on the Danube: lack of navigational reliability on certain sections of the Danube (prolonged periods of low water and stoppage of navigation in critical sectors), frequent period of extremely high or low waters where both situations prevent safe navigation, occurrence of ice, etc.
- Lack of large urban agglomerations and consumption centres along the Danube before (downstream of) Belgrade: large cities are known generators of high-value goods that are convenient for transport in containers via intermodal transport including IWT. Spatial concentration of such important cargo generators is very low downstream from Belgrade.
- Lower level of industrialization, especially of high-tech industries requiring containerization of cargo flows: on the average, economies of the Danube countries are not as developed as those in the Rhine area, where a large number of intermodal terminals are located even in small and medium ports. Developed economies are known as generators of cargo flows of higher value goods which are suitable for transport in containers.
- Lack of cooperation between modes and spatial planning organizations: for example, there are at least two container terminals outside the port of Belgrade which are very close to waterway, but without having any connection to it. Container terminal in the port of Belgrade, although connected to the railway network rarely handled all three modes. In the periods when regular container feeder lines by barge existed in the Port of Belgrade, its container terminal acted mostly as a bi-modal (IWW and road) terminal, as containers were hauled in and out of the port only by trucks. This spatial dispersion of container terminals prevents the concentration of cargo flows and cargo related activities, which is a significant barrier for the development of tri-modal intermodal terminals in ports.
- Lack of transparency and information on cargo flows: currently, there is a scarce availability of specific statistics, real-time traffic information and

forecasts of both containerized and non-containerized cargo flows on the multimodal transport network. This makes any efforts in planning of intermodal cargo flows very difficult and time consuming.

4.2.3 Infrastructure and suprastructure status quo

This section identifies existing terminals with different level of infrastructure and suprastructure, including equipment necessary for smooth operation of intermodal transport (primarily container transport). These different levels are categorized in 4 suitability levels for high quality container logistics.

Levels of suitability are as follows:

- Complete,
- Workable,
- Minimal.

Complete suitability involves the existence of a special terminal, dedicated only for the handling of containers, as well as special suprastructure and equipment designed and constructed for handling of containers as its prime use. This includes, but not limited to, the following: railway tracks long enough to handle entire block trains, quay cranes for containers, straddle carriers, reach stackers, gantry cranes, terminal tractors and trailers, and similar.

Workable suitability involves the existence of a port terminal that does not handle only containers, but other cargoes as well. Typical terminals of this type are general cargo terminals having sufficient space and equipment to handle occasional (not regular) container flows, where the quantity of containers is significant enough only for the purchase of certain elements of transshipment equipment (e.g. swappable container spreader for a quay crane, reach stacker or similar), but not a for a full-fledged specialized container terminal.

Minimal suitability means that the port does not have any permanent intermodal infrastructure, suprastructure or equipment, but it can handle occasional containers by improvising with existing equipment or when significant efforts need to be exerted in order to load/unload occasional containers, even with a rented equipment.

In this view, the ports analysed in this report are classified as follows:

Port	Complete suitability	Workable suitability	Minimal suitability
Ennshafen	X		
Vienna	X		
Bratislava	X		
Budapest	X		
Dunaújváros			X

Port	Complete suitability	Workable suitability	Minimal suitability
Vukovar			X
Belgrade		X	
Ruse		X	
Galati	X		
Giurgiulesti		X	
Constanta	X		

Table 2: Danube ports current suitability levels for handling containers

4.2.4 Status quo of connection services from inland to seaports

Connectivity of inland ports to seaports is one of the crucial requirements for a successful intermodal transport network in which inland ports are included. On the other hand, it has always been a question of "hen and egg" what should be first – transport services or cargo. In a reactive approach, the industry claims that cargo should be first, meaning that determined volumes of cargo (or containers in the case of intermodality) should first grow to a significant quantity and then the services (such as shuttle services between inland and seaports) will be triggered. In a proactive approach, cargo owners prefer to see the services established first, claiming that the cargo will follow immediately.

