MARKET REPORT 2014-2019

Main features and trends of the European Inland Waterway Transport sector

European Commission

CCNR
CENTRAL COMMISSION
FOR THE NAVIGATION OF THE RHINE

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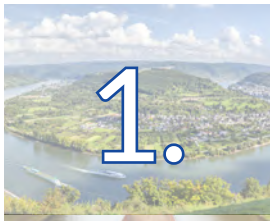

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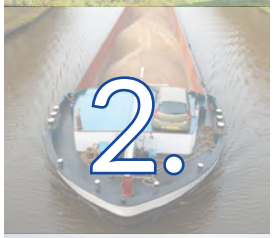

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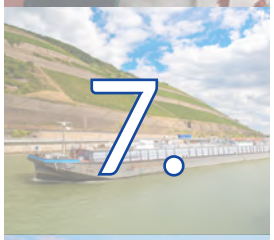

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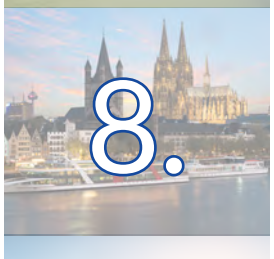

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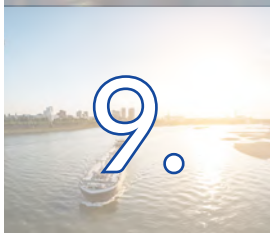

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Preliminary remarks

This report covers mainly the time frame from 2014 until 2019 and describes the development of the European inland navigation sector in that period. It is important to note that this period does not include the Covid-19 crisis. Although the report refers to the Covid-19 crisis in some places, the main datasets that constitute the statistical basis for this report cover the time period 2014-2019.

The report deals with many important trends relevant to inland navigation, such as climate change and the associated low water periods, energy transition and the associated decline in the transport of coal, industrial developments and their impact on transport demand, as well as developments in the areas of the labour market, the company sector, emissions, greening and passenger shipping. A summary and conclusions can be found at the end of the report in chapter 9.

The period from 2014 to 2019 is a suitable time frame for such a report for two main reasons. Firstly, there are macroeconomic reasons. This period coincides almost exactly with a medium-term business cycle that started after the euro debt crisis of 2011/2012 and was already gradually drawing to an end in 2019. Even before the Covid-19 crisis, there was already an economic downturn, which could be measured by indicators in the steel and chemical industries, amongst others. This had already affected the demand for transport in inland navigation in 2018 and 2019. These macroeconomic factors are referred to several times in the report.

The Covid-19 pandemic, however, represents a completely different type of influence, which cannot be compared and should not be confused with the influencing factors that were observed between 2014 and 2019. For this macroeconomic reason, it makes sense to examine the development of the European inland navigation sector for the period 2014 to 2019 separately from the developments from 2020 onwards. The structural trends examined in this report remain valid for the period after 2020 and are of great relevance for the future of the inland navigation sector.

The second reason is related to statistical data. This report was written over a period of several months in 2020, when statistical data for the year 2020 were barely available. The effects of the Covid-19 pandemic can best be analysed when a critical mass of data covering a period of at least one year are available. These effects on inland navigation should be examined in a future report covering a multi-annual time period which would include the year 2020.

1. INLAND NAVIGATION CONTEXT

1. Inland navigation context

1.1 Geographical context

Inland navigation activity is very concentrated in Europe in two countries, the Netherlands and Germany, which represent 70.1% of total European goods transport performance on European inland waterways.

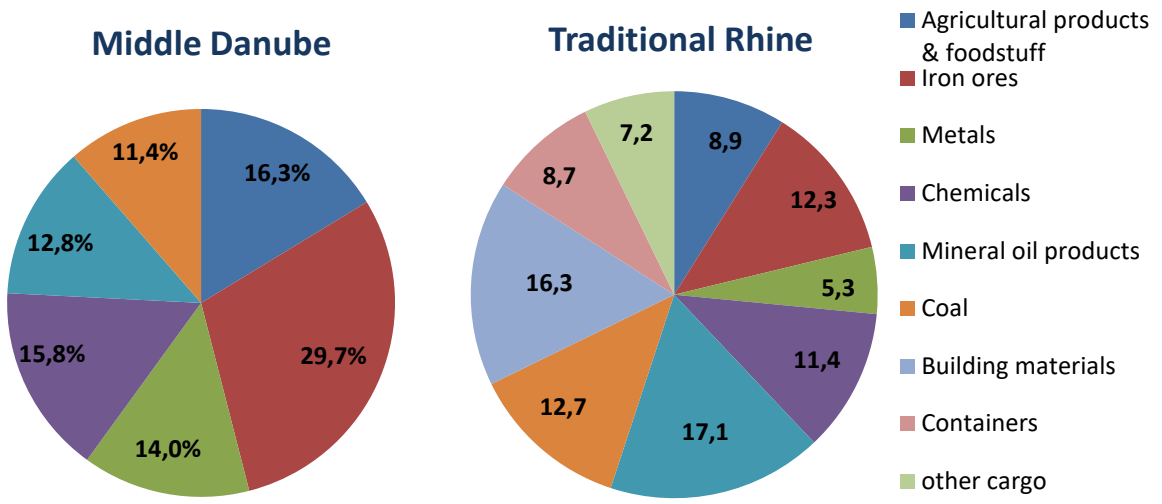
More generally, in 2019 the European Union Rhine countries and Switzerland (Belgium, the Netherlands, France, Germany, Luxembourg and Switzerland) represented 81.6% of the total inland navigation goods transport performance, while the European Union Danube countries (Bulgaria, Croatia, Hungary, Austria, Romania and Slovakia) accounted for 18.1%. All other EU countries with inland waterways had a share of 0.3% of European goods transport performance by inland navigation.

