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DIONYSUS

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

Analysis of status-quo and mid-term perspective of transport infrastructure (IWT/rail/road)

Summary report

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Abbreviations

Abbreviation	Explanation
EU	European Union
TEN-T	Trans-European Transport
LNG	Liquefied natural gas
LCNG	Liquid to compressed natural gas
LNGAFT	Liquefied natural gas as alternative fuel for transport
IWT	Inland waterways transport
CEF	Connecting Europe Facility
CCNR	Central Commission for the Navigation of the Rhine
DC	Danube Commission
IWW	Inland Waterways Transport

1 Focus of the summary report

The main objective of DIONYSUS is to integrate the Danube Region into smart and sustainable, multi & intermodal transport chains of cargo and passenger flows. An essential element is the development of the Danube Region's river and seaports into smart, sustainable and better connected multi-& intermodal logistics hubs, as well as setting priority locations for industrial investment through EU funding & financing instruments.

Port investment needs, access infrastructure and transport connections (rail, road & maritime) to port hinterlands will be aligned with transport infrastructure and regional development plans. This shall facilitate political and administrative actions, thus enabling infrastructure investment based on dedicated Market Analyses. Moreover, DIONYSUS goes further than port infrastructure needs and identifies gaps in the integration of the Danube corridor network planning (Rhine-Danube corridor) with other transport corridors benefiting the region.

The study is structured in a way to cover the most important aspects of port infrastructure analysis from a corridor perspective. The first part of the study presents the most important bottlenecks along the Rhine-Danube Corridor with an emphasis on the quality of port infrastructure.

The study also focuses on Danube region agricultural transport highlighting IWT, but by covering all bottlenecks being present by rail/road/IWW transport mode.

Equally important for the purpose of this deliverable is a discussion around the European strategies such as Corridor strategies or European Green Deal. The present document therefore provides, in a further step, a comprehensive policy analysis on the Green Deal, a policy-framework which is set to completely revolutionise the European transport system. Once implemented, the EU will become in 2050 climate neutral. The policy-part of the study furthermore deals with the expected design of the NAIADES3 Action Programme.

The report highlights further future trends and investment needs/ recommendation effected to transport sector, on EU and on Danube regions level built up from country level.

Based upon the identified challenges – both in terms of port infrastructure connections as well as the strict requirements set by the European Legislator, the present deliverable presents a set of identified best practices along the Rhine-Danube Corridor. The report concludes with concrete actions and measures to be taken in order to enhance connectivity and multimodality.

2 Executive summary

Elaborated in the framework of the DIONYSUS project, the overall objective of this deliverable is to provide an in-depth analysis of the status-quo and mid-term perspective of transport infrastructure (IWT, rail and road) along the main regions of agricultural production in the Rhine-Danube Corridor. The methodology used to collect information was twofold: on the one hand, first-hand data was collected via stakeholder-interviews, whereas, on the other hand, secondary data was collected by intensive desk-research activities from various databases, studies and other relevant statistical information which are publicly available. Where data or continental strategies can be elaborated from a higher level, the top-down methodology has been used to analyse the reports, but in other parts, such as member state level strategies or Key recommendations the bottom-up methodology has been the best solution to examine the reports.

To provide a comprehensive analysis of the current status-quo of the transport infrastructure and its expected development on a mid- and long-term timeframe, several key aspects were taken into consideration. From the corridor perspective, the present study proposes a detailed overview on the connectivity and quality of infrastructure of the main ports across the region. The study argues that multimodality is vital in securing an uninterrupted transport flow of agricultural products across the whole geographical area of the Rhine-Danube Corridor. Moreover, from the policy perspective, the present study provides a policy analysis of the expected results of the European Green Deal with a special focus on its impact on the European transport system. The study concludes with a set of recommendations and examples of good practices.

The study also focuses on best practices along the Danube region, where from governance to investment best practices being described.

As a conclusion key recommendation being elaborated to 6 strategic pillars by the countries:

- Modal shift
- Improve IWT service quality
- HR
- Harmonized regulatory system
- Cross industrial cooperation
- Administrative & Financial support

The summary report clearly highlights, that Modal shift and IWT service quality are key pillars to the future IWT sector to become more attractive in the transport sector.

3 Available infrastructure for freight traffic and modal shift

3.1 TEN-T Analysis

Rhine-Danube Core Network Corridor – overview

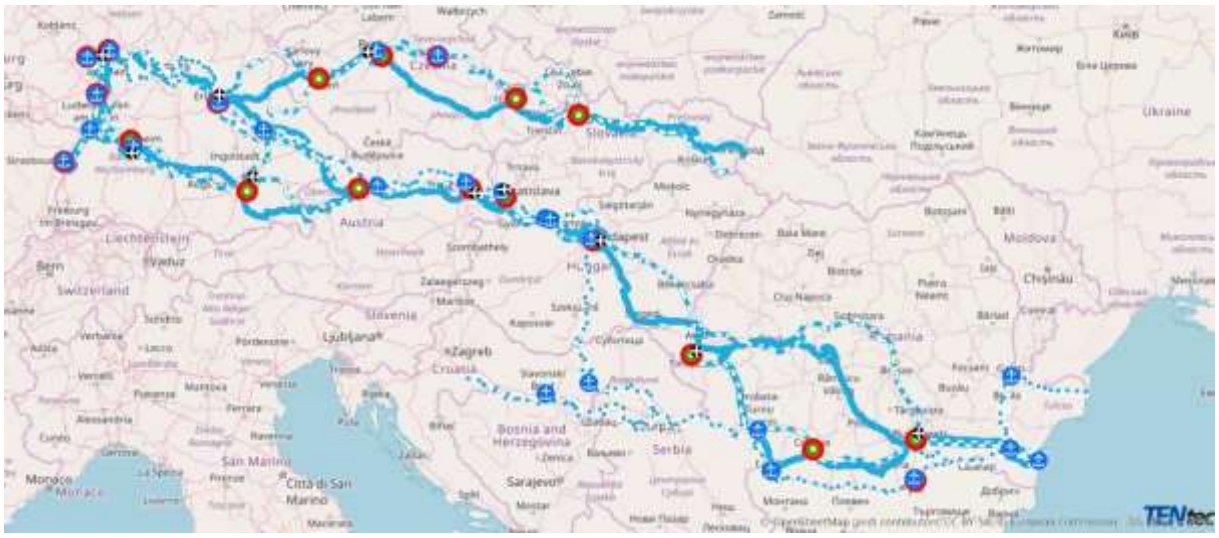

Figure 1: Rhine-Danube Core Network Corridor

The Rhine-Danube Core Network Corridor[1] is the transport backbone of the region from the Black Sea towards the very heart of the European Union. It connects the entry ports at the Black Sea, Constanta, and the ports in the Danube Delta to southern Germany and to the ports of the Rhine along the river Danube. While the other branch links the Ukrainian-Slovakian border to the same Rhine ports and central European regions.

It is quite a vast region and all modes of transport are important for its internal and external connection including France, Germany, Austria, the Czech Republic, Slovakia, Hungary, Croatia, Bulgaria, and Romania. The corridor also crosses four non-EU States, Serbia, Bosnia-Herzegovina, Moldova, and Ukraine. In all these countries, the main focus of the infrastructure deployment is laid on the development of navigation on the rivers Danube and Sava and on rail. In order to enhance multimodality, the respective locations for the interchange of freight and passengers along the rail network and the river Danube are of utmost importance.

The Rhine-Danube Corridor has several overlapping and crossing sections with other Core Network Corridors:

- **Orient/East-Med Corridor** (starting at Vidin/BG, the western part in RO, HU, in CZ between Brno and Praha, Vienna node/AT and Bratislava node/SK)
- **Baltic-Adriatic Corridor** (in CZ between Přerov and Ostrava, Žiliná in Slovakia, Vienna node/AT)

[1] Study on Rhine-Danube TEN-T Core Network Corridor 2017, page 26.

- **Scandinavian–Mediterranean Corridor** (in DE Würzburg – Nürnberg, München - Rosenheim)
- **Rhine-Alpine Corridor** (in DE on the Rhine between Frankfurt and Strasbourg)
- **Mediterranean Corridor** (Budapest node/HU)

The following figures provide a geographical overview on the overlapping of the Rhine-Danube Corridor with each of the abovementioned corridors:

Orient/East-Med Corridor & the Rhine Danube-Corridor

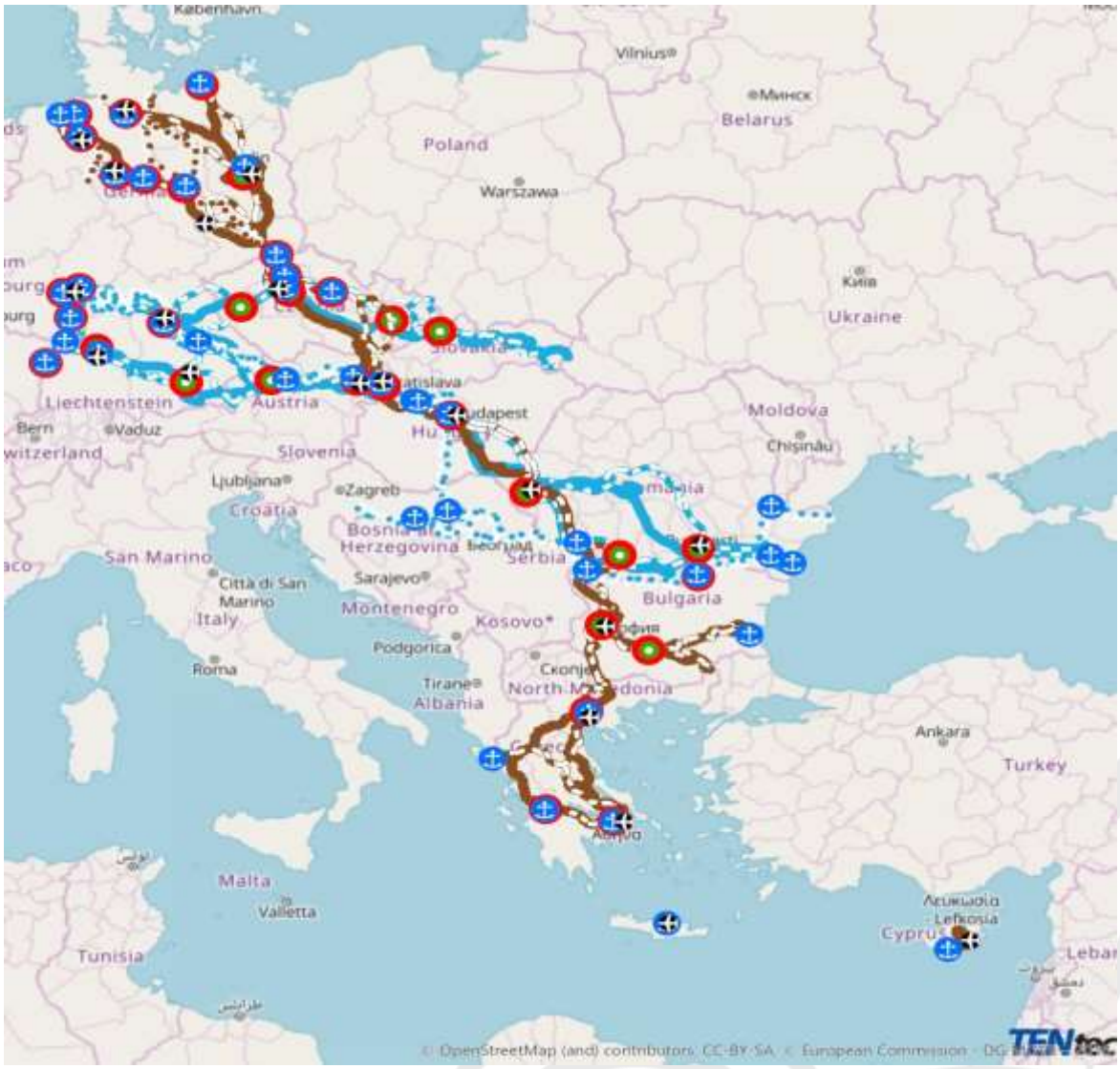

Figure 2: Orient East-Med & the Rhine-Danube Corridor

Baltic-Adriatic Corridor & the Rhine-Danube Corridor

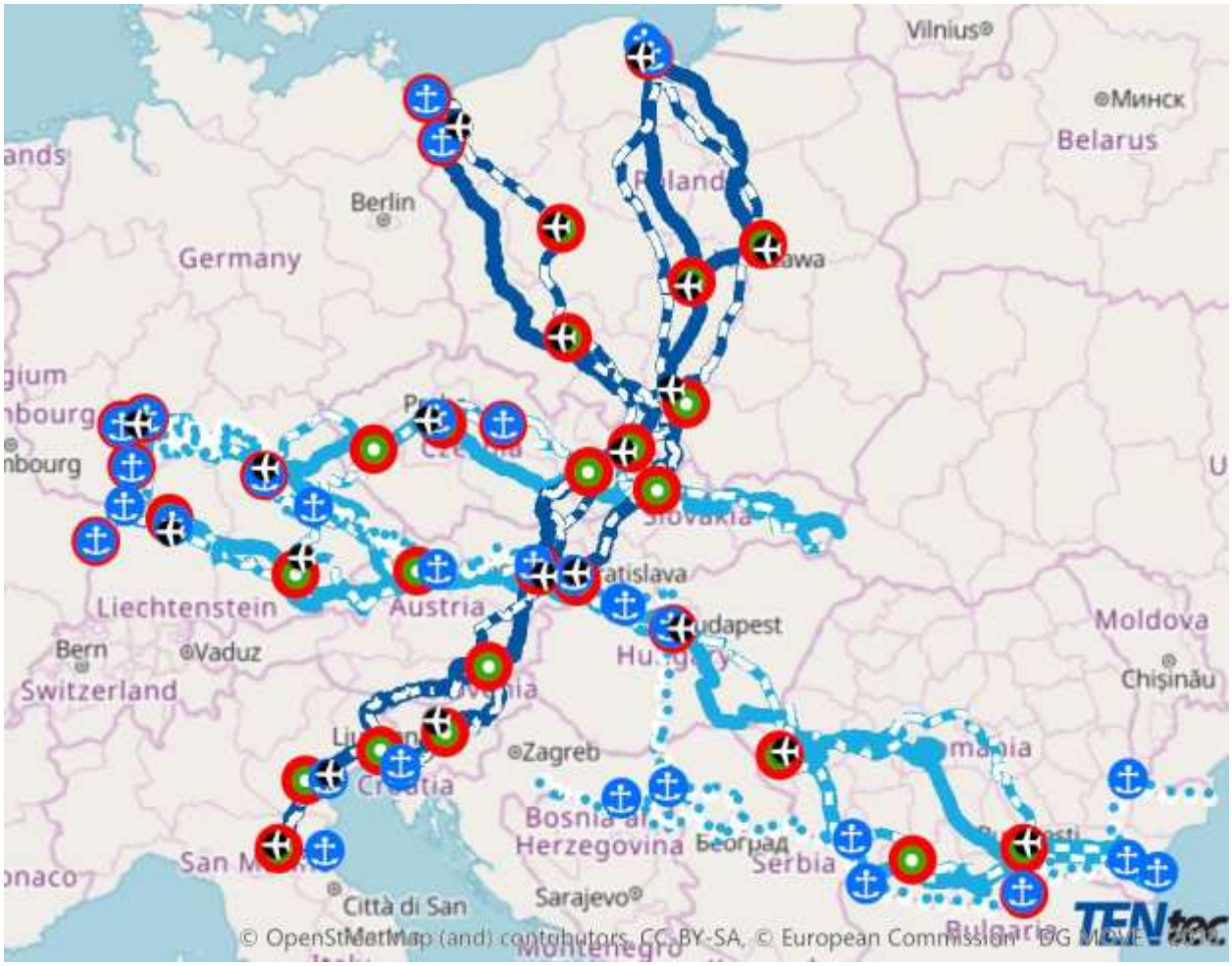

Figure 3: Baltic-Adriatic and the Rhine-Danube Corridor

Scandinavian–Mediterranean Corridor and the Rhine-Danube Corridor

Figure 4: Scandinavian-Mediterranean Corridor and the Rhine-Danube Corridor

Rhine-Alpine Corridor and the Rhine-Danube Corridor

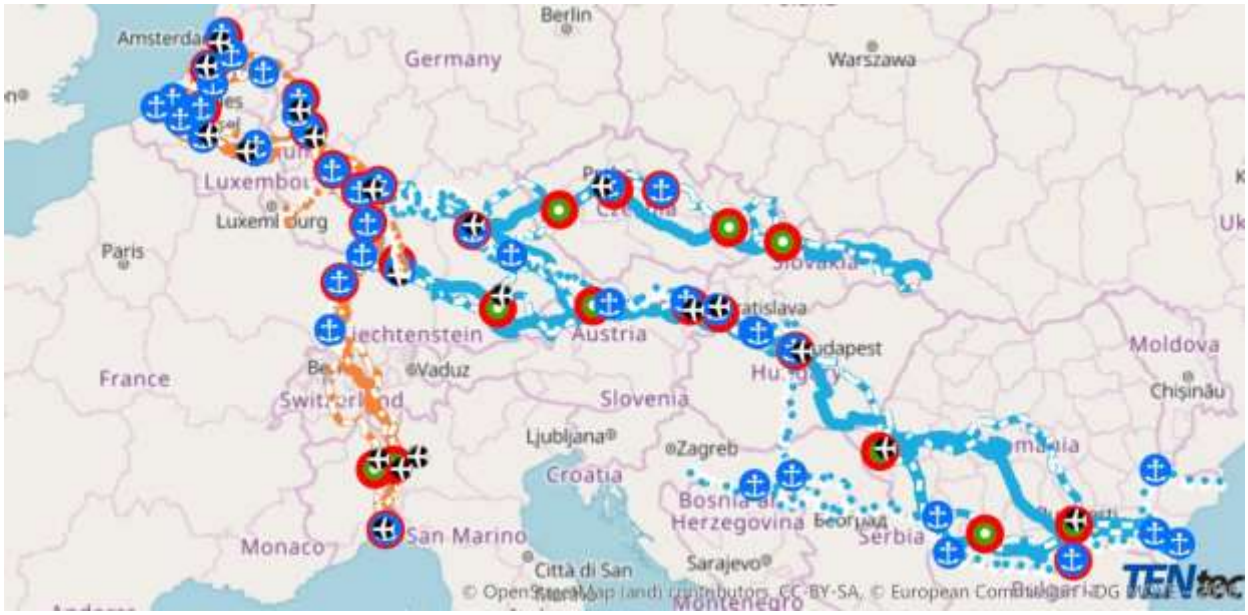

Figure 5: Rhine-Alpine and the Rhine-Danube Corridor

The Mediterranean Corridor and the Rhine-Danube Corridor

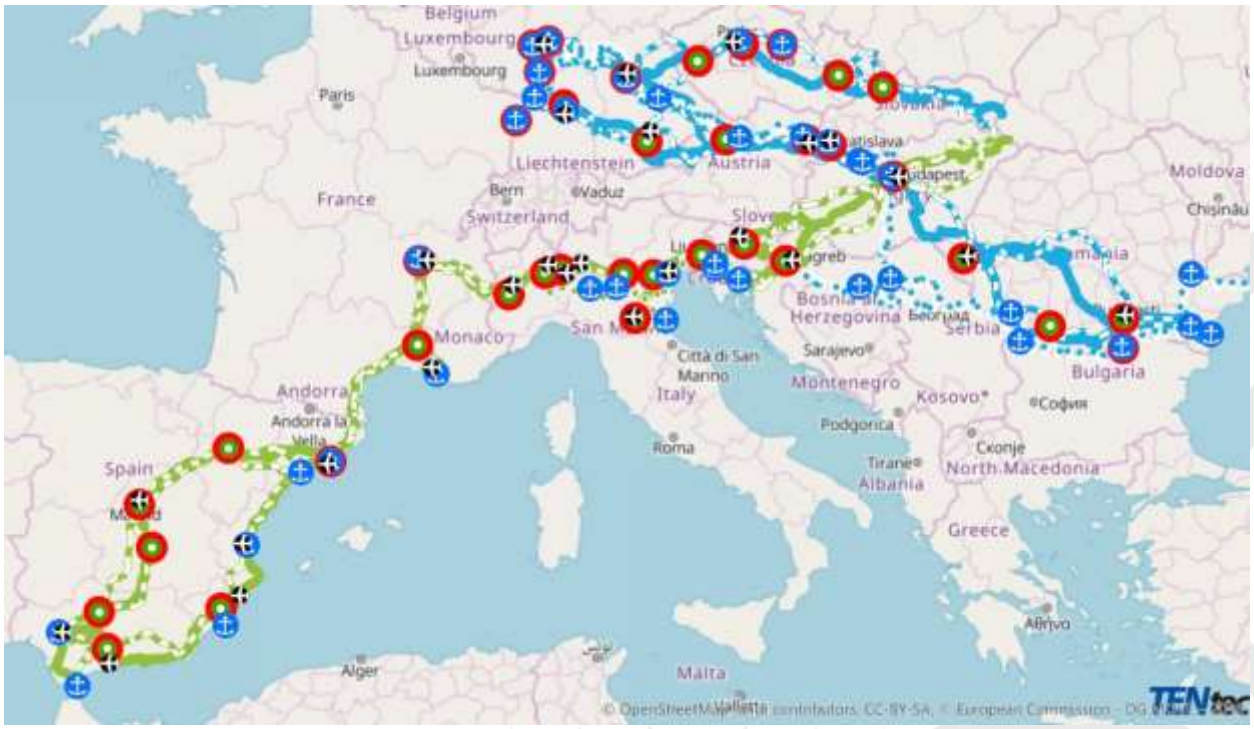

Figure 6: The Mediterranean and the Rhine-Danube Corridor

3.2 Availability of port infrastructure

The following interactive map provides an overview on the extent of rail connection of the ports across the Rhine-Danube Corridor in terms of railway connection. Based on this map, valuable information is provided on the overall development of multimodality focusing on railway connection.

Figure 7: Connection of ports with rail – overview

All core ports have a road connection but of varying quality in terms of number of lanes and capacities. The situation is similar in view of railway connection; only two ports, Komárom (HU) and Cernavodă (RO), have no fully functional rail connection to the hinterland and the rest of the network. The level of availability of intermodal facilities in ports is varying and, generally, declines further downstream.2

3.2.1 Alternative fuels

The following map provides an overview on the availability of Rhine-Danube Corridor ports' compliance with alternative fuels. As can easily be concluded, providing access to alternative fuels at this point, is rather an underdeveloped issue.

[2] Study on Rhine-Danube TEN-T Core Network Corridor, page 30

Figure 8: Rhine-Danube Corridor ports' compliance with alternative fuels

Small scale LNG infrastructure is nevertheless available to a certain extent (this is a non-exhaustive list of examples of good practices):

Enns / Ennshafen: Existing LNG infrastructure in Austria

- LNG fuelling station for trucks since 2017;
- Plans for further development of LNG infrastructure in Austria (5 LNG & 2 LNG/LCNG stations) and development of bunkering facility in Enns;
- Natural gas liquefaction of domestic gas in Austria.

Ruse: Existing LNG infrastructure in Bulgaria

- First port on the Danube equipped with LNG infrastructure developed in 2016;
- Executed within the LNG Masterplan by Bulmarket DM Ltd.;
- LNG Storage in the port (4 vertical tanks of 250 m3 of LNG);
- Vessel unloading and loading facility;
- Truck-loading station, truck & vessel fuelling station.

Mannheim: Existing LNG infrastructure in Germany close to the Danube (Rhine)

The location "Mannheim" is mentioned because it is the closest good example where

- "truck to Ship" bunkering is under operation next to the Danube Region;
- bunkering on the Rhine close to the Danube.

In addition to the existing infrastructure, the following map and the subsequent list of projects are providing information on potential locations for the future LNG implementation in the Danube Region.

Figure 9: Existing and planned LNG infrastructure in the Danube Region

LNGAFT: LNG project in Slovakia

- 1 LNG-fuelling open access point for road transport;
- 15 LNG mono-fuelled buses.

fueLCNG: LNG project in Slovakia

- Small scale LNG production plant (of assumed 1,25 ton/h production capacity);
- 3 large LNG stations for filling vehicles along the core TEN-T corridors with LNG fuel;
- 14 L2CNG stations along the TEN-T core corridors on D1 and D2 highways;
- Pilot fleet with 50 LNG fuelled vehicles;
- Mobile LNG supply for "Truck to ship" bunkering;

PAN LNG: LNG project in Hungary

- Small scale liquefaction plant based on fossil gas wells & bio-methane sources;
- Pilot deployment of 5 LCNG fuelling stations.

PAN LNG 4 Danube: LNG project in Hungary

- Making LNG available for Danube IWW transport at Csepel Freeport by deploying a fixed LNG refuelling station;
- Fuelling station for trucks and possibly for locomotives;
- Retrofitting of existing vessels for LNG propulsion.

Bio LNG - Fuelling Renewable Transport in Visegrád Countries: LNG project ongoing in the Visegrád Countries

- Project awarded in July 2017 for CEF Transport Call 2016;
- Liquefied Biogas (LBG) and Liquefied Natural Gas (LNG) production facility;

- Network of 6 LCNG fuelling stations — 3 located in Slovak Republic, 3 located in Czech Republic
  - Slovakia (Kosice, Zilina, Bratislava);
  - Czech Republic (Brno, Rozvadov, Usti nad Labem);
- Fleet of 75 LNG and LCNG trucks.

LNG Terminal in Vidin & Burgas: Potential future LNG infrastructure locations in Bulgaria

- Time plan: latest 2030;
- Possible location of LNG infrastructure on the core TEN-T port network to fulfil Directive 2014/94/EU according to Bulgarian strategy framework for alternative fuels development.

LNG for Constanta: Potential future LNG infrastructure location in Romania

- Project in preparation: estimated to be ready in 2025;
- Integrated project including fuelling stations & vehicles (LNG fuelled buses and trucks) and an LNG Terminal including bunker station for maritime and inland vessels;
- LNG-fuelled ferries to Georgia as part of the concept.

LNG for Galati: Potential future LNG infrastructure location in Romania

- Project in preparation: estimated to be ready in 2030;
- Integrated project including fuelling stations & vehicles (LNG fuelled buses and trucks) and an LNG Terminal including bunker station for maritime and inland vessels;
- Small Scale liquefaction based on biomethane sources.

3.3 Corridor Analysis – the Rhine-Danube Corridor

Defining the Rhine-Danube Corridor & main characteristics

The Rhine-Danube Core Network Corridor[3] is the transport backbone of the region from the Black Sea towards the very heart of the European Union. It connects the entry ports at the Black Sea, Constanta, and the ports in the Danube Delta to southern Germany and to the ports of the Rhine along the river Danube. While the other branch links the Ukrainian-Slovakian border to the same Rhine ports and central European regions.[4] Centered on the urban nodes, over 94 million people lived in the catchment area of the Rhine-Danube Corridor. While the forecasts indicated that road transport (as of 2017) will remain the dominant mode of transport, the study concluded that there is a need to significantly strengthen road and inland waterway transport.[5] This corresponds, considering the European Green Deal, to the current needs and requirements of regional development. The following section is entirely based on the results and recommendations of the Study on **Rhine-Danube TEN-T Core Network Corridor 2017.** The core aspects taken into consideration refer to the Danube IWT sector and its corresponding infrastructure. The latest version of the study, currently under preparation, will be updated in 2021.