Currently, the situation with regular connection services (mostly block trains) in analysed ports is as follows:

Port	Regular connections		Occasional connections		No connections
	IWW	Rail	IWW	Rail	
Enns		X			
Vienna		X			
Bratislava		X			
Budapest		X	X		
Dunaújváros					X
Vukovar					X
Belgrade					X
Ruse					X

Port	Regular connections		Occasional connections		No connections
	IWW	Rail	IWW	Rail	
Galati					X
Giurgiulesti			X		
Constanta		X	X		

Table 3: Rail and IWW connectivity of analysed inland and seaports

5 Status quo versus potentials for intermodality

5.1 General overview of intermodality in the Danube region ports

Below table contains self-assessment of the existing vs. potential intermodal services is analysed ports in the Danube region.

Port	Existing container transhipment				Potentials (for new or additional container flows)				Desired state and objectives (container transhipment development)
	From/to water	Rail and road only	All modes	None	None	Very limited	Sufficient	Considerable	
Ennshafen Port – Container Terminal Enns			X					X	- Port is fully developed and there are no further needs identified so far
Port of Vienna			X					X	- to expand the Freudenau port area - to raise the share of rail and water to 40% each at "Duisburg Gateway Terminal" by 2025, - to lower the share of road freight transport to 20% - to pursue digitalization and automation strategy - to realize the Physical Internet by 2030 - to acquire / upgrade transshipment equipment (cranes, stackers…)

Port of Bratislava			X				X	- expansion of existing intermodal terminal / construction of new modern intermodal terminal - increase of permeability of railways inside the port area
MCC			X			X		- modern, gantry crane - granting terminals to become modern ports with advanced IT system
Vukovar			X			X		- safe and reliable inland navigation - Developing and modernizing international inland ports - Increase the sustainability of the system - Improve the accessibility of the ports and their connections to other transport modes
Bogojevo				X			X	- connection of the port to the railway network - expansion of the port - proper equipment for bagging and containerization of grains - new multipurpose terminal
Bačka Palanka				X			X	- connection of the port to the railway network - expansion of the port - proper equipment for bagging and containerization of grains - new multipurpose

									terminal
Prahovo				X				X	- new intermodal (container) terminal connected to industrial zone and chemical park planned in the vicinity - construction of superstructure
Port of Ruse			X					X	- construction of an Intermodal terminal - separation of the port infrastructure from the transport activities related to servicing the logistics
Port of Constanta			X					X	- closing the gap between the port`s infrastructure and its hinterland connections - improved railway infrastructure with a higher commercial speed for cargo trains - continuous highway connection with NW of Romania and Budapest and Belgrade
Port of Galati			X				X		- finishing an intermodal terminal - assuring the minimum drought in port

Port of Giurgiu			X			X		- investment in port facilities and hinterland connection - operational railway
Drobeta Turnu Severin			X			X		- construction of a multimodal terminal (currently in progress)
Port of Izmail			X			X		- Renovation of road and railway infrastructure - Transferring the Izmail seaport in concession - Stabilization of freight rates for container shipping

Table 4: Self-assessment of existing and potential intermodal services in Danube ports

According to what has been analyzed, we can divide DR countries into three categories:

- Countries / ports with developed infrastructure for modal transhipment Austria, Hungary, Ukraine[3])
- Countries / ports with existing intermodal infrastructure where other hindering factors are present, such as Slovakia (limited space), Romania (insufficient hinterland connections)
- Countries / ports with missing intermodal infrastructure, such as Croatia, Serbia and Bulgaria

Despite the status, in all analyzed countries, new projects have been identified, either in terms of physical expansion of existing terminals or planning / studying new intermodal infrastructure.