In terms of river basins, the Danube, the Rhine and the large network of waterways in the Netherlands, Belgium and northern France (north-south axis) represent around 92-94% of the total European inland navigation transport performance.

Map 1: Main European river basins and associated annual transport performance*

*Sources: Eurostat, Destatis, VNF, Moselle Commission, CCNR analysis. * Rhine is the entire navigable Rhine running from Basel to the North Sea / North-South Axis is the dense network of waterways covering the north of France, Belgium and the Netherlands (excluding the Dutch part of the Rhine).*

Figure 1: Share of transported goods on the Middle Danube and on the Traditional Rhine (%) in 2019



*Source: CCNR analysis based on Destatis and Danube Commission. *For containers: net-weight of cargo in containers. Traditional Rhine = Rhine from Basel to German-Dutch border. Middle Danube = traffic at the lock of Mohacs in southern Hungary. Chemicals on the Middle Danube consist of fertilizers.*

In order to compare the structure per goods segment of Rhine and Danube transport, data for the Middle Danube in southern Hungary and the traditional Rhine between Basel and the German-Dutch border are used.[1] When comparing the cargo structure on the Danube and the Rhine, certain differences emerge. The steel industry (iron ore, metals, and a part of coal) accounts for 45-55% of the total cargo on the Middle Danube. (This range is due coal being partly used in the steel industry, and partly in the energy sector, and an exact share of steel related coal cannot be indicated.) Between 60% and 71% of cargo transport on the Middle Danube is derived from the agricultural sector and the steel industry taken together.

For Rhine transport, the share of steel industry related materials is approximately 23.6%. This includes iron ore (12.3%), metals (5.3%), coking coal for steel manufacturing (5.0%)[2] and metal wastes (1-2%).[3] Agricultural products, feedstuff, and the steel industry related materials have an approximate share of 32.5% on the Rhine, which is roughly half as high as the respective share on the Middle Danube.

The cargo structure in Danube navigation, being strongly focused on two market segments only, is less diversified than Rhine transport. The higher diversification in Rhine transport comes from several cargo segments, amongst them the sands, stones, and building materials, which account for 16.3% of total volumes on the Rhine and are not present on the Middle Danube. Sands, stones and gravel is a cargo segment which is present on the Upper and Lower Danube, but not on the Middle Danube. In general, its share in Danube navigation is much lower than on the Rhine. Container transport has a share of 8.7% in Rhine navigation but is not present on the Danube.

Rhine navigation has a higher share of liquid cargo than Danube navigation. In 2019, 45.4 million tonnes of liquid cargo were transported on the traditional Rhine (= 25.8% of total volume). [4] On the Middle Danube, the liquid cargo share is much lower. At the measurement point of Mohacs in southern Hungary,

[1] These datasets allow for the most detailed analysis of goods transport per cargo segment.
[2] In 2019, 22.4 million tonnes of coal were transported on the traditional Rhine. An estimated share of 40% of these volumes were used by the German steel industry. This estimation is based on data from the German Association of Coal importers (Verein der Kohleimporteure), according to which steel production accounted for 39.3% of all coal consumption in Germany in 2018 (the rest being used for electricity generation and heating energy). When applying the share of 39.3% on coal transports on the Rhine, a volume of 8.8 million tonnes emerges, which represents a share of around 5% of total Rhine transport in 2019.
[3] The exact amount of metal waste and scrap metals in Rhine transport cannot be indicated, due to statistical limitations. An estimation based on previous volumes points to an amount of 2 to 3 million tonnes per year, which represents 1-2% of total Rhine traffic.
[4] The source of this figure is another Rhine transport database. The share does not represent the sum of chemicals and mineral oil products, as not all chemicals are liquid.

mineral oil products represent 12.8% (see table). Chemicals are not considered as a liquid cargo at this measurement point, as they consist of fertilizers. The liquid cargo share is therefore equal to the share of mineral oil products and half as high as the liquid cargo share in Rhine navigation. The following table summarizes the main structural differences between Rhine and Middle Danube regarding cargo transport.