[3] Study on Rhine-Danube TEN-T Core Network Corridor 2017, page 26.
[4] Study on Rhine-Danube TEN-T Core Network Corridor 2017, page 26
[5] Study on Rhine-Danube TEN-T Core Network Corridor 2017, page 10

Inland Waterways

85% of the inland waterway network, including Serbia, is classified as a class IV waterway or higher, only the Sava River is assigned to a lower class. A draught of 2.50m is permissible at 77% of the inland waterway. Shortfalls relate not only to the above-mentioned sections of the Sava, but also to the Upper Main and the Danube between Straubing and Vilshofen (1.6m at 94% of days per year). Four bridges offered a clearance below 5.25m, 89% of the section's length does comply with the requirement. Two of the bridges, the Alte Mainbrücke Würzburg and the Rail Bridge Bogen can represent a particular challenge for the navigation of ships. River Information Services are available along the entire Corridor (100%) but to a different extent and quality. International and national data exchange is not always ensured. The specific indicator showing the percentage of section kilometres on which the targeted fairway depth was met, reveals the particular challenges of the Rhine-Danube Corridor. Achievement of targeted depths varies dynamically as it depends not only on the waterway infrastructure conditions but also on the hydrologic circumstances. Above all at free-flowing river sections, they are challenging to be met. In 2013 the targets were met at 45% of the inland waterway's sections length, in 2014 at 58%, in 2015 at 42% and in 2016 at 40%.

Ports

Most of the Corridor core ports comply with the requirements set by Regulation 1315/2013. Only two ports, Vidin (BG) and Cernavodă (RO), do not meet the minimum depth and therefore require dredging activities. All core ports have a road connection, but of varying quality in terms of number of lanes and capacities. The situation is similar in view of railway connection, as only two ports, Komárom (HU) and Cernavodă (RO) have no fully functional rail connection to the hinterland and to the rest of the network. The level of intermodal facilities in ports is varying and, generally, declines further downstream, with a noticeable need for additional provision of such facilities in determined ports. There are five ports with reported incompliances in terms of lacking intermodal facilities: Komárom (HU), Slavonski Brod (HR), Drobeta Turnu Severin (RO), Calafat (RO) and Cernavodă (RO). Based on the latest update of the project list (March 2017), ports of Slavonski Brod (HR) and Drobeta Turnu Severin (RO) plan significant modernization including the infrastructure and related facilities, which will facilitate intermodality in these ports. Plans for alternative clean fuel facilities have been reported by the ports of Constanţa, Bratislava and Enns. The Port of Ruse constructed a LNG terminal with fuelling facilities for future LNG vessels, completed in 2015. As regards the shore-side (external) supply of electricity to vessels in ports, most of the ports reported the existence of shore-side electricity supply of electricity to vessels in ports, most of the ports reported the existence of shore-side electricity supply facilities for vessels, except for the ports of Wien (AT) and Galaţi (RO).

Even though IWT is not used to its full extent and capacity by far, important step forwards have been registered. The following figure provides an overview on some of the **most important CEF funded project in IWT** on the Rhine-Danube Corridor. The covered data is not exhaustive:

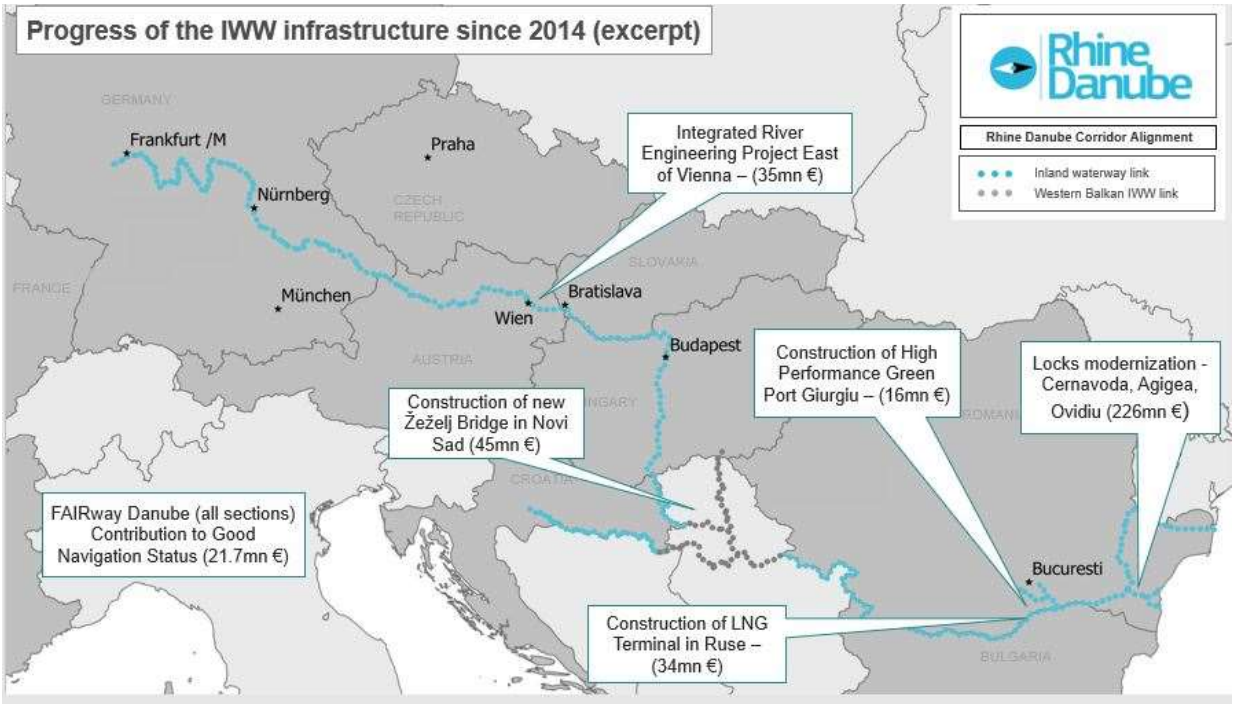

Figure 10: Progress of IWW infrastructure since 2014[6]

3.3.1 Main Cargo flows on the Rhine-Danube Corridor

Based on extensive desk research, the core objective of this chapter is to provide a comprehensive overview on the traffic volumes along the Rhine-Danube Corridor. The data was collected from publicly available resources, namely from statistics provided by the Danube Commission (DC) and the Central Commission for the Navigation of the Rhine (CCNR).

Cargo is transported along the Danube over an average distance of about 600 km. In 2019, 43.34 million tons of cargo were transported between Kelheim and the Black Sea (increase of 21% in comparison to 2018 which registered a total of 35.8 mil tons).[7]

The immense bulk freight capacity of inland navigation vessels is currently used predominantly by the metal industry, agriculture, forestry, and the mineral oil industry.

Detailed freight transport is being shown in Chapter 4.

3.3.2 Cargo handling in the Danube ports

Cargo handling in the Danube ports averaged more than 60 million tons per year in 2017-2018, having the majority in the shipment of metal ores and agricultural products. A summarizing list based on the year 2017 statistics according to NST-2007 classification for transported goods is the following:[8]

[6] Presentation on the Rhine-Danube Core Network Corridor – 4th Work Plan online conference provided by the Rhine-Danube Coordinator Mrs. Oen, in June 2020
[7] Danube Commission Market Observation, page 6
[8] Danube Commission, Market Observation 2019, page 7

- 43,0 % Metal ores and other mining and quarrying products; peat; uranium and thorium (NST 2007: 03)
- 24,2 % Products of agriculture, hunting, and forestry; fish and other fishing product (NST 2007: 01)
- 7,8 % Coke and refined petroleum products (NST 2007: 07)
- 6,9 % Chemicals, chemical products, and man-made fibres; rubber and plastic products; nuclear fuel (NST 2007: 08)
- 6,9 % Coal and lignite; crude petroleum and natural gas (NST 2007: 02)
- 6,1 % Basic metals; fabricated metal products, except machinery and equipment (NST 2007: 10).

The following figure provides an overview on the high and heavy ports in the Danube Region:

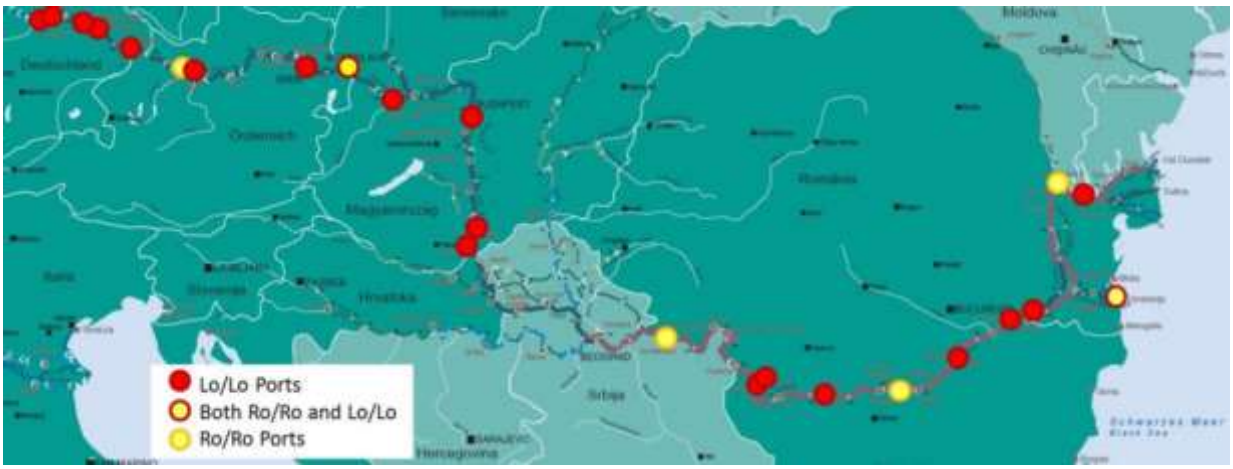

Figure 11: High and Heavy ports in the Danube Region[9]

3.3.3 Freight structure by directions

The following overview is based on the annual report published by the CCNR as part of their Market Observation activity.[10]

Goods transport on the Upper Danube is presented by data at the lock of Gabčíkovo. At this border point between Slovakia and Hungary, the total transport volume was 5.84 million tons in 2019, compared to 4.50 million tons in 2018 (+30%).

Upstream transit traffic had a share of 63.3%, which was like earlier years (2017: 64.8%, 2018: 65.0%) and 59.4% of the volumes were moved by pushed convoys (58.2% in 2018). During times of stable navigation conditions, an average of 140-145 pushed convoys passed the lock of Gabčikovo each month.

Food products and foodstuffs, as well as iron ores, are entirely transported upstream on the Upper Danube at this border point, while the other products are transported in both directions.

[9] Study on Rhine-Danube TEN-T Core Network Corridor, page 116
[10] CCNR Market Observation - Annual report 2020, Summary, Page 51

Goods transport on the Middle Danube is presented by data at the border point of Mohács in southern Hungary, near the border with Croatia and Serbia. Total cargo traffic represented 5.58 million tons in 2019. Total volumes in 2019 were 23.4% higher than the 4.5 million tons that were transported in 2018. Upstream transit traffic also has the largest share on the Middle Danube (59.4% in 2019). Transport is done mainly by pushed convoys, which carried 4.44 million tons of cargo in 2019, a share of 79.5% of total traffic on the Middle Danube. During the times when navigation conditions were stable, 60 to 70 pushed convoys passed the border point of Mohács each month. Iron ore is entirely transported upstream on the Middle Danube, while grain, food products and foodstuffs are entirely transported downstream.

On the Lower Danube in Romania, a total amount of 33.26 million tons was transported in 2019, 11.9 % more, than in 2018. The share of agricultural products was almost 30% and they registered a plus of 21%. Iron ore, chemicals and metals continued their upward trend of previous years. It should be noted that iron ore transport on the Middle and the Lower Danube had a growth-orientated trend in the recent years.

Traffic on the Lower Danube is not only carried out by inland vessels, but also by seagoing vessels. Galati and Braila are the most important river-sea ports on the Lower Danube, and cargo transshipped by seagoing vessels increased strongly in 2019. On the Sulina Canal, seagoing vessels carry out the main part of freight traffic. In 2019, traffic on the Sulina Canal reached a volume of 5,487,000 tons, which is 23.6% more than in 2018.

In the port of Constanţa, 10,395 inland vessels were called in 2019, where river traffic increased by almost 20%, to reach 15.1 mil. tons, mainly driven by more agricultural products, iron ore and chemicals.

Volumes by direction and by types of vessel (2019) based on reference point Gabčikovo locks[11]

In 2019, a total of 2,367,000 tons were transported with motorized cargo vessels, that is 40.6% of the total volume of goods (2012: 47%, 2013: 51%, 2014 and 2015: 48%, 2016: 44%, 2017: 41.3 %, 2018: 41.8%), of which:

- upstream: 1,644,000 t and
- downstream: 723,000 t.

A total of 2,027,000 t of dry goods were transported with motorized goods ships, of which:

- upstream: 1,546,000 t and
- downstream: 481,000 t.

A total of 340,000 t of liquid goods were transported with motor tankers, which corresponds to 75.8% of the amount in 2018, of which:

- upstream: 98,100 t, which corresponds to 69.1% of the amount transported in 2018;
- downstream: 241,900 t, which corresponds to 79% of the volume carried in 2018.

[11] Danube Commission, Market Observation 2019, pages 19-21

The pushed convoys which passed through the Gabčikovo locks in the first half of 2019 a total of summed up approx. 3,469.000 tons, which is around 132,8% of the amount in 2018.

- upstream 1,963.000 t representing 56,4% of the dry goods transported upstream (2014: 58%, 2015: 55%, 2016: 58%, 2017: 59.7%, 2018: 58.8%);
- downstream 967,200 t, representing 65,4% of the dry goods transported downstream.

A total of 2.117 push barges operated in push convoys upstream of which 22,8% under ballast (2014: 10%, 2015: 14%, 2016: 17.6%, 2017:17%, 2018: 18.9%).

At the same time, of the 1,755 push convoys operating downstream, 33% were ballasted (2013: 63%, 2014: 66%, 2015: 56%, 2016: 45%, 2017: 51%, 2018: 45%,), reflecting the persistent imbalance of goods traffic on the Upper Danube.

A total of liquid cargo of 538.300 t were transported via pushed convoys, of which:

- upstream: 121,000 t and
- downstream: 417,000 t.

A total of 188 loaded and 4 with ballast operated pushed convoys travelled upstream, whereas downstream 394 loaded and 10 loaded with ballast.

Volumes by direction and by types of vessel (Q1+Q2/2020) based on reference point Gabčikovo locks[12]

In the first half of 2020, with motor cargo vessels a total of approx. 1,388,000 t were transported, that is 50.8% of the total volume of goods (2012: 47%, 2013: 51%, 2014 and 2015: 48%, 2016: 44%, 2017: 41.3%, 2018: 41.8%, 2019:40.6%), of which:

- upstream: 1,021,000 t
- downstream:367,000 t.

With dry cargo vessels, there were in total 1,277,000 t, of which:

- upstream: 993,000 t
- downstream: 284,000 t.

In the first half of 2020, a total of 987 motor dry cargo vessels operated upstream and 986 motorized goods ships downstream, 85% of them loaded.

A total of 110,200 t of liquid cargo were transported with motor tankers, which corresponds to 58.3% of the value in the comparable period of 2019, of which:

- upstream: to mountain 28,100 t and
- downstream: to the valley 82,100 t.

The pushed convoys which passed through the Gabčikovo locks in the first half of 2020 a total of summed up approx. 1,344,000 t, which is around 68.2% of the amount registered in the first half of 2019.

[12] Danube Commission, Market Observation First Half 2020, pages 12-14

A total of 1,124,000 tons of dry cargo was transported in pushed convoys of which

- upstream 733,300 t, representing 42.5% of the dry goods transported upstream (2014: 58%, 2015: 55%, 2016: 58%, 2017: 59.7%, 2018: 58.8%, 2019: 56.4%);
- downstream 391,000 t, representing 57.9% of the dry goods transported downstream.

A total of 684 push barges operated in push convoys upstream (2019:1,108), of which only 8.3% under ballast (2014: 10%, 2015: 14%, 2016: 17.6%, 2017:17%, 2018: 18.9%, 2019: 14.6%).

At the same time, of the 670 push convoys operating downstream, 29.5% were ballasted (2013: 63%, 2014: 66%, 2015: 56%, 2016: 45%, 2017: 51%, 2018: 45%, 2019:33%), reflecting the persistent imbalance of goods traffic on the Upper Danube.

A total of liquid cargo of 219,400 t were transported via pushed convoys, of which:

- upstream: 30,600 t and
- downstream: 188,800 t.

A total of 34 loaded and 197 with ballast operated pushed convoys travelled upstream, whereas downstream 194 loaded and 32 loaded with ballast.

3.4 Availability of Ports

The information collected in this chapter is based on the comprehensive **Study on Rhine-Danube TEN-T Core Network.** It reflects the development pathway of the Rhine-Danube ports in terms of infrastructure development, access to alternative fuels and multimodality.[13]

Out of total 118 port projects (including inland ports of the Western Balkans) 87 projects (74%) are related to pure (standard) infrastructure works and only 6 projects (5%) are reported as mixture of studies and works. These infrastructure works involve various categories of works, ranging from infrastructure rehabilitation and upgrade to completely new construction works on port infrastructure. Small share of port projects belongs to telematics project (1 project) and clean fuels supply facilities (4 projects). Remaining projects are related with studies only, rolling stock (vessels and barges) and administrative/operational issues.

The total costs of all 118 identified and reported port projects reached 2,638 Mio EUR. The largest share of the projects (54%) and their costs (78%) comes from Romania. This is due to the fact that Romania has the largest number of ports per country (6) and the only seaport on the Rhine-Danube Core Network Corridor. The Port of Constanta is the largest seaport in South-East Europe and is frequently considered as "the Rotterdam of the East". Consequently, the largest share of projects in terms of numbers (49 projects or 41%) and in terms of project costs (1,729 Mio EUR or 66%) belongs to this seaport.

[13] Study on Rhine-Danube TEN-T Core Network Corridor, pag. 59-64

Out of 118 port projects, 68 of them are pre-identified projects. Aiming at an improvement of their hinterland connections, ports undertook and planned a total of 27 projects related to the last mile connection.

It is important to note that, although no LNG-fuelled ships are currently operating on the Danube and its tributaries, several ports have already undertaken measures towards the facilitation of LNG bunkering for future vessels. Port of Ruse (BG) has already completed such terminal which provides facilities for LNG bunkering for vessels, while ports of Constanta, Bratislava and Enns have reported planned projects for LNG bunkering facilities.

Most ports comply with most of the key performance indicators. However, this does not completely reflect the qualitative situation of ports. It is recommended that the aspects of port modernization, infrastructure efficiency and greening of port development and operations shall be considered in future spatial planning and policy documents.

3.4.1 Persisting port bottlenecks

Based on the identified port development projects, their contents and major intervention fields, as well as the gap analysis, it can be concluded that certain bottlenecks remain to be addressed in the future. Currently, no projects tackling the missing functional railway connections in the ports of Komárom (HU) and Cernavodă (RO) are planned, thus impeding the development of intermodality in these ports and the Corridor itself and not contributing to the improvement of the railway connection KPI. Nevertheless, according to the list of approved projects from CEF Transport 2016 Call, a project (2015-HU-TM-0152-S) will study the possibilities for railway connection in the port of Komárom (HU).

Concerning the provision of alternative clean fuels supply facilities, the ports of Frankfurt (DE), Nürnberg (DE), Regensburg (DE), Wien (AT), Komarno (SK), Komárom (HU), Budapest (HU), Vukovar (HR), Slavonski Brod (HR), Drobeta Turnu Severin (RO), Calafat (RO), Giurgiu (RO), Galati (RO), Cernavoda (RO) and Vidin (BG) have not reported any projects with plans to provide such facilities. According to the latest information, based on the list of approved projects from CEF Transport 2016 Call, a project (2015-HU-TM-0349-M) will investigate the possibilities for provision of alternative clean fuels (LNG) supply facilities in the port of Budapest (HU). Although selected as a KPI, availability of alternative clean fuels currently does not have any target value, due to the setup of the current legislative framework for alternative clean fuels. Currently, Directive 2014/94/EU imposes only the time horizon (31 December 2030) for the provision of an “appropriate” number of refuelling points for LNG for inland and maritime vessels (Article 6), while the TEN-T Regulation 1315/2013 does not venture into the determination of the number of such refuelling stations. Therefore, no targets in terms of numbers of refuelling points have been established. The decision on the location of the LNG refuelling points at ports will be based on a cost-benefit analysis including an examination of the environmental benefits. In this view, an action towards the realistic assessment of the demand and prospects of utilization of LNG-powered vessels is strongly recommended, following a cost-benefit and environmental analyses.

In terms of incompliance with the non-KPI technical parameters, the ports of Cernavodă (RO) and Vidin (BG) do not provide minimum draft of 2.5m at all water levels, but the port of Vidin aims to

solve this incompliance within a larger global project on inland waterways interventions. No such projects have been planned for the port of Cernavodă.

As regards to the plans for provision of intermodal facilities, the ports of Komárom (HU), Calafat (RO) and Cernavodă (RO), have not reported any plans for construction/provision of such facilities, by the cut-off date for project database formation (March 2017). However, according to the list of approved projects from CEF 2016 Call, projects 2015-SK-TM-0116-S and 2015-HU-TM-0152-S will study the possibilities for construction of intermodal facilities in the ports of Komarno (SK) and Komárom (HU), respectively.

Although not strictly a requirement in terms of TEN-T Regulation, but being one of the corridor objectives, the provision of shore-side power supply facilities is still not provided in the ports of Wien (AT) and Galati (RO) and no such plans have been reported until 2030. As per information received from the port infrastructure manager (CN APDM SA) during the Corridor Forum 9 and 10, projects of construction of shoreside power supply are too small to be standalone projects. In this view, the consultant has been informed that all projects involving quay wall construction and/or modernization will include construction of shore-side power supply facilities.

The analysis of the already completed, the on-going and planned port projects (118 projects in total with an investment volume of 2.6 bn Euro) leads to the conclusion, that gaps in development of the ports in the corridor will remain in 2030 as the target value of the various port KPIs will not be met.

Moreover - and in addition to the final status of the project list - the non-compliant sections were also checked against the funded projects of the 2016 CEF transport call. The results are summarized in the table below:

Corridor Section	Pre-identi-fied	Project	Reason for non-compliance	Comments by MS/IM
Germany				
Frankfurt (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	No targets in terms of numbers of refuelling points have been established. The decision on the location of the LNG refuelling points at ports should be based on a cost-benefit analysis including an examination of the environmental benefits. In this view, an action towards the realistic assessment of the demand and prospects of utilization of LNG-powered vessels is strongly recommended, following a cost-benefit and environmental analyses. Directive 2014/94/EU imposes only the time horizon (31 December 2030) for the provision of an "appropriate" number of refuelling points for LNG for inland and maritime vessels (Article 6), while the TEN-T Regulation 1315/2013 does not venture into the determination of the number of such refuelling stations.
Regensburg (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	Same as comment for Frankfurt (port)
Nürnberg (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	Same as comment for Frankfurt (port)

Corridor Section	Pre-identi-fied	Project	Reason for non-compliance	Comments by MS/IM
Austria				
Wien (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	Same as comment for Frankfurt (port)
Wien (port)	N	No project	No existing and/or planned shore-side power supply	
Slovakia				
Komarno (port)	N	No project	No existing and/or planned intermodal facilities	According to the list of approved projects from CEF 2016 Call, a project 2015-SK-TM-0116-S will study the possibilities for construction of intermodal facilities.
Komarno (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Hungary				
Komarom (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Komarom (port)	N	No project	No existing and/or planned intermodal facilities.	According to the list of approved projects from CEF 2016 Call, a project 2015-HU-TM-0152-S will study the possibilities for construction of intermodal facilities.
Komarom (port)	N	No project	No railway connection .	According to the list of approved projects from CEF 2016 Call, a project 2015-HU-TM-0152-S will study the possibilities for provision of railway connection.
Budapest (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port). **Addition**: According to the list of approved projects from CEF 2016 Call, a project 2015-HU-TM-0349-M will investigate the possibilities for provision of alternative clean fuels (LNG) supply facilities.

Croatia				
Vukovar (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Slavonski Brod (port)	Y	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Romania				
Drobeta Turnu Severin (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Calafat (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Calafat (port)	N	No project	No existing and/or planned intermodal facilities.	
Giurgiu (port)	Y	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Cernavoda (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Cernavoda (port)	N	No project	No existing and/or planned intermodal facilities.	
Cernavoda (port)	N	No project	No railway connection.	
Cernavoda (port)	N	No project	No minimum depth.	
Galati (port)	Y	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Galati (port)	Y	No project	No existing and/or planned shore-side power supply	As per information received from the port infrastructure manager (CN APDM SA) during the Corridor Forum 9 and 10, projects of construction of shore-side power supply are too small to be standalone projects. In this view, the consultant has been informed that all projects involving quay wall construction and/or modernization will include construction of shore-side power supply facilities.
Bulgaria				
Vidin (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).

Table 1: Port incompliances by 2030. Detailed overview

Based on the information collected and comprehensively presented in the above table, the preliminary conclusion can be drawn that progress is still to be made. A lot depends on the ongoing

political discussions, negotiations and long-term strategical planning of decision-makers and last, but not least, on the successful implementation of the European Green Deal.

The map below summarizes the main port incompliances by 2030:

Figure 12: Port incompliances by 2030 on the Rhine-Danube Corridor

Compliance of inland and seaports with established ports KPI, in a simplified form (percentages) is summarized in the following two tables.

Port KPI	Baseline 2013	Status 2016	Prospects 2030	Target 2030
CEMT Class IV waterway connection	100%	100%	100%	100%
Connection to rail	89%	89%	89%	100%
Availability of clean fuels	0%	6%	17%	TBD
Freight terminal open to all operators and transparent charges	100%	100%	100%	100%

Figure 13: Port incompliances by 2030

The table above speaks for itself. It is a well-known fact that the issue of clean fuels in IWT is not yet entirely clarified. The availability of clean fuels depends on adequate fuelling facilities and infrastructure as well as on the efficient uptake of innovative technologies in the IWT sector, an issue which, compared to other modes of transport, is rather low i.e. due to low level of profitability.

4 Transportation of agricultural products on the transport network

This chapter aims to summarize the agricultural production and transport trends in the European Union level, then in the Danube level. For further, more detailed national level please see the country reports.

4.1 Agricultural production and transportation

Zooming out to European view, please find below the modal split of inland freight transport. Inland waterway generally plays a small share in all countries. Focusing for the Danube region, Romania and Bulgaria uses IWT around 20% compared to other modes. The other EU member in focus (Austria, Slovakia, Croatia, Hungary – represents IWT with around 4-6% to other national transport modes.

Also, to compare IWT to other modes (except Netherlands and Romania), rail transport represents a higher role in the national transportation share. Road transport is still the dominant player.