Infrastructure however must always reflect local conditions a particularity of local market (demand / offer). Ports in capital cities such as Vienna, Budapest and

[3] As of 24 February 2022 Ukraine is a victim of military aggression, therefore it is not possible to expect favourable general economic data since country's economy and infrastructure are suffering significant damage.

as well as condition of state´s infrastructure and cargo flows will be severely

Bratislava may have higher potential for import and export of intermodal units than regions where main focus is transshipment of agricultural production. Here it must be pointed out the intention of port of Bogojevo and Bačka Palanka to introduce short-distance grain transportation in containers if the proper bagging equipment is available.

This deliverable underlined the necessity of developing intermodal transport infrastructure in the DR region since all country reported:

- growth of GDP and positive estimation in upcoming years

as well as

- growth of intermodal transportation on country level including positive estimation in upcoming years.[4]

Inland navigation is directly linked to maritime transport. Maritime transport accounts for about 90% of total international transport. Container transport accounts for about a quarter of the world's freight. The average annual growth rate of container traffic is estimated at 4.6% worldwide by 2026, but the world's seaports predict an average annual growth rate of container transshipment in 2019-2023 of around 5.5%. This also confirms estimated increase of the pressure on road and railway infrastructure when inland waterway freight transport may play the role of very attractive alternative.

Recommendations:

- To increase the use of freight container transport within the Danube area, it is recommended reconsider the following steps:
- Extension of the waterway network
- Elimination of bottlenecks
- Improving the maintenance and management of waterways
- Establishment of effective dam management on waterways
- Integration of water transport into modern logistics chains
- Development of ports in the form of multimodal logistics centers
- Further development / construction of trimodal "Danube" ports.

[4] For some countries, GDP and / or intermodal transportation forecast were not available

6 Strategy for the development of intermodal network

6.1 Gap analysis and strategic mitigating measures for ports

The Strategy for the development of the intermodal network in this report focuses on the necessary measures that need to be developed in ports and around ports, on the basis of the gap analysis performed by the ports themselves.

Following table contains the summary of the findings from the Deliverable D.T2.1.3 Gap analysis.

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
Enns	Gap 1: Railway Debottlenecking	Detailed study and planning tasks for improvement	CEF-Action N° 2020 AT-TM-0006-S	04/2021 – 12/2024	EHOOE, EHNOE, CTE, OEBB-INFRA	Details defined in CEF-project	details defined in CEF-project
	Gap 2: Quay 21 section	Detailed study and planning tasks for improvement	CEF-Action N° 2020 AT-TM-0006-S	04/2021 - 12/2024	EHOOE	Details defined in CEF-project	details defined in CEF-project
	Gap 3: container business on the Danube	Fulfil the relevant activity within DIONYSUS	Depends on the outcome	06/2020-10/2022	DIONYSUS-PPs	Output document	Output document
Vienna	Gap 1: Expansion by land recovery	Develop a project application for CEF-2	Get the award of CEF-2 and realise the planned investment	01/2022-12/2024	Port of Vienna	Unknown (apply for CEF-2)	award a CEF-2-project
	Gap 2: Container business on the Danube	Fulfil the relevant activity within DIONYSUS	Depends on the outcome	06/2020-10/2022	DIONYSUS-PPs	Output document	Output document
Bratislava	Gap 1: Unavailable supply of potable water for vessels and the connection of vessels to electricity during port stay	a. Identification of parameters and requirements / adoption of technical solution b. Identification of location c. Settlement of ownership relations d. Implementation of defined technical solution	Modernization of port services	5/2020 – 12/2025	VPAS, Municipality of Bratislava, City district Ružinov, City district Staré mesto, electricity providers	Unknown (apply for available co-financing)	Construction of facility for water supply Construction of OPS (Onshore power supply) infrastructure

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Gap 2: Steep quays	a. Settlement of ownership relations b. Implementation of defined technical solution according to strategical document Masterplan II	Modernization of port coastline	not yet available, strategic document in preparation Details will be available after finalization of Masterplan, Feasibility study and ownership settlement Estimation: 2027 - ?	VPAS, Slovenská plavba a prístavy a.s., Ministry of transport and construction of the SR	not yet available, strategic documents in preparation	not yet available, strategic documents in preparation
	Gap 3: Outdated transhipment facilities	a. Settlement of ownership relations b. Implementation of defined technical solution according to strategical document Masterplan II	Construction of bulk cargo terminal	not yet available, strategic document in preparation Details will be available after finalization of Masterplan, Feasibility study and ownership settlement Estimation: 2027 - ?	VPAS, Slovenská plavba a prístavy a.s., Ministry of transport and construction of the SR	not yet available, strategic documents in preparation	not yet available, strategic documents in preparation

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Gap 4: Outdated warehouses	a. Settlement of ownership relations b. Implementation of defined technical solution according to strategical document Masterplan II	Construction of new Break-Bulk terminal with air-conditioned warehouses	not yet available, strategic document in preparation Details will be available after finalization of Masterplan, Feasibility study and ownership settlement Estimation: 2027 - ?	VPAS, Slovenská plavba a prístavy a.s., Ministry of transport and construction of the SR	not yet available, strategic documents in preparation	not yet available, strategic documents in preparation
	Gap 5: Ro-Ro location currently has no parking capacities	a. Settlement of ownership relations b. Implementation of defined technical solution according to strategical document Masterplan II	New parking capacities	not yet available, strategic document in preparation Details will be available after finalization of Masterplan, Feasibility study and ownership settlement Estimation: 2027 - ?	VPAS, Slovenská plavba a prístavy a.s., Ministry of transport and construction of the SR	not yet available, strategic documents in preparation	not yet available, strategic documents in preparation

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
Budapest	Gap 1: Small storage area	- Increasing the storage capacity in the port; - Developing storage technology.	Increase storage capacity and technology in ports of Budapest	06/2021 – 06/2023	- Port operators; - Cargo owners; - Transportation companies.	- Finished procurement of storage area enlargement 06/2021; - Building of new storage area, 06/2023(assumption)	- Increased road transportation volume; - Decreased number of road incidents
	Gap 2: Insufficient capacity and degraded state of the railway bridge serving the port	- Reconstruction of a new railway bridge to replace the extisting Gubacsi Railway Bridge	The design plans are ready, procurement of the construction is underway, and the construction itself is needed	10/2021 – 12/2025	- Ministry - Railway operator -Port operators;	- Finished procurement of the construction 12/2022(assumption) - Finished construction 12/2025(assumption)	- Increased storage volumes; - Increased income of port operator.
	Gap 3: Poor navigability on the Hungarian section of the Danube	- Improving the navigability of the Danube between Szob and the southern border	Preparation of the Hungarian TEN-T inland waterway development	12/2019 – 12/2026	- Ministry -Water Management Authority -Shipping companies -Cargo owners	- Preparation of the study 12/2021 -Procurement of the design planning 12/2022(assumption) -Completion of the works 12/2026 (assumption)	- Increased volume of unloaded goods, - Increased overall volume of trade of goods.

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
Vukovar	Gap 1: Lack of space for intermodal terminal	- Locate a new space for port expansion -Define with a strategic document -Establish new port area -Resolve legal status of land -Prepare technical documentation for construction	Adopt a long-term strategy with defined space for new port area expansion.	01/2023 – 01/2041	-Government of Republic of Croatia Ministry of the Sea, Transport and infrastructure -Port Authority	- Define a project as a strategic - Establish the port area - Purchase of land	- Project define as strategic project at national level - Adopted regulation on establishment the port area - Started the process of purchasing land
	Gap 2: Lack of storage yard surface	-Define with a strategic document -Prepare technical documentation for construction -Tendering procedure for construction	Adopt a mid-term strategy for putting in usage unused port area.	12/2021 – 12/2028	-Government of Republic of Croatia -Ministry of the Sea, Transport and infrastructure -Port Authority	-Prepared technical documentation for construction - Conduct a tender for the construction works - Contract construction works	-Technical documentation successfully finished - Tendering procedure successfully finished -Signed contract for construction works
	Gap 3: Lack of vertical quay for berthing	-Define with a strategic document -Prepare technical documentation for construction -Tendering procedure for construction	Adopt a mid-term strategy for putting in usage unused port area.	12/2021 – 12/2028	-Government of Republic of Croatia -Ministry of the Sea, Transport and infrastructure -Port Authority	-Prepared technical documentation for construction - Conduct a tender for the construction works - Contract construction works	-Technical documentation successfully finished - Tendering procedure successfully finished -Signed contract for construction works