The EU 27 average shows around 75% share of road transportation, while 20% rail and around 5% of IWT transport is available. This share has not changed in the past few years/decades. Looking forward to 2030 the climate change goals, transportation strategies shows a higher share of IWT. To become these future goals true, IWT must invest on infrastructure even more then before to become competitive. With this topic Chapter 5 is aiming to give a more specific description.

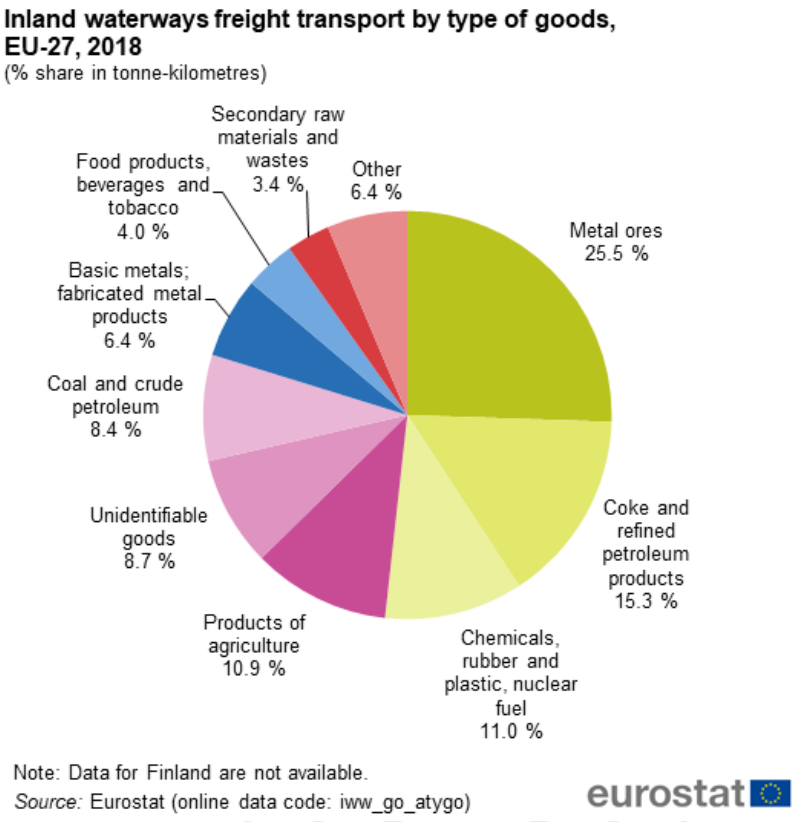

Figure 14: Inland waterway freight transport by type of goods

The biggest transported products via IWT are metal ores and fossil products like coke and refined petroleum products. The third with around 11% is Chemicals and fourth with 10,9% is Products of agriculture. In 2018 the IWT was used for 10-9% for agricultural transshipments.

4.1.1 Agricultural production in Europe

The agricultural production stayed on average amount during the last few years, only wheat had an increase from 2018 to 2019, with nearly 10 million tons more production. However, the last years represented some natural accidents like extreme weather conditions, the production remained stable. Also, the trend – that more and more warehouses are being built, can temporarily has a declined effect on transport, but even in short term that shall not be a problem, but a unique selling point for ports.

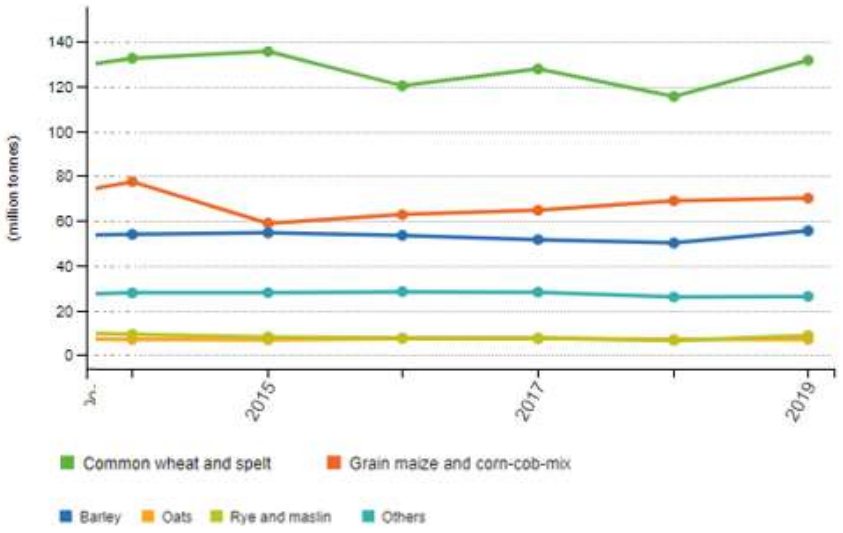

Figure 15: Agricultural production in Europe (2014-2019)

4.1.2 Agricultural transportation along the Danube

In comparison to 2018, a strong increase was recorded in 2019 in the transport of food products and foodstuffs. At the same time, the transport of cereals (mainly wheat and maize) from the ports of the Middle Danube to the estuary ports at the Black Sea remained at the level of 2018. The transport of petroleum and chemical products (fertilizers) remained quite stable as well.

On the Danube, iron ore traffic increased in 2019, as the transport of agricultural products did, like foodstuff and feedstuff. Together, the steel and the agri-bulk segments account for 60% to 70% of transport volumes on the Danube.[14]

[14] CCNR Market Observation - Annual report 2020, Summary, page 23

Comparing the upper-middle and lower Danube agricultural transport statistics:

2019 was a positive year after years of declining nearly to all products, but definitely food products and feedstuff. It represents the highest amount each year, starting from 2012 to 2019 with a closing value around 1,75 M tons.

Food products and foodstuffs, as well as iron ores, are entirely transported upstream on the Upper Danube at this border point, while the other products are transported in both directions.

Agri-bulk represents a smaller amount in this region, with around 0,2 Million tons. In total the Upper Danube made nearly 2 million tons (Food products and Agri-bulk together).

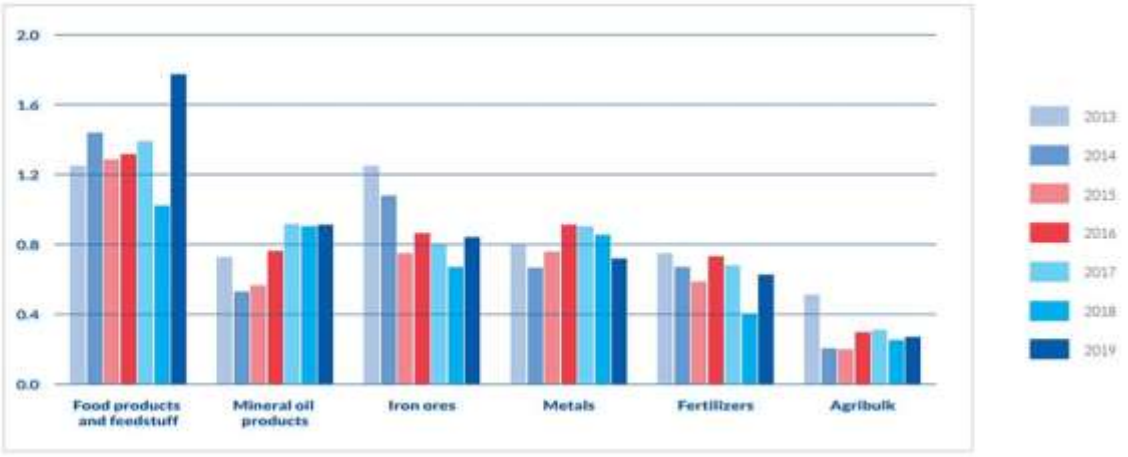

Figure 16: Goods transported on the Upper Danube (in Million Tons) [15]

Goods transport on the Middle Danube is presented by data at the border point of Mohács in southern Hungary, near the border with Croatia and Serbia. Total cargo traffic represented 5.58 million tonnes in 2019. Total volumes in 2019 were 23.4% higher than the 4.5 million tonnes that were transported in 2018.

Upstream transit traffic also has the largest share on the Middle Danube (59.4% in 2019). Transport is done mainly by pushed convoys, which carried 4.44 million tonnes of cargo in 2019, a share of 79.5% of total traffic on the Middle Danube. During times when navigation conditions were stable, 60 to 70 pushed convoys passed the border point of Mohács each month. Iron ore is entirely transported upstream on the Middle Danube, while grain, food products and foodstuffs are entirely transported downstream. The first point reflects the provision of the steel industry in Austria and Hungary with raw materials, while the second point reflects the export of agricultural products from Hungary downstream on the Danube to the Lower Danube region and to seaports.

[15] CCNR Market Observation - Annual report 2020, Summary, Page 51

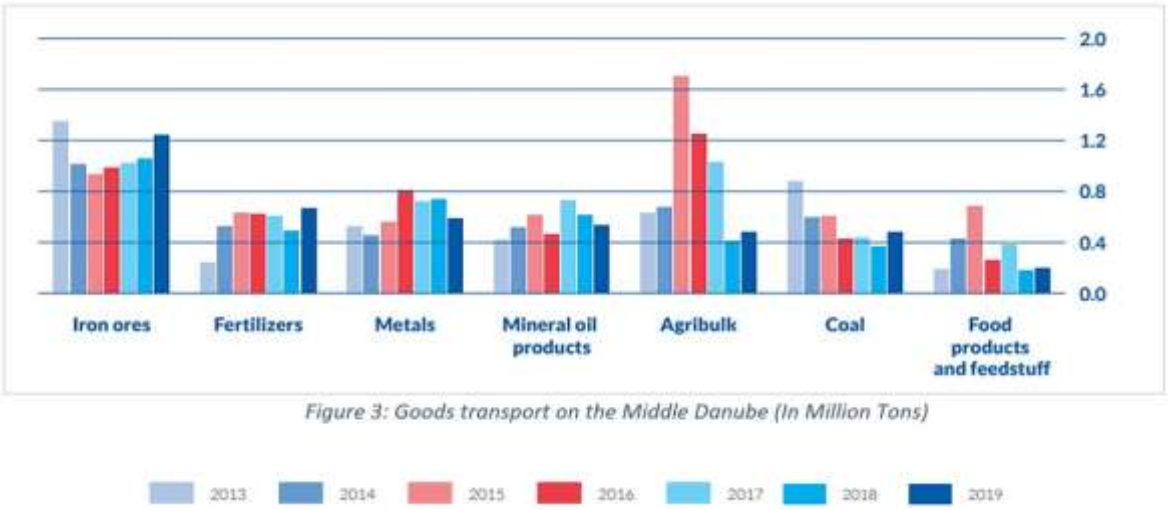

Figure 3: Goods transport on the Middle Danube (In Million Tons)

Figure 17: Goods transported on the Middle Danube (in Million Tons) [16]

On the lower Danube in Romania, a total amount of 33.26 mio. t was transported in 2019, 11.9 % more than in 2018. The share of agricultural products was almost 30% and they registered a plus of 21%. Iron ore, chemicals and metals continued their upward trend of previous years. It should be noted that iron ore transport on the Middle and the Lower Danube had a growth-orientated trend in recent years.[17] Compare to Upper Danube, 10 times more Agri-bulk were transported.

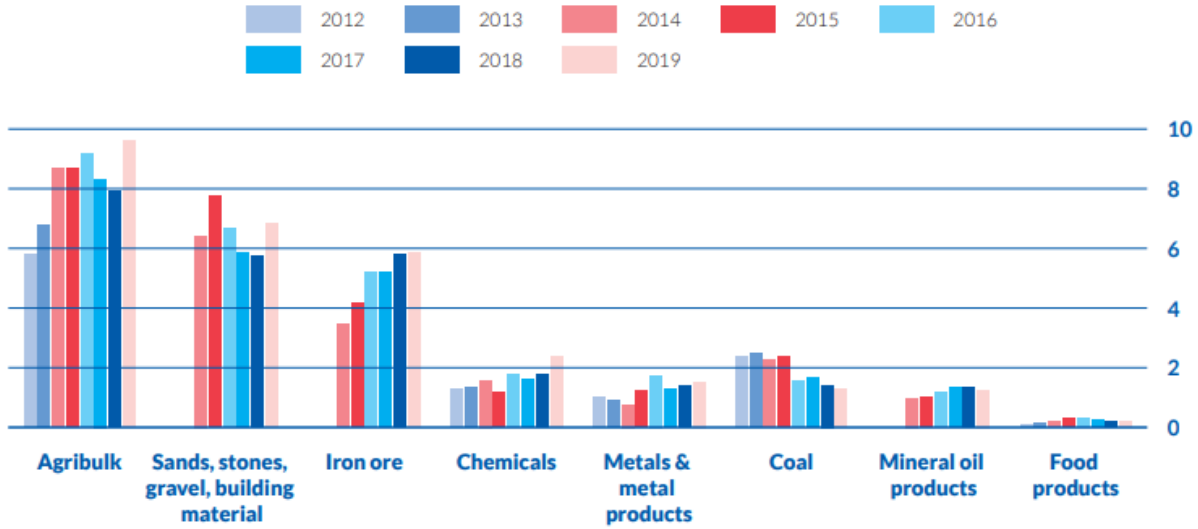

Figure 18: Goods transported on the Lower Danube (in Million Tons)

[16] CCNR Market Observation - Annual report 2020, Summary, Page 52
[17] CCNR Market Observation - Annual report 2020, Summary, Page 52

Agricultural transport on the Danube in Romania has certainly increased in the last ten years. But a comparison with other transport modes shows that road transport has grown faster, at least since 2010.

Agricultural products Outlook (Europe)

less large-scale production, more local production and less long-distance transport of agricultural goods are foreseen. The number of smaller vessels will continue to decrease, but there are options to cope with this, either by investing in own small vessels or by using small vessels belonging to corporations.[18]

Modal split of freight transport

Figure 20 shows, what the chapter described upper as well: The road transport had around 78% share in the last decide, while railways had nearly 20% and the rest 4-5% remained for IWT (others like pipeline represents the remaining %). It is clear, that it had become a stable share between modals.

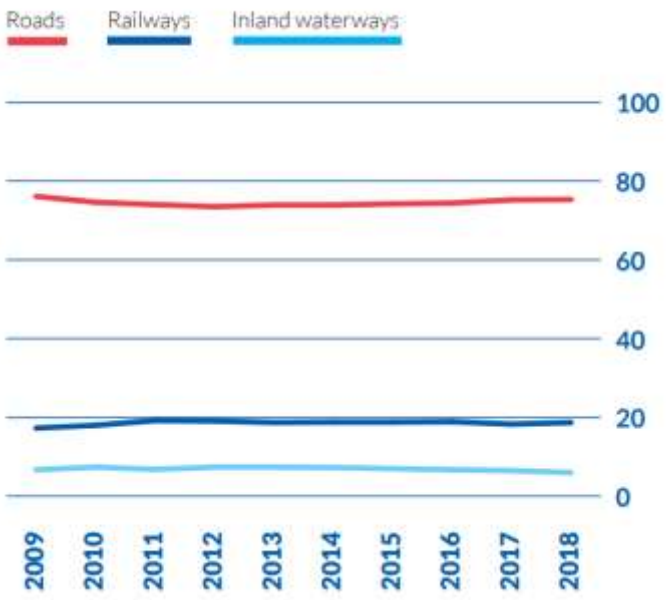

Figure 19: Modal split of freight transport (in %) 2009-2018 for EU 28

By understanding the amounts and trends in the region, please see below the bottleneck of the different networks by countries. The next topic highlights all the national and regional issues per transport mode, which gives a holistic view on the Danube regions present situation and business development requirement.

[18] CCNR Market Observation - Annual report 2020, Summary, Page 146

4.1.3 Identification of network bottlenecks

Based on the comprehensive country reports, the following chapter of the report presents a summary of the main identified bottlenecks hampering the proper functioning of all transport modes – rail, road and inland waterway. The results of this chapter will feed into the final part of the deliverable, providing recommendations to overcome the identified bottlenecks in a well-defined and coordinated manner.

4.1.3.1 Austria

Following bottlenecks were summarised after reviewing the 2020 Work Plans on the four relevant TEN-T Core Network Corridors.[19]

Motorway network bottlenecks

There is generally a high compliance to the KPIs and only minor bottlenecks registered.

Along the Rhine-Danube Corridor section there are some capacity bottlenecks especially in the sub-urban areas of Vienna.

Along the Baltic-Adriatic Corridor section, the only non-compliant sections are identified in the Austrian-Czech cross border area (A5 / D52) Brno (CZ) – Wien (Schwechat) (AT) [Mikulov (CZ) – Poysbrunn (AT)].

Railway network bottlenecks

The section on the Rhine-Danube Corridor München – Freilassing - Salzburg and connecting high-speed line Salzburg – Wien ("Neue Westbahn") will be upgraded until 2030. The corridor section Wien – AT/SK and AT/HU border regarding KPI train length is still underdeveloped.

Regarding ERTMS compliance, along the Rhine-Danube Corridor section, there are still following bottlenecks:

- The cross-border section Passau/AT is delayed from 2020 to 2023,
- the section Austrian border – Budapest is delayed from 2021 to 2024.

Rail-road terminals bottlenecks

The situation of Rail/Road Terminals on the Rhine-Danbe Corridor shall be improved by new constructions and upgrading measures in existing terminals. Projects designed to achieve compliance in existing terminals are planned in Austria (Linz).

On the Baltic-Adriatic Corridor section, there are some bottlenecks in the rail network within a short section in the core urban node of Wien: speed restrictions (the speed target of 100 km/h for freight transport may not be achieved).

Further critical cross-border sections on the Baltic-Adriatic Corridor section are:

[19] https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

- Works for the partial double tracking, upgrading and electrification of the Bratislava (SK) – Wien (Stadlau) (AT) cross-border section have commenced in October 2016 on the Austrian side and are expected to be completed by 2023.
- Works are ongoing for the modernisation and upgrading of the cross-border section Graz (AT) – Maribor (SI) on the Slovenian side. The axle load and speed standards are expected to be achieved on the existing line already by 2023, whereas the track doubling on the section is foreseen for completion by 2030. Subject to transport demand, studies on the upgrade of the section are planned to be carried out between 2022 and 2026 on the Austrian side.

Train length compliance may also not be achieved between Bratislava and Wien on the Slovak section Bratislava – Petržalka.

Along the Orient-East Mediterranean Corridor section, the bottlenecks regard the train length compliance, which is not given (0%).

Along the Scandinavian – Mediterranean Corridor section, the train length criterion might not be achieved in Kufstein – Innsbruck and on the mountain line from Innsbruck to Ponte Gardena in Italy. Further difficulties pose different electric voltage and signalling systems at the border crossing between Austria and Italy.

Port related bottlenecks

The port related bottlenecks in Austria are related to the underdeveloped clean fuel supply facilities. The completion of LNG bunkering station for vessels in the Port of Enns is planned for 2030.

4.1.3.2 Croatia

Critical bottleneck: lack of capacity in the short-medium run (bypass for freight trains needed): The most intensive long-distance cargo and passenger transport takes place along this sector, as well as the most intensive suburban area in the Republic of Croatia. Barring any large and radical efforts, Zagreb railway node shall not have sufficient capabilities to receive an increased railway transport as planed (inner suburban passenger transport and local cargo transport, inbound or outbound long-distance passenger and cargo transport, transit passenger and cargo transport).

There are requests regarding the increase of frequency and volume of suburban passenger transport in the Zagreb area, and it is expected that needs shall continue to grow. Thus, in order to accommodate all those demands and allow transit of the expected volume of transport through Zagreb railway node, it is necessary to expand the existing capacities and build new facilities to match construction and expansion of the corridor railways connecting to the node. Interventions are needed within Zagreb railway node, passenger transport on the state border – Botovo – Zagreb – Rijeka railway corridor should be carried out along a four-track Dugo Selo – Sesvete – Zagreb main railway station section and further on via a double track Zagreb Main railway station – Hrvatski Leskovac – Horvati railway section, while cargo transport shall be routed to Dugo Selo railway station bypass and further on via double track Dugo Selo – Zaprešić railway until it reaches Horvati junction. A new marshaling yard is expected to be constructed on that section.

Persisting bottlenecks - Slovenia-Croatia: on this cross-border section, which is part of the line connecting the two capitals Ljubljana and Zagreb, the line suffers from speed limitations (on the Slovenian side, only on one part of the section Ljubljana – Zidani Most) as well as limitations on train length on the Croatian side. The line is not in conformity with TEN-T standards and needs upgrading. On the Slovenian side, an upgrade to TEN-T standards is expected to be accomplished by 2030.

The limitation with regards to speed standards in Slovenia – to be completed by 2026 - and Croatia,

specifically, on the core sections linking the national network to the ports of Koper and Rijeka and in Italy on the connection Venezia-Trieste.

The MED corridor is the core network in which many kms are planned to be equipped before 2023 (3.103,67 kms) with Spain being the absolute leader. On the other hand, both France and Croatia do not have any plan to equip any section with ERTMS by 2023.

Identification of bottlenecks in Croatia's road system

Croatia takes, at this chapter, a pretty good stand against its peers in the EU. Ranking in the top 3 regarding road traffic and the quality of roads. Road bottlenecks are classified in three categories:

- Physical bottlenecks - global condition of pavement on the national roads according to the operating program for transport covering the period 2007 to 2013, 44% is acceptable, 26% is classified as fair, whereas 30% is considered rather poor.

A quarter of state roads have insufficient fund capabilities.

- Administrative and operational barriers - recent traffic counting system was provided for some

motorways and state roads. The plan is to expand the system in the upcoming years.

- Environmental and safety risks - risk of pollution increases, although progressively older cars are being replaced by new vehicles equipped with catalytic converters. Potential problem in terms of safety area rising, likely due to the reduction of resources for maintenance caused by the economic crisis.

As for the bottlenecks interfering into the Croatian ports, they are classified as following:

- Physical bottlenecks - Rijeka: container storage area is rather narrow, and space is limited, this being considered a severe bottleneck of the port of Rijeka. Increasing of container transhipment requires the construction of dry ports in the port hinterland and efficient railway connections.
- Low technical standards (compared to TEN-T Regulation) - research has shown that general cargo handling equipment in the port of Rijeka, except few recently installed harbour cranes are outdated. On the other hand, this partly modernised port equipment makes good ground for the development of a modern intermodal system. New pier with recently modernised ship-to-shore and yard equipment at existing container terminal allow a more competitive position of the terminal. Nevertheless, further rehabilitation of terminal and development of intermodal facilities are still needed.

- Administrative and operational barrier - low level of information integration among port community: a port encloses a high number of stakeholders which are necessary to be integrated within the local port community system. Lack of a strong national shipping line. Lack of common integrated development strategy of the seaports and atomized market. The concession system on the maritime property must be clear and transparent, by determining the method in which the maritime property should be evaluated, determining the concession fees, but with stronger economic and legal safety of the concessionaires. Currently, there are number of issues involved due to the lack of transparency of maritime property.
- Insufficient integration among transport modes - at the container terminal in Rijeka, there are no conditions for achieving a higher usage of railway-short range gauge that goes through the city. On the other hand, there are good highway connections created through modernisation in 2012. To have an undisturbed traffic flow for the Port of Rijeka, better road/rail infrastructure including a bridge to island Krk for the development of cargo terminals, is essential; LNG Terminal on Krk (project finished and successfully implemented) with the required traffic infrastructure; building of road section D403; importance of rail infrastructure to integrate port of Rasa (one of port of Rijeka terminals at Istria peninsula) to the rest of Croatian railway network.

4.1.3.3 Hungary

Currently, 27 kilometres long motorway section is missing between Vásárosnamény and the Ukrainian border, which is one of the major bottlenecks along the Mediterranean Core Network Corridor in Hungary. There are three HU road projects planned to construct the cross-border road section between Hungary and Ukraine, which is a main missing road link of the corridor crossing an EU external border. On the one hand, the works foreseen will extend the Hungarian M3 motorway up to the border between Vásárosnamény and Beregdaróc (HU/UA border). There is another project, which aims to connect motorway M3 and the Ukrainian border via a newly built M34 expressway (between Vásárosnamény and Záhony HU/UA). The third project is the M49 expressway project, which will connect the M3 motorway with the Romanian border at Csenger (HU/RO). In terms of prioritisation, the realisation of the HU/UA road missing link is one of the most important cross-border projects ensuring the smooth functioning of the corridor. These projects are still in the planning phase.

Other bottlenecks on the road network are the border crossing points with the non-EU and non-Schengen countries.

Railway

The major bottlenecks related to the railway network in Hungary are related with the axle load, number of tracks and the maximum speed along the railway lines. There are five lines with single track: line no. 20, 25, 40, 41, 100c and the section between Békéscsaba and Lőkösháza (HU/RO). In addition, there are also five lines with 21.0 t axle load: railway lines no. 20, 40, 41, 80a (currently under construction), 80, 100c and partially railway lines 100 and 120.

Currently, railway lines 40a (Százhalombatta – Budapest), 80a (Budapest – Hatvan) and 100 (Püspökladány – Ebes) are under reconstruction. Further reconstruction works will begin on the railway line no. 100 between Debrecen and Nyíregyháza in 2021. After the reconstruction works, 22,5 t axle load and the maximum speed of 120-160 km/h will be provided along the above-mentioned railway lines. In addition, railway stations will be renewed with 750-metre sliding tracks where necessary. A completely new section will be built between Százhalombatta and Ercsi (line no. 40a) so freight trains can avoid passing through urban areas.

Budapest (Hungary) – Lőkösháza (HU-RO border crossing) should have been in operation since 2018, but its completion was delayed to 2021. It should be noted that the border section in Hungary (Békéscsaba- Curtici) is not yet under construction, thus even the 2021 deadline might be endangered. The rest of sections in Hungary are delayed to 2024 (Austrian border – Budapest and Slovak border – Hegyeshalom).

Danube

There are three critical sections along the Danube where the draft of ships is less than 2 meters for 40 to 60 days per year. One of these sections is the Hungarian section of the Danube. There are 21 waders and 28 fairway constrictions at the standard low water level on the Hungarian and Hungarian-Slovak Danube section. In addition, there are 6 locations where ice dams can appear along the 378 kilometres long section. Unfortunately, these factors prevent to make shipping economically sustainable.

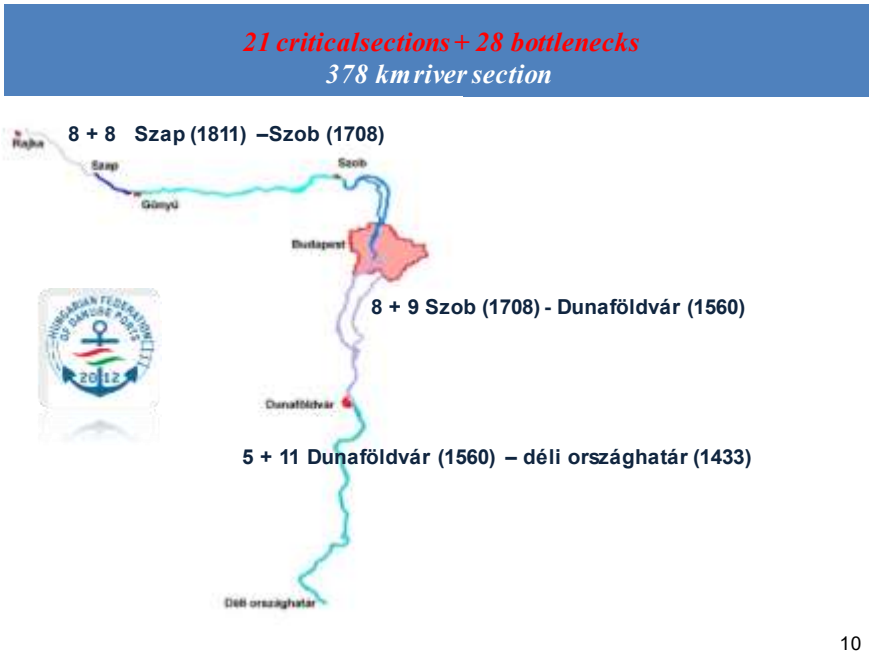

Figure 20: 21 critical sections + 28 bottlenecks (Hungary)

The fairway has not been maintained on the Danube for nearly 20 years, therefore, in case of low water levels, navigation is limited or in some cases not possible at all with ships complying with the

European standards. The hectic change of the water level of the Danube affects the navigability of the river as well as the utilized capacity of the cargo vessels.

Budapest

Budapest is a crucial node in the European transport framework, as the Mediterranean, the Orient/East-Med and the Rhine-Danube Corridors are all crossing Hungary through its capital city. The Node is particularly affected by the limited capacity of the Southern Danube Railway Bridge, the non-compliance of some of the core network corridors rail sections (between Budapest-Kelenföld and Budapest-Keleti railway stations), the missing rail link between Budapest Liszt Ferenc International Airport and the national railway network, the lack of a proper road link to the capital urban area and the airport as well as the missing North-Western section of the Budapest ring road (M0).

To improve the bottleneck sections within Budapest, several new projects started or are currently under preparation. The Southern Danube Railway Bridge is currently being extended with a third track (by building a completely new third bridge next to the already existing two tracks). The construction of the new track and the renovation of the existing two ones is expected to be completed in 2022. At the same time, the construction tender for the railway line between Budapest-Kelenföld and Budapest-Ferencváros had been issued. The plan is to extend the currently existing two tracks on this section up to 3 (or in some areas up to 4) tracks. This would allow to run both freight and passenger trains more frequently. Further sections on this line towards Kőbánya-Kispest, Budapest-Keleti and Rákos are also under planning (construction tender is expected in 2022). The plans also include the connection between the national railway line and the Budapest Liszt Ferenc international Airport.

4.1.3.4 Serbia

Motorway

Major bottlenecks along main international routes are the BCPs, where the delays represent a substantial percentage of the total travel time. There are several ongoing projects for the expanding of border crossings for road transportation which are identified as bottlenecks.

Railway

The bottlenecks identified are low speed on the existing railway infrastructure and the short length of the electrified line. The installed safety system has been in operation for over 40 years, which means that the devices are technologically outdated, and it is very difficult to find adequate spare parts. Due to the size of the network and the number of necessary investments, projects are listed according to their priority.

Inland waterways

In case of low water levels, navigation is limited or in some cases not possible at all with ships not complying with the European standards. The change of the water level of the Danube affects the navigability of the river as well as the utilized capacity of the cargo vessels.

Bottlenecks have been identified in places where navigation is difficult due to low water levels. On the section from Belgrade to Djerdap II, there are no problems in terms of the navigation because of the construction of the HEPPs Derdap I and Djerdap II. On the other hand, several sections critical for navigation have been identified on the upstream sector from Belgrade and along the joint section with Croatia.

The project Hydrotechnical and dredging works on the critical sectors on the Danube River in Serbia, between Bačka Palanka and Belgrade, is underway. The project's aim is to eliminate six critical sectors on the stretch of the Danube River between Belgrade and Backa Palanka, from km 1287 to km1195, whereby the safety of navigation on Serbian inland waterways will be significantly improved. The main activities of the Project include construction of hydro-technical structures and dredging of fluvial sediments in compliance with the environmental protection requirements.

Works will be conducted at six following sectors:

- Susek, from km 1285.6 to km 1281.4, dredging of alluvium;
- Kamičak, from km 1266.2 to km 1265, construction of a chevron and a groin;
- Arankina Ada, from km 1247 to km 1244.8, dredging of alluvium;
- Čortanovci, from km 1248 to km 1246 and from 1241.6 to km 1235, construction of hydrological engineering structures in the right tributary;
- Beška, km 1229,7- km 1227,9, dredging of fluvial sediments, and
- Preliv, from km 1199 to km 1197.7, construction of two chevrons upstream of Belegiška Ada.

This project will contribute to improve the conditions and safety of navigation, which is of great importance for the Republic of Serbia, bearing in mind that in the classification of the main transport corridors of the EU, Danube is part of the Rhine-Danube Corridor and that 87% of the total volume of water transport is generated on the river Danube, and most of the transshipment is done in ports on the section between Bačka Palanka and Belgrade.

The critical sector with the Republic of Croatia is still unresolved.

Development and installation of the navigation monitoring and electronic fairway marking system the Danube river (ATONS) was finished.

The introduction of the AIS AtoN technology in marking of waterways and management of the fairway marking system is a significant improvement compared with the traditional methods used in inland waterways. By realisation of this Project more than 160 navigation buoys will be allocated on the Danube River which are equipped with AIS AtoN transponders that will enable real-time monitoring of the condition of the marking system and at the same time make the navigation buoys more visible for all the participants in navigation by using the AIS and ECDIS systems on the ship deck. The modern supervision and early warning system and management of the fairway marking system will enable centralized supervision, faster and more efficient decision making, better planning and it will additionally enable immediate electronic marking of the fairway that is visible to the direct participants in navigation by the usage of relevant devices. Through the usage of the electronic navigation charts, participants in navigation will always be informed of the position of the fairway, irrespective of the actual navigation conditions (fog, night, damage to the existing

buoys for fairway marking, etc.) and under conditions where it is impossible to physically mark the fairway or where such marking requires time.

To eliminate bottlenecks due to insufficient capacity in the ports in the export season, projects started to expand capacities in the ports Bogojevo, Prahovo, Smederevo, Sremska Mitrovica and the construction of the new port of Belgrade. The total investments value in infrastructure is 200 million euros, in total investments value over 400 million euros.

4.1.3.5 Slovakia

Motorway

Major bottlenecks related to road transport may be divided into three groups, unfinished motorway connection between the capital city of Bratislava and eastern Slovakia (D1, TEN-T Rhine Danube Corridor), congestion of roads around some agglomerations (Bratislava, Prešov) and unfinished motorway connection from Žilina to border with Poland (Baltic-Adriatic Core Network Corridor).

Sections of Rhine Danube Core Network Corridor are not yet fully connected. This causes congestions and reduction of speed limits what refrains from using the full potential of the corridor. Sections that are missing are on hilly terrain, therefore significant part of roads must be build either on bridge or tunnel, significantly increasing the costs and duration of construction. Missing links are D1 Liet. Lúčka - Višňové - Dubná Skala (13,5 km), D1 Turany – Hubová (13,5 km), D1 Hubová – Ivachnová (14,9 km), D1 Prešov západ - Prešov juh (7,9 km).

Missing links between Žilina and border with Poland under Baltic-Adriatic Core Network Corridor are D3 Čadca Bukov – Svrčinovec (5,7 km), D3 Kysucké Nové Mesto – Oščadnica (10,08 km), D3 Žilina Brodno - Kysucké Nové Mesto (11,2 km).

Congestion in Bratislava (Project "D4R7")

Missing connection between road D4 Jarovce - Ivanka Sever (22,6 km) and Expressway R7 Prievoz – Ketelec (6,4 km).

Route shortening 4,6 km

Route length - current route: 8,0 km

Route length - expressway: 3,4 km

Time saving for car / truck: 13,7 / 13,3 min.

The aim of the D4 Motorway and R7 Expressway project is to build the southern part of the zero bypass of Bratislava and a part of the southern network of expressways connecting the west and east of Slovakia. The D4 motorway and the R7 expressway with a total length of more than 59 kilometers will serve as the outer bypass of the capital. The overall scheme includes the construction of 14 junctions and 122 bridge structures, including a new bridge over the Danube River and a viaduct.

Congestion in Prešov - Prešov západ (west) – Prešov juh (south)

The section of the D1 motorway is part of the route Bratislava - Žilina - Košice - Užhorod (Ukraine). At the same time, it is included in the international road network under the designation E 50, to

which the international road E371 is connected, leading from Prešov via Svidník to the border crossing Vyšný Komárnik - Barwinek to the Republic of Poland. The new section of passenger cars will be shortened by 19 minutes, and by 18 minutes. As part of the land reclamation, 58,000 shrubs and approximately 500 trees will be planted. The motorway section will be almost 8 km long, there will be 18 bridges on the route (the basic division is in Table 1), the Prešov double-pipe tunnel with a length of over 2 km, 17 crossroads branches and 6 km of noise barriers.

Other bottlenecks according to The Strategic Plan for the Development of Transport in the Slovak Republic until 2030:

Unapproved and unapplied change of road network concept

The current layout of the road network dates to 1946 and 1950, except for motorways and expressways. Although many changes have taken place in the road network itself since then, the principles on which it is based have not changed in any significant way. In addition, changes to the road network have been carried out on an ad-hoc basis since the late 1970s, as the previous rules have ceased to be practical, but no newer ones have been defined.

Regarding motorways, the first concept of a network of motorways and roads for motor vehicles was approved in 1963 and, in contrast to the concept of a network of roads I to III. class was later updated several times. The division of Czechoslovakia was reflected in the material "New project for the construction of motorways and expressways", which was approved in 2001 and later amended several times.

The principles of the newly proposed concept will be reflected in the draft of the new Road Act, which should replace the more than 50-year-old Act no. 135/1961 Coll. on Roads (Road Act), which is unsatisfactory in view of current needs (despite several amendments).

High intensities of trucks on 1st class roads

Significantly congested roads (according to the Strategic Transport Model of the Slovak Republic) are sections of road I / 18 in the route of the planned D1 motorway (eg critical traffic in Ružomberok and Prešov), but also the continuation of road I / 18 from Prešov via Vranov nad Topľou to Strážské. and also, the section of the road I / 10 between Bytča, Makov and the state border with the Czech Republic, ie the most important connection of the western and eastern part of Slovakia through its northern part from the Czech Republic to Ukraine. The share of heavy freight transport on the road I / 11 together with the road I / 12 between Žilina and Čadca to the Czech Republic and Poland is alarming, where it is largely a transit in the north-south direction and transport between car manufacturers near Žilina and Czech Nošovice. On the long term, it is necessary to ensure the exclusion of traffic from urban areas of municipalities within the road I / 59 between Dolný Kubín and the state border with the Republic of Poland.

Railway

Insufficient link between the collection of transport data and their evaluation, the unavailability of a database describing transport flows in rail freight transport.

The road haulage database is insufficient or completely unavailable. Without sufficient information on the directionality of flows and the type of commodities transported (in all modes of transport),

it is not possible to define and justify effective measures for shifting from road to rail, promoting intermodal transport or the segment of individual wagon consignments. Trade secrets of private freight carriers must not be an obstacle to a detailed description of the freight traffic on the transport network. The non-provision of traffic data by carriers makes it impossible for the state to target infrastructure measures, which ultimately affects freight transport itself.

Insufficient functionality of the railway junction in Bratislava

The largest Slovak agglomeration, which is also adjacent to the largest Austrian agglomeration, is already showing the lack of capacity of railway lines. Bratislava lies at the crossroads of several important pan-European freight corridors. In addition to two freight railway corridors (RFC 5 and 7), the Bratislava River also flows through the Danube River, which is an important source and destination for the preparation of commodities, which are further provided inland only by high-capacity rail transport (bulk substrates, liquids). Further growth in demand for preparation can be expected due to continued urbanisation, growth in the number of long-distance passengers, freight transport and regular commuters. The Bratislava railway junction is the main (or one of the main) supporting points of the entire Slovak railway system and its adequate functioning is a prerequisite for economic growth and sustainable transport development. The influence of the railway junction extends beyond the borders, including Vienna and the entire Slovak-Austrian-Hungarian-Czech metropolitan (functional) region. Capacity limitations of stations are a potential problem affecting the railway junction, especially the Bratislava main station.

Capacity problems and interoperability constraints on RFC lines (Rail Freight Corridors)

Two of the three Slovak RFC corridors are routed through the Bratislava junction. The port of Bratislava-Pálenisko is the main access point of Slovakia to the European network of inland waterways and in Dunajská Streda there is an intermodal transport terminal (TIP). This terminal has long had the largest volume of processed intermodal transport units of all Slovak TIPs, even though it is not part of TEN-T or RFC (it is connected to the corridors by a low-capacity single-track and non-electrified line Bratislava - Komárno). It should be noted that in the Bratislava junction and the whole Bratislava region there is a great potential to increase the number of passenger trains and that many lines in important transport directions (especially cross - border lines and the line Bratislava - Dunajská Streda - Komárno - No. HU border) are only single - track. Nevertheless, the problem of insufficient capacity may remain hidden. Rail transport, unlike road transport, is firmly organized and the railway operator does not offer freight routes that would not be possible. As a result of the (positive) development of passenger transport, routes for freight trains are being pushed to unattractive locations and their quality is deteriorating (frequent stops, long stays due to transport reasons). As a result, the potential demand for freight transport is discouraged, without manifesting itself in the form of standing columns as on the road. To reduce this phenomenon, it is necessary to maintain a slight predominance of infrastructure capacity (supply) over the current demand and to observe the acceptable quality of the offered routes also for freight trains.

Insufficient strategy for further development of intermodal transport and segment of individual wagon consignments

For strategic decisions in freight transport, it is first necessary to know in detail the current volume and direction of transport and the type of commodities transported, not only in rail but also in road freight transport (lack of transport surveys). Without this knowledge, it is not possible to responsibly define and justify the requirements for intermodal terminals (TIP) or set-up stations in the case of the transport of individual wagon consignments. The development in the stopped preparation of the construction of other public terminals of intermodal transport depends on the evaluation of the impact of the TIP Žilina-Teplička on the transfer of goods transport from road to rail and on the development of performances of other non-public terminals.

Waterway

Bottlenecks on Danube main flow[20]

According to information published at Danube FIS Portal, there are currently 21 bottlenecks on the Slovak section of Danube, out of which one is considered critical.

Insufficient navigation conditions on the Danube

Insufficient navigation parameters in the section between the mouth of the Morava River and Bratislava are caused mainly by some shallows (fords) and straits, for which even with the provision of regular dredging work, it is not possible to ensure guaranteed navigation conditions, meaning minimum navigable depths as well as widths. A total of 5 localities in this part (of which 4 on the common Slovak-Austrian section) were identified by the EU Strategy for the Danube Region from 2014 as critical, including a naturally narrow place, a stone threshold in the Devín profile. The effectiveness of treatment interventions (dredging, shoots) is exhausted in some sections, because the bottom of the section is exposed to Neogene. Insufficient navigation parameters in the section between Sap and Štúrov, caused by the implementation of only an alternative solution of the Gabčíkovo - Nagymaros Waterworks System (SVD G-N), called "Variant C", with a smaller delay and dam of the Danube near Čunovo in Slovakia, t. j. by putting into operation only the Gabčíkovo Waterworks, they represent a characteristic navigation barrier on the Danube waterway.

Influence of Gabčíkovo Hydroelectric Power Plant (VEGA) operation management, resp. manipulation of flows on VEGA, on fairway parameters

Another problem on the section of the Danube Bratislava - Sap is the issue of managing the operation of the Gabčíkovo Hydroelectric Power Plant (hereinafter "VEGA") and its impact on the parameters of the fairway. Manipulation of flows at VEGA should ensure optimal use of the hydropower potential of the Danube River, as well as all other functions of VD Gabčíkova. However, because the buffer tank of the Nagymaros Waterworks (VDN), i. j. The lower balancing reservoir below the Gabčíkovo stage, which would eliminate flow fluctuations caused by VEGA's peak operation and could thus ensure the parameters of the fairway in the section of the Danube below

[20] https://www.danubeportal.com/bottleNeck/filterBottleneck

the Gabčíkovo stage, is limited by the swelling of the Danube level. The consequence is that it is not possible to produce peak energy at VD Gabčíkovo and the parameters of the fairway are limited. In 2015, e.g., there was a problem when in the section above the Gabčíkovo waterworks the Hrušov reservoir and its own fairway were clogged with a large amount of sediment. These were at a depth just below the marked fairway, so it was necessary to relocate the fairway, which also limited the possibility of further energy use of the waterworks.

Inadequate operational condition of the Váh Waterway

The Vážská waterway was built from Madunice to Žilina. It is run along derivation channels also designed for navigation purposes, but due to its not conceptual attitude it was completed only for energy and water management purposes and its energy levels are fitted with unfinished navigation chambers. As a result, only the upper gates of the locks are in operation, which are used only for the discharge of large waters, but not for the passage of vessels. Selice water level is not completed as well, due to lack of funds.

In the section Komárno - Hlohovec the sections Komárno - Waterworks Selice remain unfinished, where due to the lack of the Nagymaros Waterworks in the section between Komárno and the VD Selice lock chamber there is considerable fluctuations in levels and insufficient navigation depth, and the section Waterworks Kráľová - Hlohovec (Madunice). It is assumed that the necessary usability of the waterway will be achieved in these sections only by the completion of existing and missing waterworks. This would open the possibility of alternative transport to industrial centers in adjacent areas. However, this assumption needs to be verified through feasibility studies as well as demand studies.

In the section Hlohovec - Žilina, conditions are created only for navigation in the navigation channels of the Váh cascade and on water reservoirs. The locks were only partially built and will need to be reconstructed and rebuilt. The lock chambers are not built at all on the Nosice and Hričov reservoirs and the VD Mikšová and Považská Bystrica stages.

4.1.3.6 Romania

Road

As of 31.12.2020, the total length of the public roads in Romania was of 86234 km, of which 17740 km (20.6%) national roads, 35085 km (40.7%) county roads and 33409 km (38.7%), communal roads. From the point of view of the type of road surface/pavement type, the structure of the public road network registered: 36689 km (42.5%) modernized roads (in proportion of 92.4% modernized roads with asphalt pavements of heavy and medium type), 21298 km (24 ,7%) roads with light road pavement and 28247 km (32.8%) paved and earth roads.

Regarding the technical condition of public roads, 38.4% of the length of modernized roads and **46.6% of the length of roads with light road coverings had exceeded the service life.**

Of the total national roads, 35% (6,176 km) are European roads and about 5% (889 km) are highways. In terms of the number of lanes, 11% (1,923 km) are 4-lane roads, 1.6% (290 km) are 3-lane roads and 0.2% (35 km) are 6-lane roads. The Romanian motorways are A1, A2, A3, A4 and

A6. 40.4% of the county roads were modernised roads and 38.2% of the communal roads were paved roads.

Railway

On 31.12.2018, the public railway lines in operation had a total length of 10765 km, of which 10627 km (98.7%) normal gauge lines, 134 km (1.3%) wide gauge lines and 4 km long gauge lines narrow gauge.

The density of the lines per 1000 km2 territory was 45.2 ‰. The highest densities are recorded, in order, in the Bucharest-Ilfov region (154.7 ‰), the West region (58.9 ‰), the South-East region (48.8 ‰) and Northwest region (48.7 ‰). At the same time, the single length of the electrified operating railway lines was 4029 km, representing 37.4% of the railway network in operation.

The rehabilitation and modernisation of the railway infrastructure related to the East / East-Mediterranean corridor on the Romanian territory aims at implementing uniform characteristics throughout the corridor.

Inland Waterway

The main bottlenecks faced by inland waterway transport in Romania are:

- ensuring the navigation depths on the Danube all over the year;
- very poor technical condition of the infrastructure in the ports;
- the bad condition of the railway and road connections of the ports with the national roads and railways network;
- border control;
- port tariffs.

In the past, up to 2016, the navigation on the river Danube was hampered due to draught during the dry season mainly on the Romanian - Bulgarian common sector and in the area of Bala – Borcea arm.

The draught was a result of inproper maintenance (dredging works) to ensure the minimum depths on some critical points. The vessels blockage reached up to 80 days per year.

On the Romanian – Bulgarian common sector, in the last years, due to the increasing of the volume of dragging works, the necessary depth was ensured and navigation was possible all over the year. In the area of Bala – Borcea arm the situation is the same.

Regarding the port infrastructure, it is very old, and the maintenance works are not executed on time and in the necessary volume.

Regarding the railway and road connections of the ports with the national networks, they are damaged or in certain ports entirely missing (the railway connections from the ports of Oltenita, Giurgiu, Corabia and Bechet).

Regarding border control, the problems that arise are those related to the large number of documents required, the fact that the authorities do not use the RIS system and the working program of the customs offices.

Especially due to the working program of the customs offices, the ships could encounter delays of 2 - 3 days.

Concerning the port tariffs, they are very high compared to the services offered by the port administrations (maintenance and repair works on the transport infrastructure, utilities etc).

4.1.3.7 Ukraine

In Ukraine, the following bottlenecks can be identified:

- the imbalance in the development of transshipment capacity and public infrastructure (road and rail access roads to seaports, electricity, gas, water supply, etc.), in particular the capacity of railway stations: Odessa-Port, Mykolayiv-Freight, Zhovtneva, Kamysh-Zorya-Volnovakha lines in the direction of Mariupol, M-28 and M-14 state roads and municipal roads in the cities of Odessa, Mykolayiv, Mariupol, Berdyansk, Kherson;
- the low coordination level in the activities of transport and local authorities to ensure port infrastructure development, the organisation of traffic in the direction of the seaports;
- the low efficiency of using the potential of existing transshipment capacities;
- the lack of an effective mechanism for attracting private investment for the port infrastructure development;
- the underdeveloped transport infrastructure in the seaports (lack of sufficient deep-water anchorages, storage sites for vehicles, etc.);
- the insufficient level and inconsistency of depths in some seaports and canals with passport characteristics;
- the slow fixed assets renewal at transport enterprises of the public sector, non-compliance of their technical level with modern requirements for the provision of services for cargo, ships, rolling stock, etc.;
- the insufficient implementation level of electronic registration systems for cargos and vehicles;
- the lack of a law on inland waterway transport, which is a major obstacle for attracting private investment in the river infrastructure development;
- the customs clearance procedures imperfection, problems which are connected with crossing the state border and the presence of corruption-causing factors in the relevant control services;
- the imperfect tariff policy in the field of services in sea and river ports;
- the slow implementation of measures to expand the list of cargo operations services, which would ensure the creation of additional value in the port;
- the lack of fully functioning free economic zones;
- the unrealized potential of river transport for cargo transportation to / from seaports;
- the insufficient informatization level of transport processes and the information interaction organization with the subjects of controlling bodies.

Rail

Ukraine has a very high share of rail transport in the grain transportation from the linear elevators to the seaports. This situation makes the Ukraine's grain market very vulnerable to all the processes taking place in Ukrainian Railways.

In 2019, there was a main production indicator deterioration of Ukrainian Railways for the transportation of grain cargo (except for the total volume of transportation), namely:

- the average speed reduction of the grain trains to 85-90 km per day (instead of the standard 200-320 km per day);
- the grain turnover deterioration from 12-14 days to 15-16 days;
- the reduction of grain truck operation. In 2019, a new problem appeared - grain trucks surplus. After all, over the last year the total fleet of such cars in Ukraine has increased by 5,500-6,000 to 27,000-27,500 grain trucks (monthly increase of 500-800 cars);
- the growth of the grain trucks fleet against the background of rolling stock falling speeds leads to additional problems for the railway network, the reduction of its total capacity and the increase of "abandoned" trains. This is 15-17 thousand cars or about 10% of the car fleet.
- the limited capacity of Ukrainian Railways port railway stations. At the moment, the maximum capacity of port railway stations is about 2,000-2100 wagons with grain. In fact, averages of 1,400-1800 wagons per day are processed. To solve this problem, Ukrainian Railways created in 2018 a separate directorate within the Odessa Railway - DN-5.

The railway grain transportation bottleneck is caused by a long period of wagons turnover, which is on average about 10 days. This leads to delays in the wagons supply for loading into elevators, the transhipment capacity of which does not provide the proper loading intensity. One of the options for solving the problem is "work routes", which is that the elevators are loaded not on individual wagons, which are then docked at the stations to the trains, but full-fledged trains, which immediately go to the destination. For the first time, experimental transportation of grain by rail was introduced in February 2012 at the initiative of one of the largest agricultural enterprises in the country - the company JV "Nibulon". Due to the company's operational work to ensure the route loading at the place of departure, effective unloading at the destination and empty wagons return, a significant reduction in the turnover period was achieved.

However, almost 80% of line elevators are now virtually cut off from the rail infrastructure or have difficulty accessing it. Today, only about 10% of linear elevators can ship grain in whole "routes" to the rail transport. These "route" elevators are located on the territory of Ukraine unevenly and do not cover all areas of grain production. They are located at 77 railway stations, with 36 stations - part of the South-Western Railway, 23 - on the Southern Railway. And on the Lviv railway there are only five stations, on Prydniprovska - two, on Donetsk - only one route station.

The deregulation consequences of the tariff (wagon component) have led to a significant increase in the cost of the grain transportation by rail - almost twice in 2019. According to market participants - rolling stock operators and shippers, the main barrier to entry into the railway market is the impossibility, in accordance with current legislation, to use their own traction rolling stock (locomotives) for transportation by public railways.

The road transport dominates in the grain cargo transportation over short distances, ensuring cargo safety, the urgency and the transportation reliability. Compared to 2018, tariffs for transportation by grain trucks have increased at a distance of up to 100 km, but for long-distance services up to 300 km have fallen.

Among the main problems in the motor transport sector of the grain market infrastructure are:

- Constantly rising fuel prices cause an increase in the transportation tariffs;
- Poor condition of the road coverage, especially at the territorial level, leads to an increase in depreciation and the cost of resources and time to repair vehicles;
- Inefficient use of the heavy-duty grain trucks, due to poor roads and the lack of appropriate shipment area in the elevators, does not fully minimize the grain cargo transporting unit cost;
- Low capacity and low allowable burden for port roads;
- Shortage of grain truck drivers. According to rough estimates, about 10% of the grain truck fleet is idle due to lack of professional drivers (deficit - 3-5 thousands of drivers);
- Uneven effect of dimensional and weight control on the territory of Ukraine. This allows some companies to transport goods in the rules violation;
- Systematic downtime associated with the expectation of cargo operations, which leads to low turnover. Due to the weak organization of automotive logistics, grain trucks are systematically waiting for freight operations.

Inland water transport

River transport is the cheapest, most environmentally friendly and efficient in the world. But currently Ukraine uses its river potential only by 10-15%. Over the past 20 years, the flow of goods by river transport in Ukraine has decreased by 6-7 times, although the volume of traffic has recently tended to increase.

As a result of such a decline and chronic underfunding of the inland water transport infrastructure, the cascade of reservoirs on the Dnieper River was on the verge of a man-made disaster. Currently, 85% of the navigable locks infrastructure is worn out, and 90% of inland vessels are morally and physically obsolete. Therefore, the significant investments are needed for construction the river terminals, barges, for organizing the multimodal transport connections and logistics. The lack of an approved basic law in the industry is a major obstacle to attracting private investment. Without clear rules of the game, international companies are not ready to invest heavily in the development of the river transport.