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Gap 4: Lack of rail tracks for full block trains	-Define with a strategic document -Prepare technical documentation for construction -Tendering procedure for construction	Adopt a mid-term strategy for putting in usage unused port area.	12/2021 – 12/2028	-Government of Republic of Croatia -Ministry of the Sea, Transport and infrastructure -Port Authority	-Prepared technical documentation for construction - Conduct a tender for the construction works - Contract construction works	-Technical documentation successfully finished - Tendering procedure successfully finished -Signed contract for construction works
	Gap 5: Lack of specialized equipment for intermodal transhipment	-Resolve Gap 2, 3 and 4 -Tendering procedure for providing services at the intermodal transhipment	Eliminate Gap 2, 3 and 4. Give a concession for port activities at the multi-purpose terminal with purpose of providing intermodal services.	12/2026 – 12/2028	-Government of Republic of Croatia -Ministry of the Sea, Transport and infrastructure -Port Authority	-Reach all milestones under gap 2,3,4 -Conduct tendering procedure for giving concession for providing services on intermodal terminal	-Signed concession contract for providing services on intermodal terminal
Belgrade	Gap 1: Limited railway access infrastructure	Better coordination with railway operators.	New port will be constructed on the different location, more favourable in terms of railway access infrastructure	12/2023 – 12/2029	MCTI, concessionaires, PGA	- Approved final design, - Works tendered - Completion of works	- Construction permit - Tender published - Works contracted
	Gap 2: Limited road access infrastructure	Adjust working hours in terms of better planning of bringing goods in and out of port by road (avoiding rush hours etc.)	New port will be constructed on the different location, more favourable in terms of road access infrastructure	12/2023 – 12/2029	MCTI, concessionaires, PGA	- Approved final design, - Works tendered - Completion of works	- Construction permit - Tender published - Works contracted

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
Ruse	Gap 1: Low efficiency of freight transportation in the area of Ruse due to poor intermodal connectivity in the Northeast region	- Construction of a dry port - Modernisation of the Ruse – Varna railway line - Construction of an additional railway line connecting Ruse and Varna	Construction of an intermodal terminal in the area of Ruse, that would serve as a dry port for the seaport of Varna. Modernisation of the existing railway track connecting Ruse and Varna, and construction of an additional one.	04/2022 – 04/2027	- Intermodal operators - Ministry of Transport and Communication	- Obtaining all legal permits requited to construct the dry port - Building the terrain and acquiring the equipment needed for the dry port - Elaboration of a plan for the modernisation of the existing Ruse – Varna railway line, and the construction of an additional one. - Modernisation of the Ruse – Varna railway line - Construction of an additional line connecting Ruse and Varna	- Due to the significant scale of the project, the verification tools and methods could be various for the different stages of the implementation.