The main issues of grain cargo transportation by river transport include:

- General fleet deficit in Ukraine. Limited number of participants in the Ukrainian market of grain cargo transportation by river transport, the total fleet of which does not exceed 130-150 vessels (the deficit is estimated at 80-100 vessels);
- Reduction of capital investments in the industry with a high level of fixed assets depreciation destabilizes the work of enterprises in the river transport market. Due to lack or extreme fleet obsolescence and hydraulic structures unsuitability for use, the river transport becomes unusable or economically inefficient and dangerous;

- The needs for dredging work on some waterways sections and increase the total length of Ukraine's waterways. During Ukraine's independence, the total length of waterways decreased from 4,600 km to 1,900 km. In some parts of the Dnieper, the depth of waterways has decreased from 3.6 m to 2.5 m. The funds lack and low waterways modernization level does not allow keeping them in good working condition and poses a threat of the environmental catastrophe. Underfunding of the main shipping routes and hydraulic structures causes a reduction in the volume of dredging works;
- The unruled water discharge from hydroelectric power plants, significant change in the water level in reservoirs, change in the waterways depth;
- The insufficient using of the inland waterways existing capacity, in particular, due to the inefficient management mechanism, which reduces the resource potential using of the river transport and leads to the transport infrastructure destruction and the coastal areas decay;
- Lack of basic legislation on the development of river transport and outdated state regulation ideology of inland waterway transport slow down the reforming process of the industry and the river navigation revival;
- Lack of strategic documents on the development of the industry aimed at ensuring the shipping companies effective development, increase the level of the inland waterways infrastructure efficiency, including port infrastructure, terminals, locks, canals, other hydraulic structures and adjacent lands, and which would be developed taking into account the requirements of cargo owners, freight forwarders, operators of private berths (terminals), which makes it impossible to attract additional investment in the industry and modernisation of fixed assets, ensuring their technical and technological re-equipment in accordance with international standards;
- The absence of the International Ships Register in Ukraine hampers the comfortable conditions creation to encourage shipowners to register vessels under the Ukrainian flag. This, in turn, does not allow Ukraine to fully realize its potential for the effective development of domestic shipbuilding;
- Unregulated relations between private river port owners and public authorities regarding the fees and charges establishment, in particular for the public hydraulic structures using, maintenance of port aquatorium, pilotage, and the lack of special mechanisms to regulate the activities of stakeholders by defining clear functions and responsibilities leads to unjustified additional costs for both the state and business entities;
- The competition intensification in the Danube freight market in the context of shrinking cargo base in combination with high interest rates on loans and burdensome taxes on Ukrainian shipping companies, which are higher than those levied on shipowners in other countries, lead to attempts to register serviceable vessels under a more convenient flag than Ukrainian;
- Lack of an effective financing system for the maintenance and operation of the Dnieper Cascade gateways, taking into account the limited capabilities of the state budget and the

lack of funding from the energy company, as well as clear state control over the targeted use of funds;

- The competition with road and rail transport, which arose due to the entrepreneurs switched to transport small consignments of goods by own or hired road transport, and large consignments of goods - by the rail transport in connection with the establishment of lower freight rates for rail freight;
- Insufficient navigation safety level on the Dnieper, Southern Buh and Danube increases the risk of accidents.

4.1.3.8 Bulgaria

Considering the country's geographical location and the fact that five of the ten Trans-European Transport Corridors pass through its territory, the small share of motorways and four-lane roads can be determined as a significant shortcoming of the national road network.

It is necessary for the activities, related to the removal of identified "bottlenecks" on the road network in Bulgaria, to continue. The completion of the "Struma" motorway, the construction of the "Ruse-Veliko Tarnovo" motorway and the tunnel under the Shipka peak are of essential importance for improving the connectivity and development of cross-border connections.

The „Hemus" highway is part of the European Road network, from the connection with corridor №4 in the west to corridor №9 close to Veliko Tarnovo. The plan is to connect Bulgaria's eastern and western parts with the Trans-European network. At the end of December 2018, the Council of Ministers decided that road I-8 Kalotina - Sofia will be part of the future motorway "Evropa". The motorway will connect its already built parts in the western and eastern end with the cities of Pleven, Lovech, Veliko Tarnovo, Targovishte and Shumen. Motorway „Hemus" will also provide a connection with the port of Varna, which is essential for the trade with Ukraine, Russia and Turkey.

At the end of December 2018, the Council of Ministers decided that road I-8 Kalotina - Sofia will be part of the future motorway "Evropa". 31,5 km of the existing road I-8 Kalotina-Sofia in the area from Kalotina to road junction "Hrabarsko" will be reconstructed and a new road will be built from road junction "Hrabarsko" to the North Speed Tangent.

Road I-8 is a major road artery, part of Corridor № 10, its modernization will develop and improve the redistribution of transport flows on the Trans-European Transport Corridors №4 and №8 in the direction of the sea border at Burgas, Turkey and Greece. Through its connection with Corridor №4 from the Trans-European Transport Network, the route will improve the opportunities for tourism development.

It is also necessary to build the northern Danube road Vidin - Lom - Svishtov - Ruse - Silistra, which will improve transport accessibility to the coastal industrial zones and will therefore increase the investors' interest in them. Currently, the connection of most Danube ports with the main roads of the country is done via second-class roads, most of which are in bad condition. This requires urgent repairs and modernization, with the aim of removing the bottlenecks and increase the bearing capacity of their pavement.

A core problem, identified in relation to the characteristics and qualities of the infrastructure in the main directions of the Bulgarian part of the TEN-T corridors, is the lack of continuous, consistent and permanent transport networks, which could ensure fast and safe movement over longer distances.

Railway

There are not enough connections of the national railway network with the sea and inland waterway ports and airports, in terms of increasing the potential for development of intermodality. Regarding the railway infrastructure, it was established that there is not enough integration of the national railway network with the European railway system and there is a need to bring the technical characteristics of the main directions in line with the requirements of Art. 39 of Regulation (EU) № 1315/2013.

One of the three projects for Bulgaria, included in the railway system integration program of the countries of Central and Eastern Europe that have joined or are waiting to join the European railway network, is the railway Greek-Bulgarian border - Sofia - Vidin - Budapest – Vienna - Prague – Nürnberg.

Work needs to be done on improving the condition of the Ruse – Gorna Oryahovitsa railway, because in this respect the Ruse railway station is of great strategic importance for the implementation of combined transport on the European transport corridors №7 and №9.

At the same time, the poor operational condition of some sections of the railway network does not allow reaching the desired speed. The technical parameters of the railway network do not meet the requirements for a safe and comfortable transport.

Inland waterway

There are some risks and problems connected with the fluctuation of the Danube river level due to periods with low water level, leading to limited navigation /for all Bulgarian river ports/. That reduces the transshipped cargo volumes, usually during the summer period. The two most narrow sections of navigation are at the island of Belene (rkm 577 - 560) and in the section between sandbank at Karageorge and Cernavoda (rkm 344 - 300).

The development of intermodal terminals, which connect the ports with the railway network, is restricted. The available container transport terminals were built in the 70's and 80's of the last century and do not meet the requirements for performing modern freight transport services. There is no national network of modern intermodal terminals to serve the needs of the rail and water freight transport.

4.1.3.9 Moldova

The national central network provides direct connection to corridor 7 "Orient/East-Mediterranean" and corridor 9 "Rhine-Danube". Due to these connections Republic of Moldova obtains indirect access to virtually all TEN-T corridors.

The national transport infrastructure at the time of 2019 is characterized by the following data:

- length of public roads - 9432 km, of which rigid clothing - 9146 km (0.27 km/km2);

- length of general-purpose railway line - 1150 km (0.034 km/km2);
- length of waterways, waterways for general use - 410 km.

The road infrastructure does not have a motorway. The central road network consists of roads of

technical category II and III, including the expressway. Maximum speed 90-110 km/h. Railway lines are not electrified. Railways have priority with a single line. Only GIFP works effectively in domestic shipping. Shipping specializes in the transportation of fuel, coal, metal, containers, construction materials and grain.

The main advantage of GIFP is the direct access along the Danube River to the markets of the countries of the European market, including the seaport of Constanta, as well as through the Black Sea to other international ports. The port has three modal transport infrastructure and a free economic zone. However, in the structure of freight traffic, no more than 1% of the total volume is transported by water transport. Another 22% of cargo is transported by rail and 77% by road.

Based on the comprehensive research provided by the national country report, the following main bottlenecks concerning Moldova have been identified:

- Transport time between Giurgiulesti and Chisinau is inacceptable high (three days for about 225 km are not an exception).
- Consolidation of railway units in Bessarabiaska causes long delays.
- The technical condition of the Cahul route is not good and limited to 1,000 tons per transportation unit.
- The route via Ukrainian territory requires transit declarations incurring additional administrative expenses and time delays.
- For the route via Ukrainian territory international tariffs are applied causing additional transportation costs.
- National tariffs should be applied for transportation from Chisinau to Giurgiulesti.
- The wagons for loading and unloading at the terminals are provided and taken out by shunting services provided by Giurgiulesti railway station with a locomotive. However, from time to time these services are difficult to schedule causing incalculable waiting times and delays of loading and unloading processes.

Indeed, it would be good if the port operator has the right to take out and bring back wagons by itself with its own shunting machine. In this case, the main operator of the „Danube Logistics" LTD would be able to provide its customers with local railway services. Given the large volumes of traffic that „Railway of Moldova" carries out, thanks to the activities of the port, the latter could create its own small subdivision under the „Danube Logistics" LTD.

4.1.3.10 Summary

The following map provides an overview on the most critical fairway conditions along the Danube:[21]

[21]https://navigation.danube-region.eu/wp-content/uploads/sites/10/sites/10/2020/01/FRMMP_national_action_plans_Oct2019.pdf

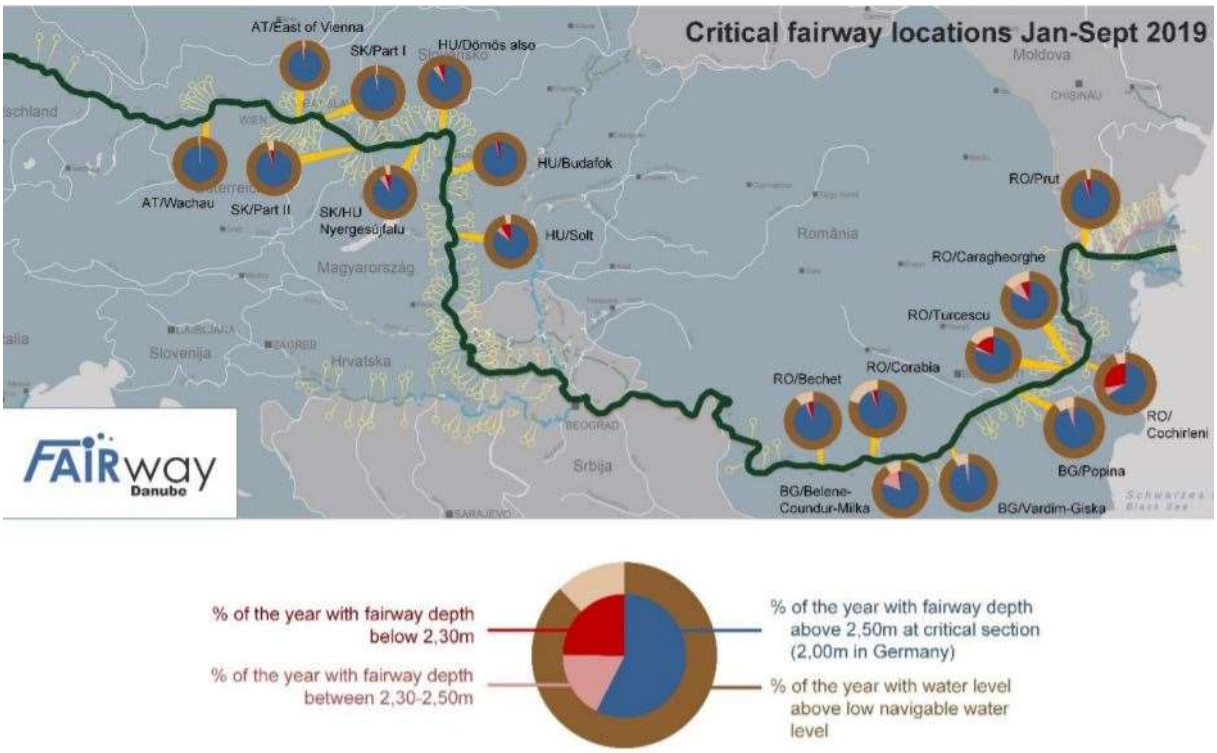

Figure 21: Overview on critical fairway conditions on the Danube

There are several critical fairway conditions identified in the above map. Due to unpredictable water level, an uninterrupted transport flow can be continuously secured.

Based on the comprehensive summary of identified bottlenecks, it can be concluded that – even though to different degrees – there are similar aspects that hamper the overall transport flow of agricultural products on the Rhine-Danube Corridor. By providing an in-depth analysis of all transport modes – road, rail and inland waterway – the preliminary conclusion can be drawn that the lack of multimodality is the main cause that hampers the adequate traffic flow of agricultural products. Some countries – mainly those belonging to the geographical category defined as the Lower Part of the Danube – have inadequate or poorly developed rail, road and port infrastructure, whereas ongoing EU-co-funded infrastructure projects addressing these issues are currently ongoing or in the planning phase. By securing a similar level of infrastructure development across the whole region is the proper way to provide adequate and enduring solutions to a multimodal transport system that must correspond to the climate goals defined by the European Green Deal.

In the framework of the Fairway projects and the EUSDR the fairway rehabilitation and maintenance masterplan are continuously updated with the involvement of the national waterway managers.

5 Mid-term perspectives

5.1 Policies and strategies on EU level with Danube scopeCorridor strategies (EU level strategies mentioned by the countries)

Core network is to be completed by 2030 and will be supported by a comprehensive network feeding into the core network at the regional and national level. This will ensure accessibility of all regions and total EU coverage. Network will be the economic lifeblood of the single market, allowing a free flow of goods and people throughout the EU. Transport is fundamental to an efficient European economy. Expectations are that freight transport will increase by 80%, and passenger transport by 50% by 2050. Areas of Europe without good connections cannot prosper, whereas the current network contains infrastructure barriers and bottlenecks. The country reports reflect only on the corridor strategies:

5.1.1.1 The Rhine-Danube Core Network Corridor

Description

The Rhine-Danube Corridor is the main EastWest link between continental European countries, connecting France, Germany, Austria, Czech Republic, Slovakia, Hungary, Croatia, Romania and Bulgaria all along the Main and the Danube rivers to the Black Sea by improving (high speed) rail and inland waterway interconnections. Completion of the high priority railway line connections by 2030: - between Black Sea and Rhine - Southern Germany and SK/UA border Inland waterway transport along the Danube - By measures improving the navigability. Improvements into energy efficiency measures will help to reduce the emissions in traffic flows: Total GHG emissions are expected to fall from 20.4 million tonnes of CO2 equivalent to 19.7 million tonnes across the selected traffic flows, by 2030.[22]

Main bottlenecks and missing links

The main missing links are cross-border rail network connections between Germany and its neighbours, France, Austria and the Czech Republic. Bottlenecks in Slovakia, Hungary, Romania and Bulgaria—and between Austria and Slovakia also need to be addressed. Navigation of the Rhine River and its connection with the Rhine-Main-Danube Canal are of a high standard but must be matched by the Danube River if these inland waterways are to offer a genuine alternative modal choice as an unbroken, integrated corridor for freight transport. In addition, the Western Balkans section of the Danube plays an important part in the functioning of this corridor and must therefore attain similar high standards.[23]

Overview of the projects

By 2020, almost half of all projects along the corridor have been implemented. Intensified measures for the projects to be completed by 2030 foresee reaching the KPI's on train length and clean fuels for all modes of transport. Regarding geographical allocation, most projects come from Germany

[22] Source: https://ec.europa.eu/transport/themes/infrastructure/rhine-danube_en
[23] Source: https://ec.europa.eu/transport/themes/infrastructure/rhine-danube_en

(165), followed by Czech Republic (111), Romania (105), Austria (82), Hungary (74) and Slovakia (54). Almost half of the projects (356) have already been concluded or were expected to be completed by 2020. The completed projects are still included in the analysis to document the progress made on the Core Network Corridor since the implementation of EU Regulations 1315/2013 and 1316/2013. In the "critical" time window 2026-2030, 124 (17%) projects are still to be finalized. One (rail) project is scheduled to be completed after 2030, while another 62 projects are lacking information about the completion date.

563 projects are identified: 141 projects concern rail 65 projects concern inland waterway 118 projects concern ports 91.9 billion EUR of estimated investment: 54.7 billion EUR for rail 4.2 billion EUR for inland waterways 2.6 billion EUR for ports.

Regarding IWW, the strategies concentrate on the achievement of target fairway depths, admissible draughts, upgrade and construction of infrastructure, studies regarding environmental concerns and the implementation of RIS along the Danube. The attractiveness of rail connections to the ports is essential to a modal shift of from road to rail. The most important legislative drivers/emerging trends for the Rhine-Danube Core Network Corridor are incentivizing decarbonization, use of clean fuels, LNG bunkering and water pollution.

Innovation focus is set on the deployment of alternative fuels for all modes of transport, transport telematics applications and implementing sustainable freight transport services.

The projects realized within the Rhine-Danube Corridor shall lead to an estimated € 813 billion increase of GDP and 2.3 million additional job-years until 2030.

5.1.1.2 The Baltic-Adriatic Core Network Corridor

Description

The Baltic-Adriatic Corridor is one of the most important trans-European-road and railway axes in Central Europe. It runs from the Baltic seaports of Gdansk, Gdynia, Szczecin and Świnoujście in the north, to the Adriatic ports of Koper, Trieste, Venice and Ravenna in the south, taking in the industrial regions of Central and Southern Poland, before straddling the Czech, Slovakian and Austrian/Slovenian boarders on its way south to Italy and Slovenia. The corridor features key railway projects including the Semmering Base Tunnel and Koralm Railway Line in Austria, as well as important cross-border connections between the six corridor countries.[24]

Main bottlenecks and missing links

A chain is only as strong as its weakest link. In other words, only by investing in the cross-border sections can the development of long-distance international traffic flows across the corridor countries be encouraged. The Baltic-Adriatic Corridor still faces important bottlenecks on six railway and two road cross-border sections in terms of their compliance with the TEN-T requirements (i.e. PL-CZ, PL-SK, CZ-AT, AT-SK, AT-SI and SI-IT). These are therefore rightly at the centre of Baltic-Adriatic Corridor implementation strategies. There are also two missing links

[24]https://ec.europa.eu/transport/sites/transport/files/themes/infrastructure/ten-t-guidelines/corridors/doc/bal-adr/2014-11-20_bac_wg_corridor_study.pdf

located at the alpine crossings in Austria: The Semmering Base Tunnel and the Koralm Railway line and tunnel. Moreover, appropriate last mile connections to the core ports as well as sound interconnections within urban nodes are to be developed and strengthened on the corridor.[25]

Overview of the projects

Overall, 486 projects have been identified for the development of the Corridor. These projects are either ongoing or planned for implementation, with a total budget of € 71.7 billion. More than 150 projects, corresponding to nearly half of the total project list value, relate to rail and ERTMS initiatives. Road transport represents the second largest category of projects in terms of budget, with more than 25% of the project list budget and 125 projects. Maritime transport follows with about 19% of the total project list value and 102 initiatives. The work plan priority projects concern 163 investments totaling € 37.2 billion, equivalent to more than 50% of the total project list.

Most of the projects were expected to be completed by 2023, with a total cost of € 26,8 billion. 119 initiatives are foreseen to be completed between 2024 and 2030 at an overall budget of € 39,5 billion. 31 projects are planned to be finalized after 2030 or have undefined completion dates, with a total cost of € 5.4 billion.

By 2020, approx. 180 projects had been completed, with a total value of € 13.6 billion.[26] Further 485 initiatives are ongoing and planned for implementation by 2030, with a total value of € 71.7 billion. The current work plan remains consistent with the previous one and has following six priorities:

- modernisation of the critical rail and road cross-border sections, with focus on digitalisation;
- completion of the Alpine crossings in Austria;
- further modernisation of the railway infrastructure;
- enhancement of multimodality by improving connections to ports and within logistic clusters;
- interconnection of transport in urban nodes;
- further development of telematic applications, with one focus on ERTMS deployment.

Interoperability, interconnectivity and innovation are the main driving forces in the strategy for the Baltic-Adriatic Core Network Corridor.

5.1.1.3 The Orient – East Mediterranean Core Network Corridor

Description

The Orient/East-Med Corridor connects large parts of Central Europe with ports of the North, Baltic, Black and Mediterranean Seas. It focuses upon fostering the development of these ports as major multimodal logistics platforms and providing economic centres in central Europe with

[25] https://ec.europa.eu/transport/themes/infrastructure/baltic-adriatic_en
[26] Here and following "Baltic Adriatic Fourth Work Plan of the European Coordinator Anne Elisabet Jensen Mobility and Transport JUNE 2020"

modernised, multimodal connections to Motorways of the Sea. The corridor incorporates the Elbe River as a key inland waterway and will improve multimodal connections between Northern Germany, the Czech Republic; the Pannonian region and Southeastern Europe. The corridor will also provide an improved link to Cyprus.[27]

Main bottlenecks and missing links

Numerous missing links remain with most of the multimodal connections between Hungary, Bulgaria, Romania, and Greece yet to be constructed or substantially upgraded. The Elbe also requires important upgrades if it is to facilitate increased traffic flows. Cross-border traffic management systems on rail and inland waterways are still to be implemented on many sections.[28]

Overview of the projects

Corridor´s project list comprises 649 projects, thereof 241 Rail + Rail ERTMS, 136 Road, 89 Maritime, 72 Airport, 55 Inland Waterway, 25 Innovation, 22 Multimodal and 9 Motorways-of-the-Sea projects.

Approx. half of the projects along the Corridor (310) have been completed by 2020. There is a general tendency of shifting the projects' deadlines towards 2030. 106 additional measures (with a total value of € 9.6 billion) were proposed in order to reach compliance with the KPI's by 2030. The focus of these additional measures is mainly on "Train length" (Rail) and "Clean fuels" for all modes of transport. ERTMS deployment is also an important aspect.

Elbe and Weser Rivers have underused capacity but less reliability. Rail capacity restrictions are frequent in Germany, Slovakia and Hungary nodes. Bottlenecks: HU – RO – BG – EL stretches must be adapted to TEN-T standards. Administrative border-crossing obstacles are to be minimized. Achieving compliance of the Corridor with the TEN-T standards by 2030 will reduce the dominance of road transport in international freight transport (56.8% from 59,5%), while the share of rail is foreseen to increase to 33.1% (from 27.1% in 2010). 415 projects are identified: 177 projects concern Rail, RRT & ERTMS 24 projects concern IWW 68 billion EUR of estimated investment: 40.4 billion EUR for Rail, RRT, ERTMS 2.2 billion EUR for IWW.

Regarding IWW and inland ports, strategies are aiming to increase fairway depth and enable navigability, RIS deployment and provision of clean fuels. Clean fuels are also an important KPI for roads and rails.

The estimated investment of € 83 billion along the Corridor is expected to generate more € 572 billion of GDP over until 2030.

5.1.1.4 The Scandinavian-Mediterranean Core Network Corridor

Overview

The Scandinavian-Mediterranean Corridor represents a crucial north-south axis for the European economy. The corridor stretches from Finland and Sweden in the North to the island of Malta in the

[27] https://ec.europa.eu/transport/themes/infrastructure/orient-east-med_en
[28] https://ec.europa.eu/transport/themes/infrastructure/orient-east-med_en

South, taking in Denmark, Northern, Central and Southern Germany, the industrial heartlands of Northern Italy and the southern Italian ports. The most significant projects on the corridor are the Fehmarnbelt Fixed Link and Brenner Base tunnel, including their access routes. This north-south corridor will integrate Priority Projects 1, 11, 12 and 20, ERTMS Corridor B and the Scandinavian-Mediterranean Rail Freight Corridor.[29]

Main bottlenecks and missing links

The cross-border alpine connection between Munich and Verona represents a major bottleneck on the corridor and will be alleviated by the construction of the Brenner Base Rail Tunnel when it becomes operational in 2026. The removal of this bottleneck is crucial for the realisation of the entire corridor, linking Northern and Southern Europe. Together with the Gotthard-Monte Ceneri axis in Switzerland and the Lyon-Turin rail connection, the Brenner corridor will bind together a complex network of high-capacity rail links. Together these networks will help to achieve the environmental objectives set by the EU and ensure the modal shift from road to rail, necessary for the future of the ecologically sensitive alpine region. The Fehmarnbelt Fixed Link crossing is a key component in the main north-south route between Central Europe and the Nordic countries. This cross-border bottleneck will be removed by the construction of the new immersed rail/road tunnel under the 18 km wide, Fehmarn Strait, between Rødby in Denmark and Puttgarden in Germany. Following the completion of the project in 2028, the travel time between Copenhagen and Hamburg will be reduced by approximately one hour, and for rail freight transport, by approximately two hours.[30]

Overview of the projects

By 2020 there were completed 142 projects with a total value of €29.9 billion. The majority of completed projects completed were in the IWW (30), and the highest share of investment - €14.8 billion was taken by rail projects. There are currently 817 projects and measures planned, whilst 312 are shared with other Corridors. The 515 projects on the Scandinavian-Mediterranean Corridor have a total cost value of about €121.2 billion (official + estimated costs).

By their completion, the projects will generate an additional increase of GDP in 2030 of 0,3% and additional 142.000 jobs.

One important focus is set on the harmonised deployment of ERTMS/ECTS, which is still very undeveloped. The aim is to achieve an ETCS coverage of 20% by 2023 and 100% by 2030. Further endeavours regard Rail-Road Terminals and electrification. A simplification of administrative procedures should contribute to a development of railway operations and increase rail competitivity for modal shift. Further themes of interest are related to green fuels on ports and generally all modes of transport. Better hinterland connectivity is also an issue.

[29] https://ec.europa.eu/transport/themes/infrastructure/scandinavian-mediterranean_en
[30] https://ec.europa.eu/transport/themes/infrastructure/scandinavian-mediterranean_en

5.1.2 The European Green Deal - at the heart of smart and sustainable mobility

The European Green Deal - at the heart of smart and sustainable mobility

The European Green Deal announced by the European Commission in December 2019 is a roadmap meant to foster the transition of the European Union towards a climate-neutral economy by reducing carbon emissions towards 55% by 2030 and achieving carbon neutrality by 2050. According to the newly elected Commission, the core objective of this policy framework is to serve as "(…) a new growth strategy that aims to **transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy** where there are no **net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use**" (European Commission 2019: 2, bold in the original). This policy framework comprises several initiatives, strategies and legislative acts that together are intended to enable a just, sustainable and inclusive transformation of European societies and economies. This chapter will provide an in-depth policy analysis of the specific legislation, initiatives, strategies and related policy domains that have an immediate impact on the future of the European transportation sector. Given the ongoing health crisis, the question arises as to what extent the COVID-19 pandemic has slowed the implementation of the ambitious plan to make Europe the first climate-neutral continent by 2050.

Objectives and main policy domains

The main goal of the European Green Deal is, as emphasized several times in the official Communication published by the European Commission, a net carbon neutral European Union by 2050 and a decoupling of economic growth and resource use. The objectives of this policy framework can be summarized as follows:

1) Increasing the EU's climate ambition for 2030 and 2050;

2) Supplying clean, affordable, secure energy;

3) Mobilising industry for a clean and circular economy;

4) Building and renovating in an energy and resource efficient way;

5) A zero-pollution ambition for a toxic-free environment;

6) Preserving and restoring ecosystems and biodiversity;

7) Farm to Fork: a fair, healthy and environmentally friendly food system;

8) Accelerating the shift to sustainable and smart mobility.

Figure 22: The European Green Deal

Of interest for this report is the objective dealing with the shift to sustainable and smart mobility. The figure above illustrates the core objectives and areas covered by the European Green Deal. For its actual implementation, major existing regulations and standards will be revised, while new European legislation will be created. A central part of this newly created legislative framework which aims to accelerate the shift towards sustainable and smart mobility is the **Sustainable and Smart Mobility Strategy** – presented by the European Commission in December 2020.

5.1.3 The European Green Deal - Increasing the EU's climate ambition for 2030 and 2050

The transport sector had the lowest share of renewable energy in 2015, with only 6%. By 2030, this must increase to around 24% through further development and deployment of electric vehicles, advanced biofuels and other renewable and low carbon fuels as part of a holistic and integrated approach. Secure access to batteries will be critical to rolling out electric vehicles, while clean hydrogen will be crucial for 4 https://www.weforum.org/agenda/2019/01/why-digitalization-is-the-key-to-exponential-climate-action/ 5 New buildings today consume only half as much as typical buildings from the 1980s. About 35% of the EU's buildings are over 50 years old. 6 Calculated according to the methodology as set out in Directive 2018/2001/EC. 9 decarbonising heavy-duty transport and, through its derivatives, in the aviation and maritime sector. The decarbonisation of the transport fuel mix by 2050 will also be supported by greater use of rail and other sustainable transport modes such as inland waterways and short sea shipping, in particular for freight transport.[31]

Some sectors have a smaller, yet still significant, cost-effective emissions reduction potential by 2030. Today, road transport accounts for a fifth of the EU's greenhouse gas emissions and increased its emissions by over a quarter since 1990. It may see a decrease in emissions of only around 20% between 2015 and 2030, underlining the increased focus the sector will require to achieve increased decarbonisation. All transport sectors - road, rail, aviation and waterborne transport - will have to contribute to the 55% reduction effort. A smart combination of vehicle/vessels/aircraft

[31] Green Deal - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0562&from=EN

efficiency improvements, fuel mix changes, greater use of sustainable transport modes and multi-modal solutions, digitalisation for smart traffic and mobility management, road pricing and other incentives can reduce greenhouse gas emissions and at the same time significantly address noise pollution and improve air quality. In addition, new sustainable mobility services and increased use of the existing urban bus and rail services can reduce emissions, congestion and pollution while improving road safety, especially in urban 7 Report on Eco-design Impact Accounting, forthcoming 10 areas. The upcoming Strategy for a Sustainable and Smart Mobility will set a pathway for the sector to master the twin green and digital transitions building a resilient and sustainable transport system for generations to come.[32]

To achieve climate neutrality and ensure that sectors with emissions that are more difficult to abate have access to enough renewable and low carbon fuels, conventional cars will need to gradually be displaced by zero emissions vehicles and greater use should be made of sustainable collective transport services. The Impact Assessment projects reduction levels in 2030 corresponding to a decrease of around 50% of the CO2 emissions per kilometre for passengers' cars, as compared to the 2021 targets. The production and sales of electric vehicles are already taking off, and hydrogen promises new ways of propulsion, particularly for heavy duty trucks, indicating that this is a realistic scenario.

To achieve climate neutrality, a 90% reduction in overall transport emissions by 2050 compared to 1990 levels will be one main objective of the forthcoming Sustainable and Smart Mobility Strategy while addressing recovery of the sector.

5.1.4 Sustainable and Smart Mobility Strategy

The strategy lays the foundation for how the EU transport system can achieve its **green and digital transformation**, as outlined by the European Green Deal. The document outlines the **development direction of the European transport policy** in order to reduce greenhouse gas emissions and transport's reliance on fossil fuels. The successful implementation of the ambitious goals set by the European Green Deal depends on the sustainability of the transport system. **Digitalisation** is in this regard an indispensable driver for climate neutrality. The Strategy provides an action plan which is expected to be implemented around 10 key areas for action – the so-called *flagships* – that will guide transport specific policy development.

The European Commission recognizes the challenges faced by waterborne transport in terms of decarbonisation due to reduced uptakes of innovative technologies, an issue affecting both ports and vessels. Moreover, the document stresses the importance of ports as key factors of international connectivity and their capacity to become multimodal mobility and transport hubs. It highlights the necessity to support the creation of zero-emission airports and ports, aiming to propose, in the foreseeable future, dedicated set of actions and measures to make ports clean by incentivising the deployment of renewable and low-carbon fuels are in this regard of utmost importance. All modes of transport should have adequate access to proper recharging and refuelling infrastructure.

[32] Green Deal - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0562&from=EN

The Strategy seeks to increase the share of inland waterway transport by 25% by 2020 and by 50% in 2050 as compared to 2015 (Sustainable and Smart Mobility Strategy: 11). Maintaining and further strengthening the modal share of IWT is directly addressed in the strategy, highlighting that the already achieved milestones along the TEN-T Corridors must be preserved and untapped potential further exploited.

Therefore, by highlighting the overall important role of waterborne transport in successfully implementing the goals as defined by the European Green Deal, this strategy can be regarded as an important step forward in providing enduring solutions to raise the attractivity of IWT as a reliable, clean, and efficient mode of transport.

The strategy clarifies what is considered as sustainable transport based on the level of emissions in order to define necessary and realistic measures in all transport sectors. It furthermore highlights the fact that the transportation sector needs to undergo a radical transformation in order to meet the ambitious targets as defined by the European Green Deal. **Sustainable mobility** will be fully achieved if the following conditions are met:

- all transport modes are more sustainable,
- sustainable alternatives are made widely available in a multimodal transport system,
- There are right incentives to drive & support the challenging transition.

Digitalisation – a key prerequisite for sustainable mobility

Digitalisation refers to enabling or improving processes by leveraging digital technologies and digitized data. Therefore, digitalisation presumes digitisation. Digitalisation increases productivity and efficiency while reducing costs. It is considered an important driver in simplifying administrative procedures and increasing efficiency. From the perspective of IWT, digitalisation has the potential to attract new businesses, making this mode of transport more attractive while at the same time, having the capacity to improve the transport flow on inland waterways.

Digital Transformation is really business transformation enabled by digitalisation. The process of digital transformation implies new qualities. The acceleration of innovation speed enabled by the technological connection of people and objects, the enormous potential of data collection and analytics, sensors and mobile accessibility, are examples of aspects which need to be considered when talking about digital transformation.

Implementing the digitalisation of the IWT sector – the RIS Directive

The RIS Directive establishes a framework for the deployment and use of harmonised, interoperable and open River Information Services (RIS). It requires Member States to develop and implement RIS in an efficient, expandable and interoperable way and to provide interfaces with transport management systems and commercial activities. Member States must provide RIS users with the data necessary for voyage planning, electronic navigational charts for waterways and notices to skippers shall be provided as standardised, coded and downloadable messages. In line with the RIS Directive, the Commission laid down technical guidelines and specifications for RIS through five implementing acts. It is important to note that that the RIS Directive is currently under revision.

Digital Inland Waterway Area (DINA) – providing digital solutions

The European Commission launched in 2017 an initiative on the Digital Inland Waterway Area (DINA) discussing aspects of the future digitalisation of IWT based on the study "Towards a Digital Inland Waterway Area and Digital Multimodal Nodes, which proposed a number of short, medium and long-term building blocks. From a short-term perspective, the focus was made on the continued implementation and extension of RIS, the standardisation and implementation of the shared European databases, a European Reference Data Management System (ERDMS), the European Hull Database and, most recent the European Crew Qualifications Database. From the medium-term perspective, the focus was made on joint public-private initiatives to develop future e-IWT onboard tools, the data platform for barge operators and the integration with other stakeholders. From the long-term perspective, the focus is put on further integration with other modalities and the use of DINA as a platform for new applications.

The European Climate Law

The **European Climate Law** is a key element in the implementation process of the ambitious goals defined by the European Green Deal. Tabled a year ago by the European Commission, the European Climate Law is the centrepiece of the green deal. It will have an EU-wide legally binding character. It addresses the necessary steps and a well-defined trajectory to reach the core objective of the European Green Deal: climate neutrality by 2050. One of its main objectives is to ensure that the transition to climate-neutrality is **irreversible**. The European Climate Law is still the subject of intense political negotiations. It has not passed yet the ordinary legislative procedure.

NAIADES III

The NAIADES III Action Plan will play a major role in shaping the future of IWT given the ambitious climate plans as defined by the European Green Deal. The currently available draft of the NAIADES III Action Plan foresees a multitude of aspects to be considered in effectively and efficiently adapting IWT to the climate goals defined by the European Green Deal. The main identified challenges can be summarized as follows:

- Insufficient integration of IWT into the logistics chain:
  - Insufficient quality of infrastructure and related services;
  - Insufficient digital integration of IWT in smart, sustainable and resilient synchromodal supply chains;
  - Lack of incentives for modal shift to inland navigation.
- Lack of attractiveness and well qualified work force;
- Fragmentation of the governance structure of the IWT sector
- Progress towards innovation and alternative fuels, including zero emissions vessels is limited.

Addressing regional challenges – the European Strategy for the Development of the Danube Region

The European Strategy for the Development of the Danube Region (EUSDR) was adopted by the European Commission (EC) in 2010, having the core objective to address the multitude of challenges the Danube Region is facing in terms of societal and economic development. The strategy

deals with strategic domains such as rail, road and waterway mobility, sustainable energy, biodiversity, landscapes etc., supporting the initiation and implementation of thematic projects that promote the overall well-being of the Danube Region's inhabitants.

Based on the success stories of the previous financing period, the decision was taken to continue the fruitful transnational cooperation in the Danube Region for the period 2021-2027. A key challenge for the region will be to adapt the transport system (and not only this sector) to the goals defined by the European Green Deal. The priorities defined for the next programming period therefore fully adhere to the policies aimed to support an efficient implementation of the Green Deal. With the political agreement reached in December 2020 by the European Parliament and the European Council on the EC's proposals for 2021-2027, an important milestone has been reached in adopting all the instruments related to Cohesion Policy. The political agreement is expected to be confirmed by the European Parliament in March 2021.

For 2021-2027, thematic aspects ranging from renewable energy, green infrastructure and pollution reduction will be, among other aspects, high on the agenda. **A greener, low-carbon Danube Region** shall be made possible by:

- Promoting renewable energy;
- Promoting climate change adaptation, and disaster risk prevention, resilience, taking into account eco-system-based approaches;
- **Promoting access to water and sustainable water management**;
- Enhancing biodiversity, green infrastructure in the urban area, and reducing pollution.

Equally important for the continuous and effective development of IWT in the Danube Region refers to the priority aiming at making the Danube Region smarter:

- Enhancing research and innovation capacities and the uptake of advanced technologies;
- Developing skills for smart specialisation, industrial transition and entrepreneurship.

The former two mentioned priorities are the more important as IWT in the Danube Region must cope with a rather low uptake of new technologies. This goes hand in hand with issues related to staff shortage and the development of proper skills in order to adequately adapt human resources to new and innovative technologies.

The following figure provides a brief overview on the multitude of thematic aspects which will be in a way or the other touched by EUSDR:

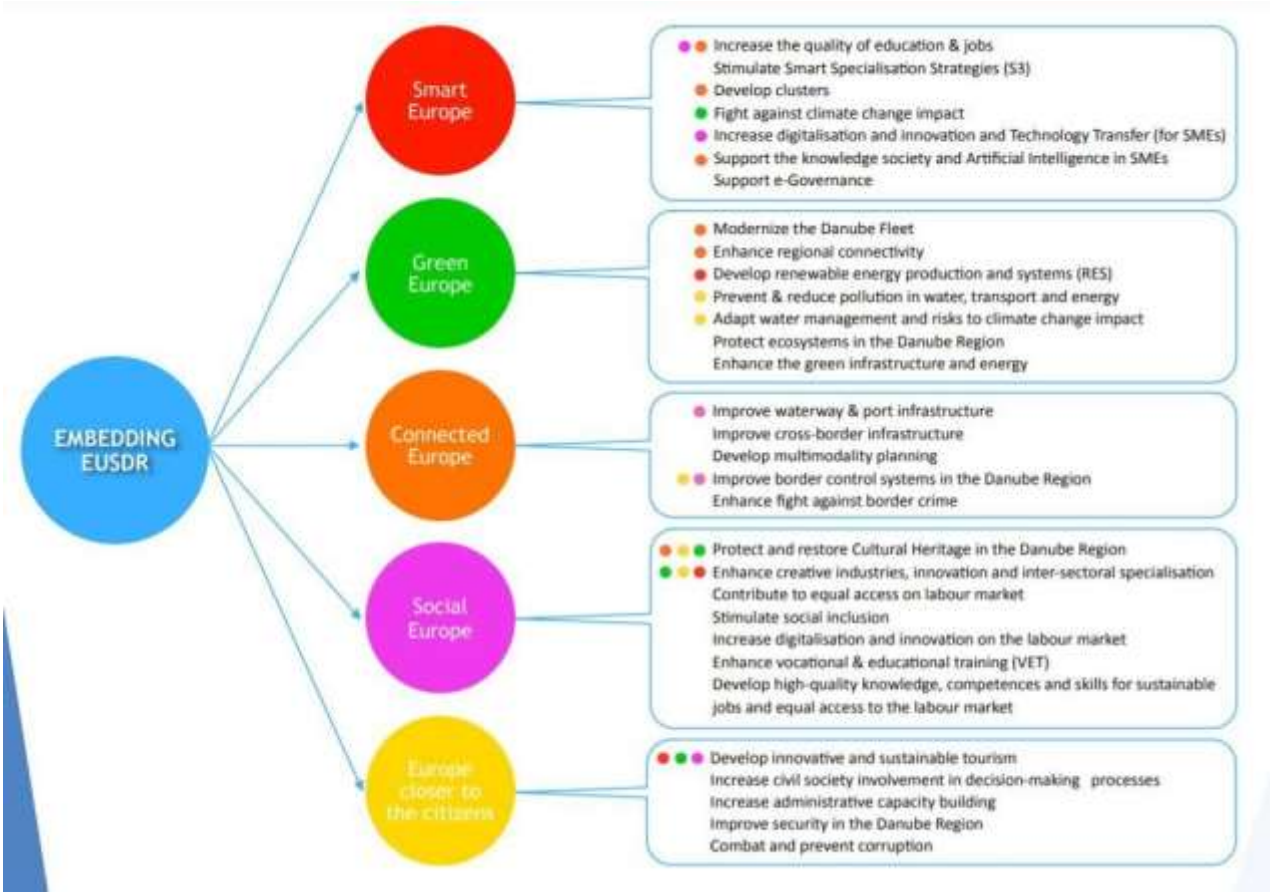

Figure 23: Embedding EUSDR

Corresponding to the ambitious climate goals defined by the European Green Deal, IWT is expected to play a prominent role in the upcoming period which shall facilitate the promotion of this environmentally friendly mode of transport by taking several aspects into consideration such as the improvement of waterway infrastructure, the modernization of the Danube fleet and the improvement of multimodality. All these future initiatives & projects supported by EUSDR will continue to further develop the results already achieved in the previous DTP programming period.

5.2 Transport development plans and strategies at Member State level

5.2.1 Analyses of the country report strategies

This chapter is aiming to summarize the transport strategies at member state level. It is essential to understand and analyse all relevant documents, which had been mentioned in the country documents as a scope. To get a fully big picture, please see below all the documents mentioned by the countries:

Country	Relevant documents on national level
Austria	Austrian Transport Policy
Austria	Mobility Master Plan 2030
Austria	Innovation aid programme for combined transport
Austria	National Action Programme Danube 2022
Austria	Programme supporting the development of connecting railway and transfer terminals in intermodal transport 2018-2022 (SA. 48485)
Austria	Klimaaktiv mobil
Austria	National environmental Aid scheme
Austria	Logistikförderung 2019 – 2023 (Innovative logistics)
Moldova	Transport and Logistics Strategy for the years 2013-2022
Croatia	Transport development plans
Hungary	National Transport Strategy (2030)
Hungary	National Port Development Master Plan (2019-2030)
Hungary	NTFS – National development plan (2030-2050)
Serbia	National Transport Strategy (2008-2015), 2022 to 2030 - under planning
Serbia	Strategy on waterborne transport development of the Republic of Serbia, 2015-2025
Serbia	Railway Master Plan (2012-2021)
Serbia	Roads medium - and long-term plan of business strategy and development plan
Slovakia	Strategic plan for the development of transport in the Slovak Republic until 2030 - Phase II
Slovakia	Program statement of the government of the Slovak republic (2020)
Romania	Romanian Ministry of Transports and Infrastructure (2021 plan): a strategy and a program for the development of maritime and inland waterway transport, inland waterway infrastructure, sea and river port infrastructure in the short (2027), medium (2035) and (2050) long-term
Ukraine	National Transport Strategy for the period up to 2030
Bulgaria	Integrated Transport Strategy 2030
Bulgaria	Master Transport Plan for Bulgaria 2020
Bulgaria	Strategy for development of the transport system of the Republic of Bulgaria until 2020

Table 2: List of relevant national master plans and other documents

Austria has a really detailed cross sectorial strategy program. Other segments of economy like climate are also in scope of transport. The master plan is already available till 2030, while other Innovative and Climate related plans are still in the middle of their period. Slovakia has also launched its 2030 national plan for the development of transport, but no other documents were mentioned. As for Hungary beside the National Transport Strategy and National Port Development master plan the National Development Plan (NTFS) is also available, which has a serious plan in terms of climate change and transport. Going further with the high-level analysis, Croatia has a very detailed National Transport plan in terms of all transport modes. Strategy on waterborne transport development of the Republic of Serbia document is live, while Romania is currently working on its

strategy for the development of maritime and inland waterway transport, inland waterway infrastructure, sea and river port infrastructure in the short (2027), medium (2035) and (2050) long-term. Bulgaria has released its 2030 master plan as well, regarding the national transport strategy. Ukraine has its own ambitious Strategy Plan to develop quality service to European standards. Moldova's national plan cycle is about to end in 2023, the planning part of the new period has not yet started officially.

Going one level deeper, the study examines the main strategic point, KPI's or main pillars for each country strategy, so the document highlights the similar strategic focus points to each other. With that analysis it is possible to see the whole Danube region's action plan (connected), as well as the similar and opposite strategic directions. It is also very interesting to see, how the countries are about to achieve the European transport and climate goal in a national level (2030).

Austria

The Austrian Mobility Master Plan 2030 was developed by the Austrian transport sector and is based on an integrated strategy for passengers, freight and individual transport. The plan includes concrete measures for IWT, rail, road and air transport as well as for creating optimal framework conditions.

Country	Stakeholders	Description
Austria	Austrian Transport Policy	-
Austria	Mobility Master Plan 2030	1. Ensure sustainable energy supply 2. Extension of infrastructure 3. Efficient use of infrastructure 4. Drive digitization forward 5. Coordinate spatial planning in a targeted manner 6. Ensure long-term funding 7. Shaping education in a future-oriented manner
Austria	Innovation aid programme for combined transport	The programme supports the development of the combined transport (modal shift towards environmentally friendly modes of transport.
Austria	National Action Programme Danube 2022	The programme supports navigation, environment and flood protection for the Austrian Danube until 2022. Future topics with IWT-connections are greening of ports, infrastructure for alternative sustainable fuels as well as automatization and digitalization.
Austria	Programme supporting the development of connecting railway and transfer terminals in intermodal	Development of transshipment facilities for combined transport and private railway connections designed to support the modal shift of freight from road to rail and water.

Country	Stakeholders	Description
	transport 2018-2022 (SA. 48485)	
Austria	Klimaaktiv mobil	The purpose of this funding is to achieve environmental effects such as reduction of greenhouse gases (CO2-, NOx- emissions and dust) through transport and mobility measures.
Austria	National environmental Aid scheme	The programme supports company-related traffic measures to reduce air pollution, climate-relevant pollutants, noise and waste.
Austria	Logistikförderung 2019 – 2023 (Innovative logistics)	Supports the development and implementation of innovative logistics concepts.

Table 3: Austria - member state strategies and main actions

Austria has a well-built strategy portfolio in a national level. First of all, the nation is focusing to increase efficiency, the optimization and the achievement of climate targets on all modes of transport.

Key areas are:

1. Ensure sustainable energy supply;
2. Extension of infrastructure;
3. Efficient use of infrastructure;
4. Drive digitization forward;
5. Coordinate spatial planning in a targeted manner;
6. Ensure long-term funding;
7. Shaping education in a future-oriented manner.

The adoption of the transport policy is in sync with the Green Deal and the EU's Sustainable & Smart Mobility Strategy. The focus is on climate neutral mobility until 2040 based on a back-casting model and the goal of energy self-efficiency.

There are other programs, like the development of the combined transport (modal shift towards environmentally friendly modes of transport); project size EUR 8.000 - 800.000, grant 30% for investments, 50% for feasibility studies.

Slovakia

In the Slovak Republic, the strategic plan for the development of transport is built until 2030. The table below shows the main strategic topics:

Country	Stakeholders	Description
Slovakia	Strategic plan for the development of transport in the Slovak Republic until 2030 - Phase II	1. Ensuring equivalent accessibility of settlements and industrial zones supporting economic growth and social inclusion within all regions of the Slovak Republic (nationally and Europeanly) through non-discriminatory access to transport infrastructure and services. 2. 2. Long-term sustainable development of the transport system of the Slovak Republic with emphasis on the generation and efficient use of funds in relation to the real needs of users. 3. Increasing competitiveness in passenger and freight transport (counterparts of road transport) by setting appropriate operational, organizational, and infrastructural parameters leading to an effective integrated multimodal transport system supporting the economic and social needs of the Slovak Republic. Improving the quality of transport planning in the Slovak Republic by defining the optimal target value of the division of transport work in the conditions of the Slovak Republic and setting steps and tools to achieve it. 4. Increasing the safety and security of transport leading to the permanent provision of safe mobility through a secure infrastructure, introduction of new technologies / procedures using preventive and control mechanisms 5. Reduction of negative environmental and negative socio-economic impacts of transport (including climate change) due to environmental monitoring, effective planning/implementation of infrastructure and reduction of the number of conventionally powered means of transport, resp. using alternative fuels.
Slovakia	Program statement of the government of the Slovak Republic (2020)	-

Table 4: Slovakia - member state strategies and main actions

In scope with IWW transport mode, there are three main areas during this period:

- Improve the dating conditions on the Danube and when it is provided as a justification and implementable.
- Improving the system of the Slovak public ports
- Determination of eligibility, conditions for the development and the modernization, and reconstruction of other monitored waterways in the Slovak Republic.

From the point of view of fulfilling the global strategic goals, 38 specific measures were selected. According to the mode of IWW transport, the following are being highlighted:

- Modernize public ports in Slovakia and ensure their subsequent regular maintenance.
- Implement technical measures to ensure the required parameters of the Danube waterway fairway.
- Implement extended River Information Services

Hungary:

In Hungary, the transport development plans and strategies until 2030 are summarized in the National Transport Strategy. The focuses of the strategy are written below in the table:

Country	Stakeholders	Description
Hungary	National Transport Strategy (2030)	The focuses of the strategy are the following: 1. Connecting supply chains, 2. Optimize social impacts, such as encourage an environmentally sustainable economy and those transport solutions that have a positive impact on reducing territorial inequalities, 3. Support cost-effective developments, 4. Support cost-effective and economically sustainable operation by eliminating road and railway sections with poor technical conditions and supporting better preservation of the infrastructure.
Hungary	National Port Development Master Plan (2019-2030)	The Strategy sets out five strategic objectives: 1. Modal shift 2. Generating additional demand 3. Development of a financing system 4. Human resource development 5. Creating a sustainable regulatory environment

Table 5: Hungary - member state strategies and main actions

In addition, Hungary aims to implement the White Paper "Roadmap to Single European Transport Area" issued by the European Commission. This means that 30% of road freight over 300 km should be replaced by other modes of transportation, such railway, or vessels, thanks to the efficient green freight corridors. The share of inland waterway freight transport within the total volume of domestic freight transport should reach 10% by 2030. Achieving this goal will also require the development of an adequate infrastructure: increasing the role of inland waterway freight transport can only be achieved in coordination with other modes of transport, integrated into the combined and intermodal transport system. Cargo ports need to serve as intermodal hubs.

National Port Development Master Plan

The Strategy defines the political, technical, institutional, environmental, market and business aspects of the port development at the Hungarian section of the Danube. In addition, it covers the

areas of port infrastructure, capacity, services, and human resource development in the sector. The Strategy sets out five strategic objectives:

- Encouraging mode change
- Generating additional demand
- Development of a financing system
- Human resource development
- Creating a sustainable regulatory environment

Croatia:

The country report made a very detailed analyses in term of national transport development Plans. The focus is shown below the table, with concentrating on higher level.

Country	Stakeholders	Description
Croatia	Transport development plans	1. Change the distribution of passenger traffic in favor to public transport (PT) and forms of transport with zero emissions. Includes PT in agglomerations and local regional context (trams, local bus lines, etc.), rail transport, public transport in maritime and inland waterway transport (ships), bus transport on regional and long-distance lines, as well as pedestrians and cyclists 2 2. Change the distribution of freight traffic in favor of rail, maritime and traffic inland waterways. 3. Develop a transport system (management, organization and development of infrastructure and maintenance) according to principles of economic sustainability. 4. Reduce the impact of the transport system on climate change. 5. Reduce the impact of the transport system on the environment (environmental sustainability) 6. Increase traffic system safety. 7. Increase the interoperability of the transport system (PT, rail, road, sea and air transport and inland waterway transport) 8. Improve the integration of traffic modes in Croatia (management, ITS, VTMIS, P&R, etc.) 9. Further develop the Croatian part of the TEN-T network (core and comprehensive)

Table 6: Croatia - member state strategies and main actions

Regarding IWW Croatia has 4 focus points on the table:

- Improve the competitiveness of Vukovar and Osijek as the main inland freight ports
- Cooperate with BiH, related to the development of Slavonski Brod freight port
- Use the potential of inland navigation for tourism and local PT
- Adjust the navigability requirements to the traffic needs and to safeguard the necessary level of navigability.

The strategies and plans clearly describe that Croatia is working on connect and develop TEN-T close infrastructure, ensuring a competitive transport option.

Romania:

The European Commission aims to promote and strengthen the competitive position of inland waterways in the transport system and to facilitate its integration into the intermodal logistics chain. Inland waterway transport is a competitive alternative to road and rail transport.