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Gap 2: Lack of capacity to transfer cargo from road to railroad transportation	- Reorganisation of activities in Ruse-East terminal - Construction of an intermodal terminal in the city of Ruse (optional)	Reorganisation of activities in the Ruse-East terminal, so that its facilities would be used to transfer cargo form road to railroad transport and vice versa. An additional option being the construction of an intermodal terminal in the city of Ruse.	04/2022 – 04/2023 (04/2026)	- Port Complex Ruse J.S.Co. - Private or public railroad operator - Ministry of Transport and Communication	- Initiation of the required internal procedures by the port operator to perform activities for transferring cargo from road to railroad transport. - Engagement of a railway operator. - Implementation of the plan for the construction of an intermodal terminal in the Integrated Transport Strategy for the period until 2030 (optional)	- Means of verification should be aimed at tools for the collection and analysis of data considering the volume of freight loaded from road to railroad transport and vice versa, on the basis of which the potential usefulness of an additional intermodal terminal could be assessed
Galati	Gap 1: Finalisation of the intermodal terminal A multimodal terminal is under development in the Port of Galati	- Carrying out the works in time, for rail and road connection infrastructure - Contracting the hydrotechnical works and carrying out the works in time - Carrying out the superstructure works in time - Make operational the terminal and attracting cargo -	- Proper management of the contracts, from both sides: company (ies) executing the works and port administration - Proper operation of the terminal in order to achieve the target of 150,000 TEU/year	08/2016 – 12/2023	- CN APDM SA - SC Port Bazinul Nou SA - SC Metaltrade In&Out Gate SRL Galati	According to the contracts signed	According to the contracts signed

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Gap 2: Rail – slow commercial speed 20 km/h.	Carrying out feasibility studies for the improved rail connections of the port of Galați	Execution of specific maintenance works / make more use of IWT and roads until Modernization of the railway infrastructure connecting the Port of Galati with its hinterland	01/2030 – 01.2032	CFR Infrastructura	Feasibility study	Elaboration of a feasibility study
	Gap 3: Assuring the minimum drought in port basins ...	Measurements and maintenance works (dredging) in the port basins and along the berths	Execution of specific maintenance works	Permanent	CN APDM SA Galati		Yearly maintenance plan execution
Constanta	Insufficient infrastructure dedicated to river barges (N)	Implementing Barge Terminal Phase 2 project	Revising Master Plan (on going) Identifying financing sources	2024 - 2027	CN APM SA Constanta	Feasibility study	Elaboration of a feasibility study
	Port setup – scattered stevedores (N)	Implementing projects related to development of logistics areas	Revising Master Plan (on going) Identifying financing sources or private investors	Permanent	Private operators		Investments of the private port operators
	Port setup (S) – considerable investment	Identifying financing resources	Revising Master Plan (on going) Identifying financing sources	2022 - 2030	CN APM SA Constanta	Master Plan of th Port of Constanta	Master Plan of th Port of Constanta

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Planning (N)	Insufficient terminals; additional rail& road movements - congestion	Port Planning – Master Plan - planning towards south	2022 - 2024	CN APM SA Constanta	Final plans for new terminals towards South	Elaboration of final plans for the development of new terminals in the Southern area oof the port of Constanta
	Access – roads &rail &barges (N&S)	Roads projects Rail to be rehabilitated by CFR Reducing bureaucracy	Revising Master Plan (on going) Identifying financing sources	2021 - 2027	CN APM SA Constanta	Extension at 4 lanes of the road between gates 10 and 10 bis Extension at 4 lanes of the road between gates 7 and 9	Road between gates 10 and 10 bis with 4 lanes Road between gates 7 and 9 with 4 lanes
	Status of infrastructure (N) Blockages at rail in terminals	Rail projects	Revising Master Plan (on going) Identifying financing sources	2020 - 2023	CFR Infrastructura	Feasibility study	Elaboration of the feasibility study
	Status of infrastructure – surface (N) – aging warehouses	Demolishment and newly built warehouses	Private investors	Permanent	Private operators		
	Berth and maritime access (Midia Zone) – insufficient depth for large tankers, break-bulk vessels.	Dredging	Revising Master Plan (on going) Identifying financing sources	2022 - 2024	CN APM SA Constanta	Modernisation of berths no 10 and 12	Berths no. 10 and 12 - modernized