For the reasons mentioned above the Romanian Ministry of Transports and Infrastructure intends to launch this year a strategy and a program for the development of maritime and inland waterway transport, inland waterway infrastructure, sea and river port infrastructure in the short (2027), medium (2035) and long (2050) long-term national, regional and local interests in order to promote sustainable economic growth and in line with environmental protection. The main focus is written below:

Country	Stakeholders	Description
Romania	Romanian Ministry of Transports and Infrastructure: Strategy plan: - maritime IWW infrastructure - sea and river port infrastructure in (2027),(2035) (2050) term ,	The main goals of this strategy are: 1. Assess the current state of the river transport fleet and proposals for modernization and development, in line with EU policies, to increase the role of inland waterway transport; 2. Prioritize river ports according to existing and potential freight traffic, as well as the current economic situation and outlook for the area; 3. Increasing the role of ports as logistics nodes within the Romanian transport network; 4. Assessment of the current state of shipping infrastructure and proposals for modernization and development to increase port efficiency and optimize transport relations; 5. Development of Romanian ports in terms of performance and efficiency in the use of infrastructure tariffs; 6. Promoting the development of ports as industrial areas (energy and digital hubs); 7. Develop a clear and comprehensive program that will result in a staged port development for the main stakeholders (central public, local government, port administrations and the private sector); 8. Develop a plan for the modernization and restructuring of port and waterway administrations in terms of efficient management of transport infrastructure, investment decision-making and promotion of business opportunities; 9. Proposals on the legal and institutional framework

Country	Stakeholders	Description
		from the perspective of port and waterway administrations and state aid regulations to facilitate the development of ports; 10. Proposals to optimize the use of EU funds for the next programming period by reducing project preparation and implementation duration.

Table 7: Romania - member state strategies and main actions

Serbia:

The General Master Plan complemented the 2007 Transport Strategy for Serbia, which provided an operational approach to solving transport problems and traffic forecasts until 2027.

Country	Stakeholders	Description
Serbia	National Transport Strategy (2008-2015) , 2022 to 2030 - under planning	The goal of the strategy is to contribute to the development of an expanded, improved, and safer transport network, which will contribute to improvement in all areas of transport services, influence the attraction of investments in underdeveloped areas, balanced regional development, more investments in innovations, etc.
Serbia	Strategy on waterborne transport development of the Republic of Serbia, 2015-2025	-

Table 8: Serbia - member state strategies and main actions

Since 2007-2008 several sub-sectoral strategies have been produced, not always in a coordinated or integrated manner. In 2015, a strategy on waterborne transport development of the Republic of Serbia 2015-2025 was adopted, dealing with broad issues ranging renewing and modernizing the national fleet, to developing the economic potential of Serbian ports and harbours, and developing the navigational standard of national inland waterways.

The action plan for the Strategy has been elaborated. After 5 years, most activities are set to reach targeted values are either completed or ongoing.

Bulgaria:

The Integrated Transport Strategy for the period until 2030 was adopted by the Council of Ministers of the Republic of Bulgaria with Decision No 336/23 June 2017.

The strategic objectives of the transport policy for the period until 2030 are:

1. Increasing the effectiveness and competitiveness of the transport sector
2. Improvement of the transport connectivity and access (internal and external)
3. Limiting the negative effects of the transport sector development.

The following table summarizes the priorities and further relevant documents:

Country	Stakeholders	Description
Bulgaria	Integrated Transport Strategy 2030	The strategic priorities of the transport sector are as follows: 1. Effective maintenance, modernization, and development of transport infrastructure 2. Improvement of the management of the transport system 3. Development of intermodal transport 4. Improvement of the conditions for implementation of the principles for liberalization of the transport market 5. Reduction of the consumption of fuel and increasing the energy efficiency of transport 6. Improvement of the connectivity of the Bulgarian transport system with the Single European transport space 7. Ensuring quality and easily accessible transport in all regions of the country 8. Limiting the negative effects of transport on environment and people's health 9. Increasing security and safety of the transport system.
Bulgaria	Master Transport Plan for Bulgaria 2020	2030 is under planning
Bulgaria	Strategy for development of the transport system of the Republic of Bulgaria until 2020	2030 is under planning

Table 9: Bulgaria - member state strategies and main actions

A general update of the analysis and evaluations is required using current transport data and documents in the field of transport policy. The updated scenario will contribute to the identification of priority investments in the core and comprehensive TEN-T network for the horizons until 2020 and 2030.

Moldova:

The main and only relevant document that most reflects the strategic tasks for the development of the transport industry at the national level is Government Decision no. 827 of 28.10.2013 regarding the approval of the Transport and Logistics Strategy for the years 2013-2022. This transport strategy document was developed in the context of the transition to an economic growth strategy.

The main objectives of the national transport strategy are written below:

Country	Stakeholders	Description
Moldova	Transport and Logistics Strategy for the years 2013-2022	1. Formation of a single transport space based on the balanced development of an efficient transport infrastructure; 2. Ensuring the availability and quality of transport and logistics services in the field of freight transportation at the level of the needs of the country's economic development; 3. Ensuring the availability and quality of transport services for the population in accordance with social standards; 4. Integration into the global transport space, implementation of the country's transit potential; 5. Increasing the level of security of the transport system; 6. Reducing the negative impact of the transport system on the environment.

Table 10: Moldova - member state strategies and main actions

Transport plays an important role in the development of the country's competitive advantages in terms of realizing its transit potential. Access to safe and high-quality transport services determines the efficiency of work and development of production, business, and social sphere.

Ukraine:

Today, the Ukrainian transport industry in general, meets only the basic needs of the population and the economy in transportation by volume, but not by quality. The current transport sector state does not fully meet the effective implementation requirements of Ukraine's European integration course and national transport network integration into the trans-European transport network, says the country report. The transport strategy creates conditions for ensuring quality service focusing on its economic, social and environmental impacts within the principles of sustainable development and lays a true foundation for starting the change in the proportions between the different modes of transport.

In 2018, the Ukrainian government decided to approve the National Transport Strategy for the period up to 2030. The main strategic guidelines are written below in the table:

Country	Stakeholders	Description
Ukraine	National Transport Strategy for the period up to 2030	The main strategic guidelines: 1. The international transport corridors development (development of the TEN-T corridor network - connection with the EU; new transit corridor through the territory of Ukraine - new Silk Road). 2. Eliminate existing barriers in the field of logistics and multimodal transport within national corridors, integrate into TEN-T and improve transit conditions. 3. The integrated transport systems introduction which will meet the users' requirements by increasing the economic benefits of using existing fixed assets. The new technologies application to increase the transportation efficiency. 4. Improving energy efficiency and implementing environmental protection policy. 5. Improving the transport sector governance and transparency to fight corruption. 6. Reducing the transport risks for human life and ensuring the reliability. 7. Adequate and reliable financing of the transport sector (direct and indirect taxes, other non-tax fees) is a prerequisite for the sustainable provision of transportation services. 8. Providing acceptable, reliable transportation services that help improve transport links between the regions of Ukraine. 9. Creating an effective research system in the transport field is one of the most important prerequisites for the development and improvement of the transport system of Ukraine.

Table 11: Ukraine - member state strategies and main actions

Ukraine's transport system is trying to join the TEN-T Trans-European Transport Network, but cannot be fully connected to it yet, due to the low level of interoperability and the general technological backwardness. For the transport sector, this is expressed, in particular, in the reduction of the transit traffic, the number of ships calling at the ports, the inability to provide quality transport services for export traffic. It has a negative impact on the competitiveness and efficiency of the country's economy.

5.3 Conclusion by involving stakeholder interviews.

Interviews with the stakeholders included asking representative members from the selected ministries and organizations/companies for a purpose of giving new dimension and insights from the most relevant institutions to this study. The stakeholders represent a bridge between the

European and national strategies and the key takeaway area. The focus is on the current business experiences, bottlenecks of the pandemic. In each country report there were 3-5 interviews with very different topics, but some can be discovered in all country reports:

- Covid-19 and current situation
- IWT water level as a key issue
- Financing opportunities

The current report highlights these 3 thematic areas, all other national comments can be seen in the country reports. During the recommendations, all countries built its insight to that part, so all national specific suggestions are built into that chapter.

5.3.1 COVID 19 and current situation

The pandemic had a deep impact on the global economy, even on the transport sector. In the tourism industry there was a 90% fallback compared to previous years.

The transport sector, particularly shipping on the Danube, is currently affected by the Covid-19 pandemic. Since the entire Danube region is classified as a risk area, the ship crews must adhere to the decreed quarantine measures. This leads to significant delays in changing of crews, loading, and unloading the ships as well as in cross-border traffic. However, fortunately there are signs of exemption for the shipping sector in this respect.

Especially in the current Covid-19 situation, shipping has proven to be a crisis-proof means of transport, especially for agricultural goods. The fact that shipping is a crisis security sector is increasingly recognized by politicians.

Small ship crews, self-contained with little contact to the outside world and ports far away from densely populated areas are essential advantages of crisis security, that can also be built up more strongly. In this context, it can also be assumed that shipping as a means of transport will gain more influence and importance in the future.

However, freight transport offers a reliable business continuity, the following experiences were described:

- In producing factories, the presence of Covid-19 disease causes delay on loading time in producing facility. Consequently, the production is delivered to port with delay which creates pressure on vessel loading and may results another delay.
- Nevertheless, due to the coronavirus pandemic in 2020, a significant portion of the freight traffic was diverted as borders have been closed and crossing for trucks became difficult.

In short, Covid-19 had a negative effect in life generally, but for IWT freight transport segment compared to road, smaller problems occurred upper due to the reasons described.

5.3.2 IWT water level as a key issue

Regarding the required maintaining activity of the waterway in many countries are critical going to the lower regions. Comparing the Danube to other western routes, this is the biggest competitive disadvantage. Companies are usually afraid of unpredictable situation; they do not like to take risks

if it is not a must. This is a hard topic; the whole industry is aware the situation. The study reflects more in chapter 7 on this topic.

Business owners are complaining the most because of unpredictable water level, which sometimes makes their plan risky. To experience tangible situations, here is a general statement:

"In his view the biggest problem, or at least challenge, is the constantly low level of the river and its navigability. Usually in the summer, the Danube river level is the lowest and the capacity is to load only 500-600 tons per 1 barge, which can otherwise take up to 1000 tons" – an interview from Bulgaria region shows the situation.

5.3.3 Financing opportunities

Many of the interviewed clients mentioned financing and European aids as a key from the past, but for the future as well. The following aids were mentioned:

- European Structural and Investment Funds in the financial period 2014-2020.
- Connecting Europe Facility (CEF) for the period 2014-2020.
- European Structural and Investment Funds in the financial period 2021-2027.
- Connecting Europe Facility (CEF) for the period 2021-2027.
- National Recovery and Resilience Plan 2021-2023 under the Recovery Mechanism and resistance (RRF - Recovery and Resilience Facility)
- State Budgets
- Interreg cooperation

To obtain co-funding from EU funds, projects must be in some state of maturity (mostly at least completed EIA procedure). Also, a view from the interviewed head of company, who runs business every day in IWT sector:

"A big problem about these investments is that the preparation of the project is very long, therefore by the time construction starts, the amount of support originally awarded will not be enough to complete the project. On the other hand, individual private operators would not be able to finance such large infrastructure developments."

The interviewed members are counting on further future investments, especially in infrastructure.

6 Identified best practices

This section of the study is focusing on collecting the best practices from the country reports. The methodology is to carefully choose those recommendations, which are the most attractive in terms of future available developments in term of Danube region.

It is not possible find a best practice which can be a good solution to all country, but there are several opportunities which could be great examples to some member states.

6.1 Best practice project on small to medium scale the investment: Organic cereals silo – Vienna port Albern


As example for a best practice project on small to medium scale the investment of "Bioprodukte Pinczker" in Vienna port Albern can be mentioned. The grain silo in the port of Albern was acquired in 2013 and has since been expanded to a storage capacity of 27,000 tons. Organic arable crops such as grains, maize and oil crops are stored and handled at the site. The organic grain is delivered by truck from 20 rental warehouses in the agricultural catchment area of 50-150 km. By investing in the grain silo in the port of Vienna Albern, overcapacities can be better stored, which has led to greater flexibility in the company.

Export activities to Switzerland, Germany, Netherlands, France by IWT/rail/road are carried out from the location. Transport by water ways and rail is preferred. The cost savings of water transport are around 25% compared to rail and up to 40% compared to road transport. At present, the turnover of goods by water is 7 to 10%. The basic requirement for transport by water is that the customer has the appropriate port infrastructure to take over the goods. At this point, it should not go unmentioned that the Port of Vienna Albern is well connected to the TEN-T core network.

Regarding container traffic, it is noted that smaller batches of organic grain can be transported economically through more cost-effective phyto-sanitary and organic controls. It is generally stated that the transport of bulk goods in Austria is declining. In particular, the capacities for tipper transport are falling, which is accompanied by price increases. This is especially the case at the time of the sugar beet campaign in Austria.

Overall, the Danube is seen as the gateway to the Black Sea for overseas transport. A strong argument in favour of the transport of organic grain on waterways is that ship transport is associated with a significant reduction in CO2 emissions. As an instrument to increase the transport

of agricultural goods on waterways, more intensive support of business settlements at river ports compared to other locations is recommended.

In conclusion the best practise has the following characteristics:

- small to medium scale the investment
- Expanding storage capacity
- Infrastructure investment to reduce transport CO2 emissions (from road to IWT).

6.2 Best practice project on making sectoral strategy – methodology and stakeholder involvement

The Strategy for the Hungarian section of the Danube were made recently with a lot of experience, and working hours, which shall be useful to those areas, who are struggling to prepare their own sectoral strategy, or struggling with the perfect methodology or struggling how to involve stakeholders and how to keep them close during the end-to-end strategy making process.

The steps of the Strategy-making were the following:

- Analysis of Hungarian and EU publications (such as scientific articles and publications of recent years) and strategies, outputs of international projects affecting the sector, as well as relevant domestic and international legislation,
- Statistical analysis of trade trends and the performance of the sector,
- Surveyed the goals and opportunities of Hungarian stakeholders through surveys that were conducted among several target groups, such as actors of Danube ports, municipalities, companies with a significant commodity base,
- The Danube freight ports in Hungary were surveyed in the framework of on-site visits,
- The analysis of each sub-area was deepened with in-depth interviews with key national and international personnel, focusing on the key players in the sector.

The methodology that was utilized during the implementation of the strategic planning task ensures that the Strategy is adopted to the existing capabilities and opportunities, it has a great contribution to transport development and economic policy objectives by being feasible, effective and sustainable and that the key actors are committed to the Strategy.

Accordingly, the following session was followed during the strategic planning:

- Throughout the process, key stakeholders in the sector were consulted in several rounds and they were involved in strategic planning throughout conferences and workshops,
- As part of the Strategy, four events were held during the spring of 2019, where stakeholders and decision-makers in the port sector were brought together. During these workshops opinions, ideas and suggestions by the industry actors were collected and were categorized into four groups: (1) expectations with the Port Development Master Plan, (2) port network plan, (3) potential development options, (4) thematic objectives and priorities of the strategy.

In conclusion the best practise has the following characteristics:

- Sectoral strategy making

- Involve stakeholders
- Methodology

6.3 Best practice project on putting national strategy into work

In 2015, a **strategy on waterborne transport development of the Republic of Serbia**, 2015-2025 was adopted, dealing with broad issues ranging renewing and modernizing the national fleet, to developing the economic potential of Serbian ports and harbours, and developing the navigational standard of international and national inland waterways. Action plan for the Strategy has been elaborated and priority projects and activities are set in order to reach targeted values.

Through its own funds and the use of pre-accession funds, the Republic of Serbia is actively working on the improvement of navigation conditions and the enhancement of port capacity. Among the current projects, we emphasize: hydrotechnical and dredging works on critical sectors of the Danube and Sava, the reconstruction of the navigation lock at HPP Đerdap 1, the implementation of the electronic waterway marking system, the expansion of port capacity in Smederevo and construction of the rail and road access infrastructure, the expansion of port capacity in Prahovo, Bogojevo and Sremska Mitrovica, the construction of new port in Belgrade, while the expansion of the capacities of other ports shall be taken into consideration in accordance with the demand and commercial possibilities.

In addition, PGA has been intensively working, in cooperation with the Ministry of Construction, Transport and Infrastructure, the Border Police Directorate and the Customs Administration, on the redefinition of border crossing points for river transport, as well as on joint procedures for ships in international traffic, when the port of loading or destination port is in the Republic of Serbia.

By improving overall navigation conditions on inland waterways, as well as by investing in the rail and road networks, we will create the environment for ports to become large logistics centres, which not only perform import and export traffic, but are also capable of accepting significant transit traffic and providing a wide range of logistics services.

In conclusion the best practise has the following characteristics:

- Elaborating national strategies
- Involve funds
- Hydrotechnical and dredging works, reconstruction
- National cooperation

6.4 Best practice project on operation of port Authority (Vukovar)

Port Authority Vukovar - Croatia, is a member of Association of Inland Port Authorities at the national level. Association of Inland Port Authorities is established on the initiative of all inland port authorities with support of the Ministry of Maritime, Transport and Infrastructure of Republic Croatia.

Association is established with the purpose to perform task of harmonization and cooperation between inland ports, as well as with other competent bodies connected with inland ports and waterways on the national level. Tasks related to harmonisations are directed to equal development of all inland ports without creating competition related to public service, as well as

harmonization of port dues, other fees and port fees for usage of infrastructure and superstructure. Furthermore, focus is also on the permanent cooperation between Croatian Railways, shipowners, port agents, forwarders, as well as with Agency for Waterways that is in charge for maintaining of inland waterways. However, the cooperation with Association of Maritime Port Authorities is being implemented as a reason to collecting and exchanging practices from the maritime ports. Regarding the activities related to education in the field of inland ports and Association of Inland Port Authorities organizes educations, conferences and seminars at the national level.

The Port of Osijek is in the City of Osijek, the administrative centre of Osijek-Baranja County. The county, being a regional government unit, is situated in the north-eastern part of the country, in the Pannonian region. It covers an area of 4.155 km2 and comprises 7.3% of Croatia's total territory.

Port Osijek was located on two sites. The "old port" was situated in the centre of the city and in the vicinity of Clinical Hospital Centre. In the old port, which has been closed in 2015, there was only the bulk cargo terminal. By allocating their resources towards newer investments and port's perspectives, Osijek port is almost nearing its final phases of construction of the new port.

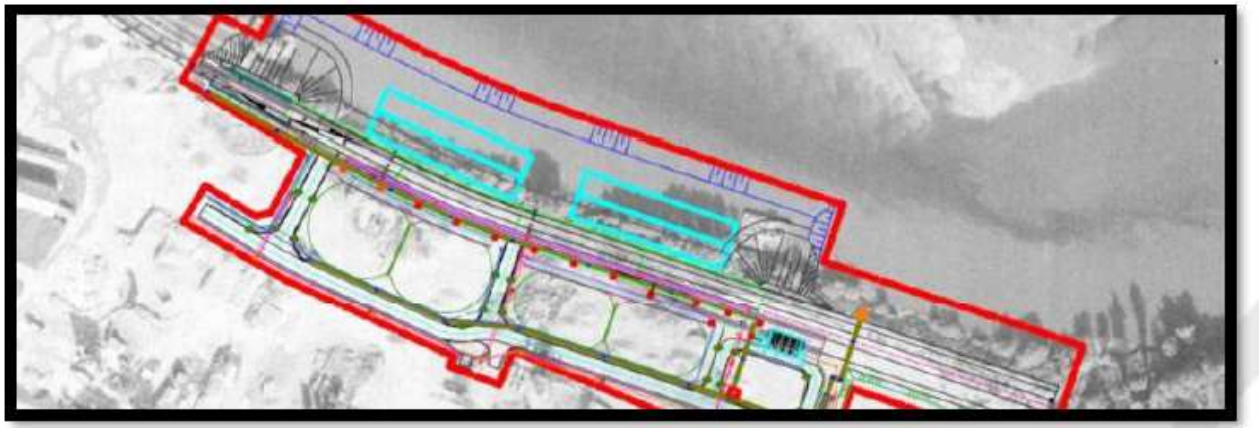

Figure 24: Bulk cargo handling terminal construction blueprint in Osijek

In May 2017, the Port of Osijek Authority concluded a Grant Agreement No. KK.07.3.1.01.0001 for the project "Construction of a bulk cargo handling terminal" in the Port of Osijek. This is the first project of all sea and river ports in the Republic of Croatia that has been approved for co-financing from EU funds (aid intensity is 90.0375383% of eligible costs).
The project includes:

- Construction of a shore for transshipment of bulk cargo in the length of 240m with 2 berths for ship's
- Cargo handling plant and hopper
- Crane tracks in the length of approx. 300 m
- Construction of a continuation of railway tracks in the length of approximately 450 m
- Construction of an access road in the length of approximately 300 m
- Construction of infrastructure necessary for the operation of the terminal (water supply, stormwater drainage, lighting, electricity supply, etc.)

The total area of the planned project is 4.5 ha. The total value of the terminal construction project amounts to HRK 145,533,786.00, while the Grant Agreement will co-finance 90.04% of the eligible

costs of the project, i.e., HRK 117,567,474.53 with public funds. The planned completion of the project is in the second quarter of 2021.

Facilities on the area of the "old port" need to be relocated to the location of the "new port" for four most important reasons:

- Necessity of integral cargo transshipment in one location
- Better traffic connections at the New Port location
- Prevention of possible ecological incident in the city centre
- Reduction of noise and dust in the vicinity of the hospital

Through the implementation of this project, some economic, social and ecological results will be achieved there as well. These are:

1. Increasing the safety of navigation
2. Decreasing of transport costs
3. Increasing traffic on the Drava and Danube rivers
4. Employment during the implementation of the project for a period of about 3 years but also after the end of construction

As transport of goods on the Danube and its tributaries has a cross-border character, the entire Danube region will benefit from building infrastructure in the Port of Osijek.

In conclusion the best practise has the following characteristics:

- Association is established with the purpose to perform task of harmonization and cooperation
- Co-financing from EU funds

6.5 Best practice project on adopting European standards

The Integrated Transport Strategy defines the contribution of the Republic of Bulgaria to the Single European Transport Area in accordance with the general priorities under Article 10 of Regulation (EU) No. 1315/2013 of the European Parliament and the Council, including priorities for investments in primary and extended TEN-T network in secondary connectivity.

At a national level, the different modes of transport create preconditions for the application of many good practices.

In terms of roads, in the period 2017 – 2018 an inspection of all tunnels on the national road network has been made by EA Road Infrastructure. Motorway tunnels, matching the TNT-T network are 10 and their total length 6 377 m. The results showed that it is necessary the facilities on the highway Hemus and Trakia Motorway to be improved and modernized.

As part of a pilot project a „Smart transport systems" for Trakia Motorway and a tunnel "Trajan's Gate" have been implemented. It includes intelligent system for automatic identification of incidents; electronic information boards (Variable message signs), LED lighting, traffic lights tunnel installations.

Resolving the problems faced by the Bulgarian port system directly or indirectly will be positive in terms of safety and security. Adapting the relevant European and international best practices for

performing quantitative risk assessment of the Bulgarian ports for public transport (in terms of safety environmental efficiency of port activities - processing, waiting, administrative and logical procedures, etc.)– will improve to a more efficient transport option. Based on the results of the implementation of formalized risk assessment an opportunity to prioritize measures and planning improvements and corresponding investments should be sought.

6.6 Best practice project on modal shift into multimodal opportunities

Infrastructure development and European integration are the main and constant priorities of Ukraine's development. Further development and deepening of relations between Ukraine and the EU, carried out on the principles of political association and economic integration, will contribute to the implementation of better European standards in the field of infrastructure.

In 25 years, more than 200 international agreements have been concluded, most of which have been signed with European partners. The Ministry of Infrastructure of Ukraine is an active coordinator and participant in the development and implementation of infrastructure and transport and logistics in the framework of international projects and programs.

One of the largest projects implemented under this project is the railway terminal transformation in the port of Chornomorsk into a multimodal one (EUR 6.4 mio).[33].

In 2018, the implementation of large-scale projects to increase depth in the Chernomorsk seaport began. The port approach canal was reconstructed, because of which its depth was increased to 16.0 m and width to 160.0 m. Also, during 2018-2019, dredging works were performed within the first and second stages of the project construction "Reconstruction of the 1st bucket operating area of the Dry Estuary (USPA Chornomorsk branch) with an increase in depth to 15 m". The implementation of the "The operating area reconstruction along the 14-17 berths line border located in the water area of the Dry Estuary 1st bucket (USPA Chornomorsk Branch)" project will promote the large vessels services at berths 14-17, increase cargo turnover and incomes. The technological lines modernization of the existing TransBalkTerminal (Kernel Group) has been completed, bringing the capacity to 4 mio tonnes of grain cargo per year.

In 2019, due to various government programs and cooperation with the international financial partners, key infrastructure facilities were completed. Due to the joint efforts of USPA, port management and contractors with the active support of the EBRD and private partners, the readiness of the berth 1-c in the Odessa seaport is 93%. The construction of berth 1-c is part of a large investment project that USPA is implementing together with Brooklyn-Kyiv and Louis Dreyfus Ukraine with the support of EBRD. The amount of investment is more than USD 100 mio, and the future berth capacity is 4 mio tonnes per year. When it will be ready, the facility will be 254 m long, 35 m wide and 12 m deep at the border. These parameters will be enough to serve Panamax ships with deadweight of 60,000 tonnes and above. Thus, a modern grain handling complex will be built on Androsovsky Pier.[34].

[33] https://mtu.gov.ua/content/rozvitok-infrastrukturi-ta-evrointegraciya.html
[34] https://mtu.gov.ua/news/32420.html

7 Key recommendations

The partners together analysed and recommended 71 development points to improve IWT sector in any directions. All in all, 61 suggestions were grouped and analysed in strategy level in order to receive a higher and more detailed perspective throughout the Danube region. Considering that not all the received materials are on the same granularity, the points are being strategically matched into main categories and then to subcategories. It is essential to analyse the country inputs in two ways:

- Evaluation of development points by strategic pillars (summarizing the categorized recommendations into strategic directions as mentioned below)
- Regional evaluation (recommendations construed by regions). In this section (differently to the general Danube categories) geological territories are the followings:
  - Upper region consists of Austria, Hungary, Slovakia,
  - Middle region consists of Romania, Serbia, Croatia, and Bulgaria,
  - Lower region consists of the non-EU members: Moldova and Ukraine.

The following table shows the 6 main categories and short descriptions related to the category point.

Category	Description
Modal shift	Aims actions (new investments) which helps to influence, innovate and improve IWT in order to be more attractive
Improve IWT service quality	Aims actions (extending a better quality of existing assets or processes) which helps to improve the quality of existing services
Administrative & Financial support	Actions to be able to support the strategies financially or in an administrative way
Harmonized regulatory system	Integrates regulatory systems related to domestic and to cross-border actions
HR	Human Resource actions related to education and generation changing issues
Cross industrial cooperations	Actions which are in connection with other industries, stakeholders and solutions in order to expanding demand - vertically as the amount of goods and horizontally as type of goods

Figure 25: Strategic pillars of country recommendations

Cross industrial cooperation is linked to external activities/sectors. Administrative & Financial support and Harmonized regulatory system have a support function to be able to finish successfully big strategies, while HR, IWT service quality and Modal shift are reflecting to internal development needs. It is essential to cover all internal and external points to give a holistic overview on the future development points and to achieve a better, more attractive position in transport industry.

7.1 Evaluation of development points by strategic pillars

The suggestions are being grouped to 6 different categories. Please see below the numeric analyses of received answers:

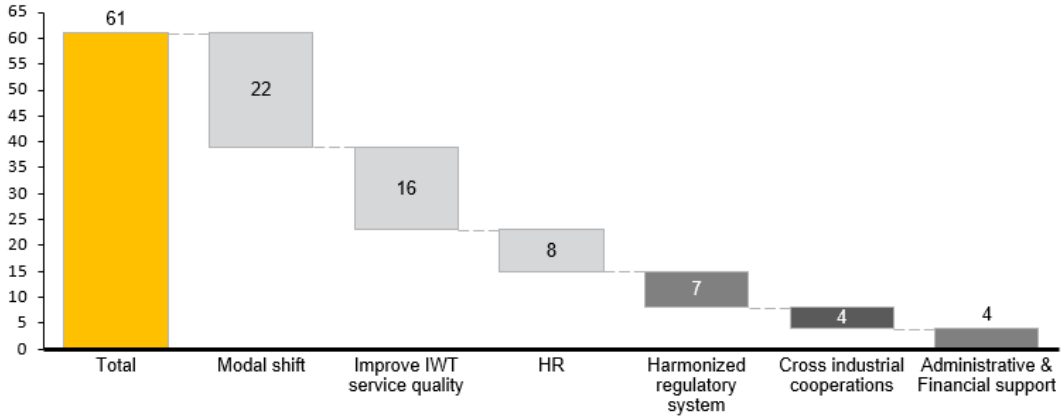

Figure 26: Numeric analyses of recommendations

More the 60% of recommendations are covered by two segments: Modal shift and Improve IWT service quality. HR is also related to this segment (see light green) – together with 46 improvement remarks. That points out that the countries together see most of the opportunities and development areas internally. After that with 11 recommendation points comes the two support segments: Administrative & Financial support and Harmonized regulatory system. These two areas can support investments and service development projects with financial, project and legal/regulatory aspects. Cross industrial cooperation is also very important part of the global transportation chain (4 recommendations). This section is the link to other industries and transport chains. The following part of this chapter highlights on each pillar a more detailed insight.

7.1.1 Modal shift

This segment represents itself with 22 registered suggestions. Most importantly intermodal and multimodal developments and warehousing facility improvement/investment were suggested to be able to use combined transport opportunities. With multi- and intermodal investments, not only the relevant port areas, but the linked transport routes shall be also renewed. As a result of multi- and intermodal investments offers a cheaper and better quality through the value chain. A more cost-effective price gives more opportunity to IWT transport.

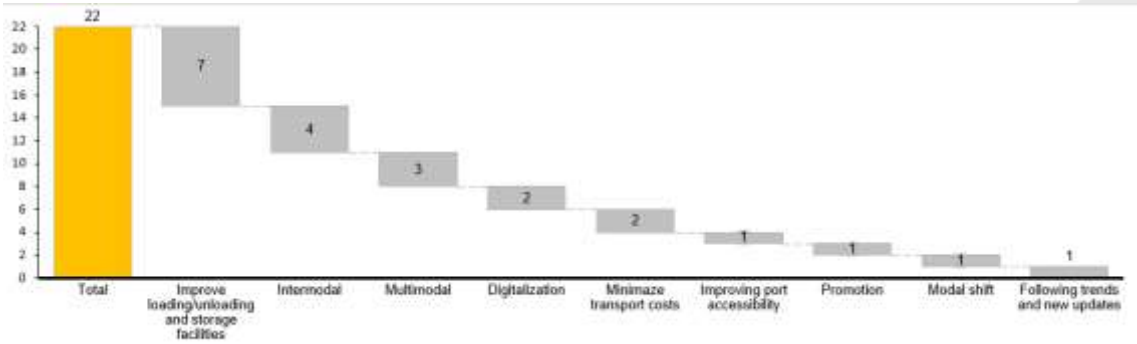

Figure 27: Breakdown of Modal shift strategic pillar

Efficiency – one of the key factors of nowadays transportation - can be gained by these logistic investments as well, which will also reduce the time and cut the total transport costs. To put it to another way, not all agricultural regions relate to IWT ports/loading facilities, so multi- and

intermodal developments are the gates to make IWT more attractive to consumers. Secondly, storage and warehouse capacity investments are also a key area for countries, four of the country reports mentions this part. It is also linked to multi- and intermodal opportunities by strengthening the role of inland ports and improving intermodal transport infrastructure and connections. The quality of these facilities is also a key area to be developed, but the study will have a deeper analysis on the IWT service quality section.

Finally, digitalization as a subcategory is also mentioned. There are two areas regarding digitalization: IWT management and smart ports. Both are key areas for a more efficient and harmonized logistic chain. However, promotion is being mentioned only once, to make Modal shift a reliable strategic goal, this subcategory shall have a bigger part in the future.

7.1.2 Improve IWT service quality

Analysing this section, the top three improvement ideas are IWT maintenance, port improvements and service development. By IWT maintenance the country reports mention unstable navigable conditions along the Danube. As mentioned before, for clients and other transport modes predictability is a key factor. However, this is a much bigger question (national water supply strategies, Green and nature regulations etc. are firstly affected by this question), shipping shall be also a winner by assuring depth and width along the Danube for fluent calculatable shipments. The country reports clearly describe, that IWT maintenance (water level, dredging, etc.) are key factor for staying predictable and competitive in the market. Not only comparing with other transport modes, but with other IWT routes such as the Rhein.

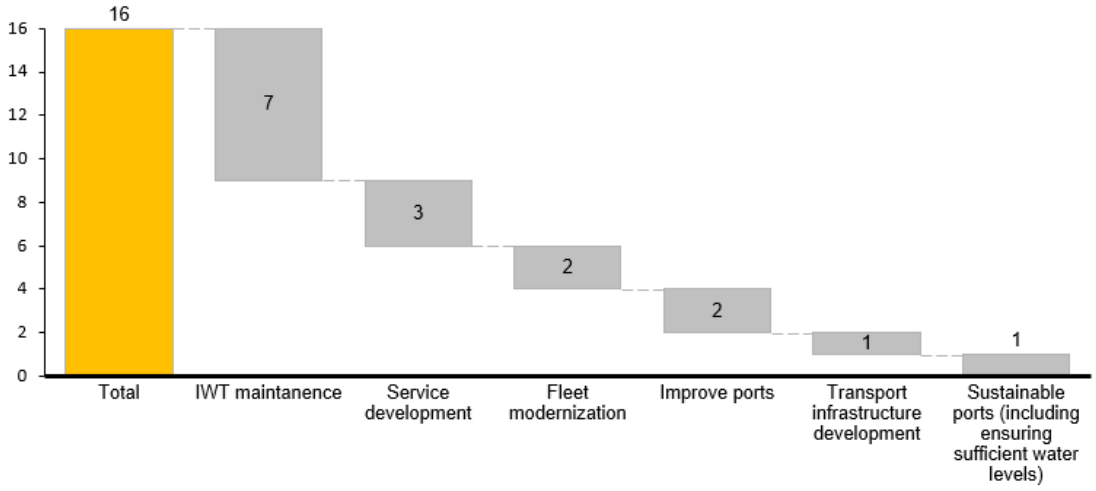

Figure 28: Breakdown of Improve IWT service quality strategic pillar

As for port developments we can see different aspects. In the upper region, the suggestions are mostly to equip ports to withstand climate change effects (e.g. flood and low water periods). Poor port hygiene and sanitation is a factor waiting for development. Ports where iron is the first material to be shipped are not always prepared for agricultural transports (Bratislava).

From one hand, service development contains a better infrastructure (e.g. intermodal logistic solutions, better connections with other modes), but on the other hand IWT maintenance is also part of it, as small water results an unplannable route (as described upper). Thirdly by service

development the quality of the whole IWT service (communication, people, information flow, efficient processes) are being mentioned.

Business cases for IWT new investments are difficult, as important investments are required upfront and benefits will – or might – come in the longer term. Thus, it is critical to increase the uptake of existing innovative solutions to modernize the fleet, which will improve the competitiveness of waterborne transport (and subsequently also improve its environmental performance). The IWT development will accelerate these processes due to its environmental friendliness and its possibility to partly replace other transport modes with a greater negative environmental effect. In a highly competitive market economy, manufacturers within the production and logistics chains strive to minimize costs, including transport costs. IWT service quality improvement and infrastructure investments are most likely to contribute to this trend.

7.1.3 HR

However, IWT is not a HR heavy transport mode as per transported goods kg/ FTE (full time employee) there are a few development areas in this segment as well. Shipping is a traditional transport mode with a high and complex barrier to start business. Most of the assets can be used at the age of after 50 years as well. That means digitalization and modernization affects the industry slowly, much slower than to the other transport modes (road transportation).

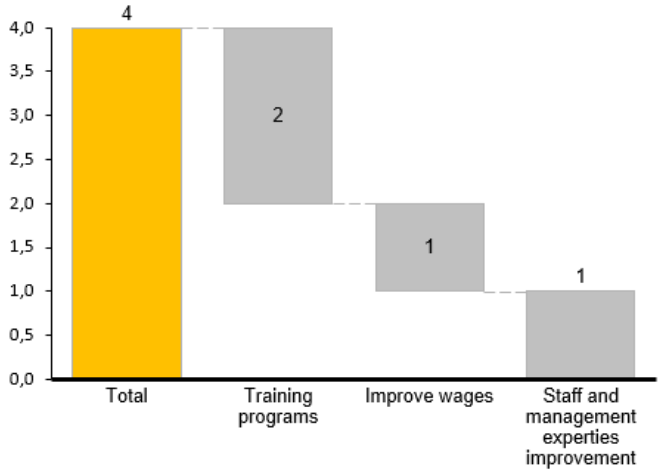

Figure 29: Breakdown of HR strategic pillar

Training programs, rising wages are usable tools to make IWT sector more attractive as per country reports. In some cases, not just the operational level, but the management is an aging profession as well. That issue can be solved by targeting the current employees with coordinated training programs and making IWT profession more attractive (e.g. by service quality improvement and promotion). There is an electrical shift in navigation segment from general technical and mechanic positions. That means, the older generation, who were used to work with general tools, now using electrical equipment for the same jobs. As decarbonization becoming slowly a reliable solution in IWT as well, workers will have a bigger effect on learning new solutions, even completely new trainings will be required.

7.1.4 Administrative & Financial support

Administrative & Financial support is representing one of the support segments as written at the first phase of this chapter. The countries are suggesting different levels of this segments. Starting from the lower levels, supporting strategies by efficient implementation of international and domestic transport programs and end-to-end projects are recommendations. Industry association in national level can coordinate these projects. Going further, more specialized cross regional integrated advocacy (e.g. for ports) are suggested. This helps to create regional strategic, helps to inflow regional and sectoral investments, and supports the implementation of new methods.

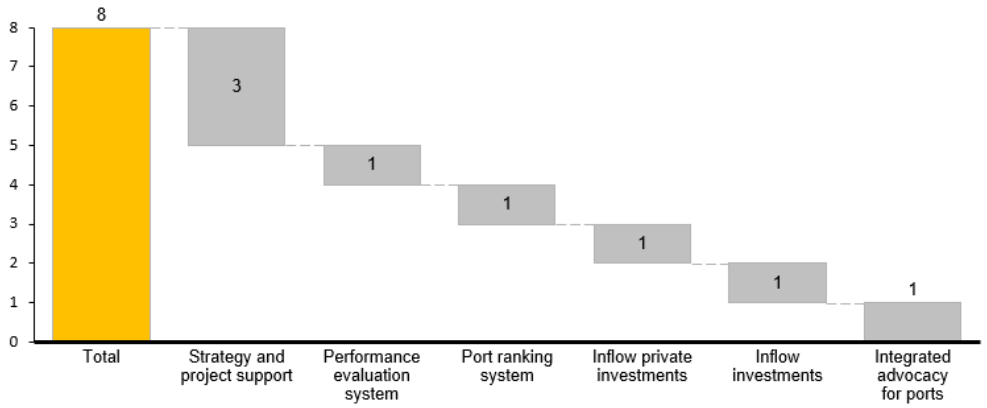

Figure 30: Breakdown of Administrative & Financial support strategic pillar

This section is immensely related to the countries outside the EU border as well (Ukraine, Moldova) or very close to the border. By generating projects from the EU and other aids, private investments are also likely to appear along the EU border countries. Also spreading the existing knowledge of implementation of big projects shall be very helpful for these regions, as per country reports.

7.1.5 Harmonized regulatory system

The other support segment is Harmonized regulatory system segment. Most of the recommendations are in touch with the Schengen border control or other EU regulation harmonization between authorities and between countries.

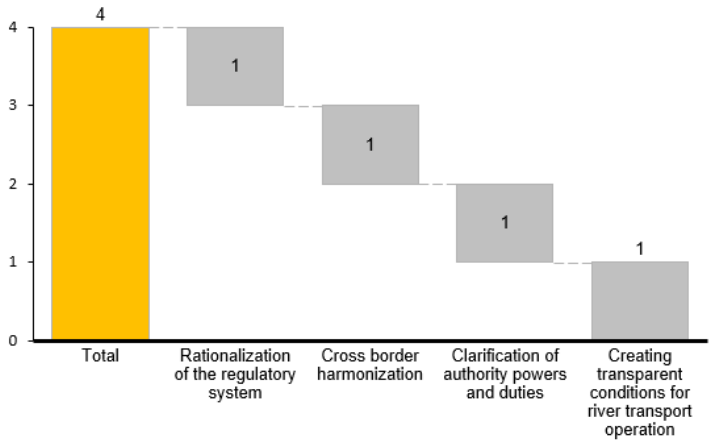

Figure 31: Breakdown of Harmonized regulatory system strategic pillar

There were several projects related to these points for example to eliminate administrative barriers (DANTE, Daphne, Danube STREAM etc.). Other suggested point is rationalization of the regulatory system. The previously mentioned point is linked with HR as well: "another obstacle to find qualified employees is the absence of a regulatory framework for workers' professional qualifications across-borders"- says one of the country reports.

Another recommendation point is clarification of authority powers and duties. Promotion between authorities and private sector shall help to clarify the positions.

7.1.6 Cross industrial cooperation

In total, seven suggestions are related to this segment. With the achieving strategically important conditions in terms of corresponding infrastructure and superstructure (reliable navigable conditions, port and warehousing facilities, access infrastructure), promotion campaigns, close coordination with the industry and continuous trainings on different levels, shall achieve more utilization.

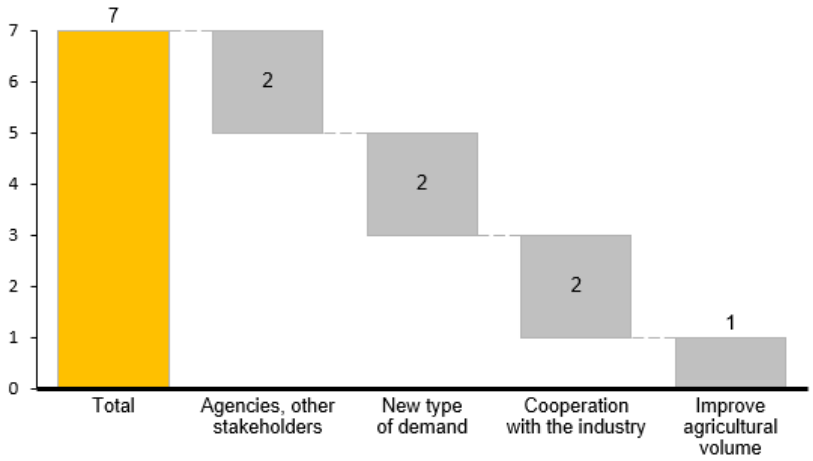

Figure 32: Breakdown of Cross industrial cooperation strategic pillar

Cooperation with the industrial partners IWT offers a more punctual information flow with a demand side of the market. It results a better understanding of business, a closer look, and a higher demand. A well seen issue is that shippers prefer transporting goods using trusty and well-known and tested routes and modes. They might consider transshipments to different modes as a risk. To avoid experiencing this habitats HR activities are considered to implement. With changing the mindset, supporting the crew with trainings it is possible to increase support of business settlements along the waterways, by cooperating with business agencies and relevant stakeholders. The middle and the lower region countries suggestion a closer cooperation with industries to develop a higher volume of transport mostly with existing goods, while the upper region recommends following new trends (bioenergy, organic products etc).

7.1.7 Conclusion

To summarize, there are six segments of the recommendations with an overwhelming section of "Modal shift" and "service quality improvement". While Modal shift had more focus on investments

which supports to become multi- or intermodal, or to have a bigger storage capacity - to encourage higher traffic share, IWT service development focuses more on internal process, service development, as well as fleet and waterway maintenance.

These two strategic pillars represent 62% of the total recommendations, showing the severity of the current development requirements. One key area is IWT maintenance, balanced and predictable water level insurance. Without professional expert no industry is capable of staying / becoming competitive. These points are in priority in future investment requirements if IWT would like to decrease its wacky business habitat, but more importantly transport and other linked costs (as per country reports).

7.2 Region evaluation

Beside the summarized Danube level analysis, it is also important to have another view of the data, which is a regional research. With analysing the development points per region, the report shall detect different maturity levels of each and another region.

Regional evaluation (recommendations construed by regions). In this section (differently to the general Danube categories) geological territories are the followings:

- Upper region consists of Austria, Hungary, Slovakia,
- Middle region consists of Romania, Serbia, Croatia and Bulgaria,
- Lower region consists of the non-EU members – Moldova and Ukraine.

Analysis of North area:

As for data quality, 31 recommendations were written by these countries. The north area mostly covers higher levelled development proposals.

- increase support of business settlements along the waterways, by cooperating with business agencies and relevant stakeholders;
- consider expansion opportunities at the interface to the bioenergy sector;
- consider expansion opportunities regarding organic products;
- pursue the digitalization of IWT management;
- develop transshipment facilities for combined transport and railway connections designed to support the modal shift of freight from road to rail and water;
- secure tax and promotional benefits;
- improving loading/unloading and storage facilities;
- digitalization and automatization of ports (smart ports);
- sustainable ports (including ensuring sufficient water levels);
- integrated advocacy for ports;
- improve wages;
- training programs;
- clarification of authority powers and duties;
- improve port hygiene and sanitation;
- improving technical state of barges;
- assure Danube depth and width for fluent calculatable shipment.

Analysis of Middle area:

As for data quality, 19 recommendations are implemented in the study. Mostly IWT quality service points are being described which currently make IWT less attractive. To give a deeper understanding, the report highlights some of these points below:

- Infrastructure of waterborne transport still needs to be developed and upgraded in many regions of the EU. The needed investments include the IWT and ports infrastructure itself (fairways, locks, quays…) and the hinterland connections of seaports and inland ports.
- A lack of qualified IWT staff for both operational and management has been identified. Another obstacle to find qualified employees is the absence of a regulatory framework for workers' professional qualifications across-borders.
- Lack of collaboration or coordination among stakeholders.
- Moreover, the poor integration between IWT and the other actors within the logistics chain hinder the development of alternative solutions.
- Bulgarian river ports used for transportation, storage or transshipment of agricultural products are few and their storage and other related facilities are in poor condition.

Analysis of Lower-non-EU area:

As for data quality more than 11 recommendations are implemented in the study. The Lower region mentions Financial, regulatory and IWT service quality improvement suggestions, such as:

- It is necessary to organize reliable and competitive container shipping chains;
- development of a scientifically ground strategy for the river transport development in Ukraine;
- further national transport system integration into the international system will facilitate Ukraine's accession to the EU, so the transport infrastructure development will allow integrating not only the transport process, but also trade and production capacity;
- the river transportations development is necessity due to the need to create an alternative (free competition) in the Danube transport market to optimize capacity, reduce costs and improve the services quality for the passage of goods in the river-sea, as well as a response and demand for harmonious development of all modes of transport;
- Danube freight traffic will grow by switching freight from land transport in creating transparent conditions for river transport operation, providing simplified clearance procedures;
- active implementation of international and domestic transport programs and projects.

In conclusion, the northern areas are focusing more on fine tuning existing procedures, further improving existing assets and utilizing best practices. While the middle region is focusing on HR related developments, quality service and port investment recommendations. The lower region is focusing mostly on adopting EU standards, strategic frameworks, and governance methods, to be able to improve quantity and quality IWT as well. Of course, other points such as IWT maintenance and multi- and intermodal investment needs covers nearly the whole Danube region.

8 Closing remarks

In 2020 The United Nations has released its final document called "White Paper on the Progress, Accomplishments and Future of Sustainable Inland Water Transport". The document covers all necessary parts but reflect more in Chapter IV to present challenges. The chapter called "Developments and Challenges in European Inland Water Transport and the Way Forward" highlights the pain points of the European IWW sector in general:

Fleet modernization and greening

"Many vessels currently operating on the European waterways were built more than 30 years ago. Almost the entire fleet is equipped with diesel combustion engines and diesel-powered electrical generators to provide electrical power on board. Environmental performance can be improved by using alternative propulsion systems, alternative fuels and by the aftertreatment of the emissions from engines. The readiness of the sector to proactively invest into new and enhanced power supply systems is rather low, since most owners will not replace an engine that is still functional. Alternative propulsion systems are now a widely discussed topic in the IWT sector, which has already implemented low sulphur diesel as an industry standard, thus significantly lowering the emission of sulphur oxides. The most common alternatives for diesel are Liquified Natural Gas (LNG), Gas to Liquid (GTL) and hydrogen. The success of these systems in the future will be highly dependent on their reliability, their availability, their durability and probably very importantly, their price."[35]

Building a resilient inland water transport infrastructure

The past years showed the impact of climate change on the water levels on some of Europe's main waterways such the Rhine and the Danube. A resilient and well-maintained waterway infrastructure is crucial for the IWT sector. The flawless functioning of the waterways and the waterway infrastructure are paramount for green, safe and efficient shipping.

Waste management

For the Danube region, the project on the Convention on Waste Management for Inland Navigation on the Danube (CO-WANDA)84 has developed a concept for on an International Danube Ship Waste Convention (IDSWC) which is not yet in effect. DC member States and contracting parties to CDNI have expressed their willingness to establish the uniform regulations at their joint meeting in October 2018 in Vienna. States of both river basins have agreed in principle that, for the effective management of ship-generated waste, international regulations should have a legally binding nature, like CDNI, which has been proving its practical applicability for 10 years.[36]

Smart shipping and digitalization

Research and pilot projects in the field of automated navigation and smart shipping are conducted in many countries in two directions:

[35] IWW_White Paper ECE Trans, United Nation 2020 – Chapter IV.
[36] IWW_White Paper ECE Trans, United Nation 2020 – Chapter IV.

- Creation of "smart" and automated vessels for various purposes;
- Creation of a "smart" onshore infrastructure to provide safe and cost-effective navigation of "smart" and automated vessels; this work is closely related to the task of "digitalization" on inland waterways. [37]

Both advantages and disadvantages and risks of implementing automated navigation and smart shipping should be comprehensively assessed. Risks of a technical nature are quite predictable and can be consistently eliminated by industry and science. Social risks are currently impossible to assess and predict. Due consideration should be given to legal aspects, including those in the event of an accident involving an unmanned vessel, consequences for the cargo and the coastline.

Education and training

The main challenges for the education and training of future IWT professionals are plentiful and include the fact that some crew members do not undertake homogenous training. They may have undergone a dual education consisting of practical and theoretical training on a regular training institute in the best case. Other professionals received theoretical training before entering the sector. In addition, numerous workers have not received any formal professional education at all.

It is furthermore necessary to assess the current content of training and education in the light of the ongoing digitalization of the sector. It is expected that the operation of automated vessels will require a different, more digitally oriented skill set than the operation of a conventional vessel.[38]

Working and wages

The average age of workers on an IWT vessel is often higher than 50, and the boatmasters are often older on average. This means that a growing number of IWT professionals are about to leave the sector due to their age and cannot be sufficiently replaced by newly recruited staff. Some European educational institutions report dwindling numbers of new students.

The job market within the European IWT sector is currently characterized by many vacancies and an insufficient influx of newcomers. There are insufficient crew available, even if the jobs are, at least in western Europe, relatively well paid (compared to the wages paid in short sea shipping) and offer predictable free time, since most crews enjoy several work free weeks after their usually two- or four-week shifts. Furthermore, such technical professions are not the first choice for many youngsters when they choose a career path.[39]

Comparing the White Paper with the Danube Region's bottlenecks and moreover with the recommendation chapter, we can see some very similar patterns.

Going through the themes "Fleet modernization and greening" is critical question in terms of climate change and economic trends, even in short term 2030. As IWW is not as attractive (read above this chapter), skippers and ship owners are simply not yet forced from business or regulatory side to invest and use greener technologies. It seems a little contrast, that shipping is a greener

[37] IWW_White Paper ECE Trans, United Nation 2020 – Chapter IV.
[38] IWW_White Paper ECE Trans, United Nation 2020 – Chapter IV.
[39] IWW_White Paper ECE Trans, United Nation 2020 – Chapter IV.

alternative against road transport, however in general, shipping cannot change and react at all to climate change compare to HGV-s. The second, IWT infrastructure is crucial for the sector, what for every business owner is voting for. Smart shipping and digitalization if not in the same level, but also a key point on the recommendation list of the Danube IWT summary country report, as for the White Paper as well. HR – or digging deeper the lack of appropriate number of new generated and digitally educated experts are generally missing from the industry. Without human resources non-of any industry capable of staying competitive.

Promotion of modal shifts from road to maritime shipping, inland navigation and rail saves emissions. Road is the main mode of freight transport in the EU, representing over 51 % of all tonne-kilometres transported in 2016, while sea represents almost 33 %, rail 12 %, inland waterways 4 %, and air transport a mere 0.1 %. As other modes are less carbon-intensive per tonne kilometre, a modal shift from road to rail, inland navigation or shipping is always environmentally beneficial if operationally feasible. The EU has set a goal of a 50 % shift of medium-distance freight journeys to rail by 2050 (European Commission, 2011). To achieve this goal, it is necessary to deploy transhipment terminals in ports and multimodal terminals in rail and inland navigation.[40]

Electrification is to play an earlier role in the decarbonisation of domestic shipping than in that of international marine navigation. Depending on different purposes (freight versus passengers) and distances travelled (national or international) different technologies and fuels may enable shipping to be rendered carbon-neutral. While for some purposes (e.g. local and regional passenger ferry transport or inland navigation) electrification by the use of batteries may prove to be the optimal choice, for other purposes (e.g. intercontinental cargo shipping) hydrogen with fuel cells, biofuels, liquid biomethane or synthetic or renewable fuels — or a mix of these options — may be the cost-efficient solution. From a technical point of view, electrification of short sea shipping and inland navigation is a feasible decarbonisation option, but further investigation of the operation of batteries is needed in view of the safety requirements for waterborne transport. For some long-distance marine navigation purposes, nuclear propulsion could be imagined as this option can rely on a submarine and icebreaker experience base. Drawbacks, however, include the production of radioactive waste, accident risks and concerns over proliferation of nuclear materials (von Hippel, 2016) as well as negative attitudes and perceptions of society. Hydrogen fuel cell ships can also be a solution for isolated regions with a surplus of renewables and poor connections to gas and power network.

[40] European Commission - COMMISSION STAFF WORKING DOCUMENT REFIT EX-POST EVALUATION of Combined Transport Directive 92/106/EEC Final Report, 2018