Port	Gaps	Steps to bridge gaps	Proposed solutions	Time frame	Stakeholders	Milestones	Means of verification
	Status of infrastructure (surface) (Midia Zone) – old rail, roads, no parking	Rail & road & parking projects	Revising Master Plan (on going) Identifying financing sources Parking should become eligible under EU funds	2024 - 2027	CN APM SA Constanta	Improvement of access infrastructure in Midia Zone	Improved roads in Midia Zone
	Utilities – insufficient electric infrastructure	Feasibility Study ongoing from own resources	Identifying financing sources	2022 - 2024	CN APM SA Constanta	Improvement of the electric infrastructure	Works for improvement of the electric infrastructure ongoing
	Port and hinterland access – rail is not enough used – 200 empty wagons idle	Improvement of rail – rail projects	Revising Master Plan (on going) Identifying financing sources	2022 - 2023	CFR Infrastructura	improved rail access	Removal of empty / non used wagons from Constanta port marshalling yard
	Port and hinterland access – underused Danube Black sea connection	Create storage spaces	Identifying financing sources	2024 - 2030	CN APM SA Constanta	Development of infrastructure in the river – maritime area	Infrastructure for the development of terminals in the river – maritime area

Table 5: Strategic recommendations for the development of intermodal services in ports

7 Conclusions

The upper Danube and middle Danube ports, down to Budapest, benefit from their geographical position and relative nearness to North Sea ports and Adriatic ports, enabling them to harvest the benefits of economies of scale and use frequent rail shuttles to and from seaports. Moreover, these ports are physically closer to large industrial centres of high-tech products capable of generating containerized cargo flows of higher value goods and have excellent railway connections. Last, but not least, the high economic development of their host countries serves as a perfect generator of both inbound and outbound flows of goods suitable for containerization and therefore for intermodal supply chains.

Nevertheless, most ports of the upper and middle Danube cannot perform their usual role of being a fully tri-modal intermodal centres and nodes of intermodal supply chains due to the lack of any regular liner services by barge between any Danube ports themselves or between any Danube ports and Constanta as the sea gate for the Danube inland waterway. Instead, they serve mostly as nodes and intersections of rail and road transport, hosting intermodal terminals that are actually bi-modal terminals. Occasional transports of empty containers by barge are still far away from creating and embryo of future stable regular barge shuttles between the seaport of Constanta as a “gate” for the region, or between the Danube ports. This, however, does not prevent these ports to develop as bi-modal intermodal terminals with waterside access, at least for occasional or future transport of containers by barge. In fact, these ports (e.g. Enns, Vienna, Budapest, etc.) handle large volume of containers both in import and export directions and thus attract numerous value added services related to containers. Operators of such services tend to locate their businesses in, or at least close to, ports, thus creating the spatial concentration of cargo and logistic activities. This, in turn, enables the creation of economies of scale and related logistic and economic benefits to all parties involved.

Full intermodal network, consisting of intermodal notes (terminals in ports) and intermodal links (rail and inland waterways services between ports) is still far from being fully functional in the Danube area. This is due to the numerous gaps and barriers, and, from the point of view of ports, they can be classified as external and internal.

With regards to the internal gaps, the project partners, most of them being from the port authorities themselves, have developed a strategy for removal of the part of these barriers. This Strategy contains gaps that need to be bridged by corrective actions, steps that need to be taken, proposed solutions, estimated timeframe, relevant stakeholders that need to be involved in the implementation of the Strategy, as well as proposed milestones and means of verification of the Strategy implementation.

These gaps and the recommended corrective actions are the backbone of the Strategy. They are applicable to a wide variety of ports, starting from those that already have fully developed and specialised container terminals and long standing and stable railway connections to various seaports through which the country’s overseas exports and imports are performed.

There are various barriers that are yet to be mitigated and that require wider action, not only by ports but a strong, coordinated and persistent action of multiple countries and multiple authorities within each country. These barriers include the geographical distribution of seaports in and around Danube countries, strong railway competition from seaports not having inland waterway connections with the Danube ports, regular liner shipping services on the Danube for the transport of containers to/from Constanta, Lack of large urban agglomerations and consumption centres along the Danube downstream from Belgrade, lower level of industrialization, especially of high-tech industries requiring containerization of cargo flows, lack of cooperation between modes and spatial planning organizations, etc.

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