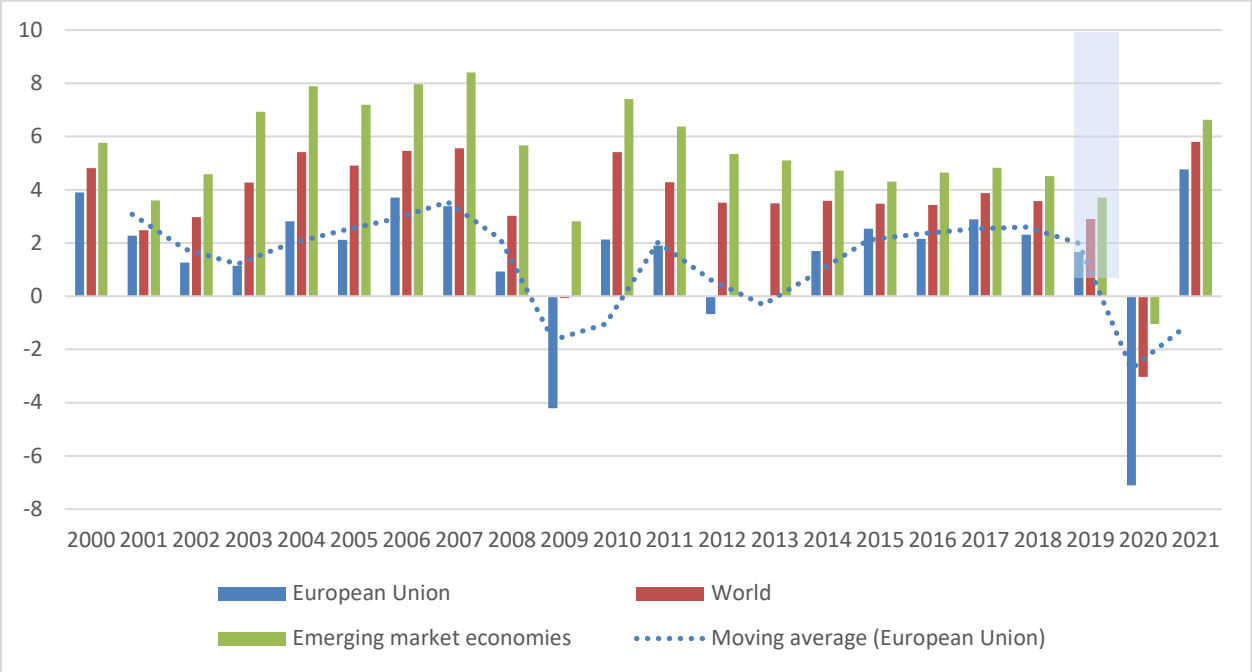
Table 1: Structural differences in cargo transport between Rhine and Danube in 2019

Cargo segment	Share in Rhine transport	Share in Danube transport*
Steel industry	23.6%	45-55%
Agriculture, food, feedstuff	8.9%	16.3%
Liquid cargo	25.8%	12.8%
Construction sector	16.3%	0.0%
Container transport	8.7%	0.0%

*Source: CCNR analysis based on national data and Eurostat, Danube Commission. * Cargo structure on the Middle Danube in southern Hungary (Mohacs). Although the structure might be different on other stretches of the Danube, a high share of agricultural and steel related materials are in general typical features of Danube transport, as well as a relatively low share of liquid bulk and sands, stones and gravel. Container transport is almost absent on the Danube.*

1.2 Economic context

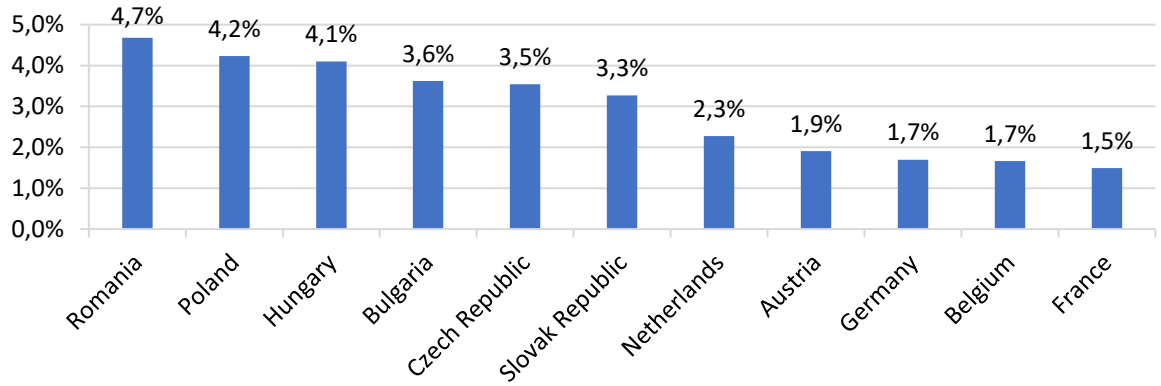
Figure 2: Percentage change of gross domestic product (in constant prices) compared to one year previously and the forecast for 2020 and 2021 in the optimistic baseline scenario



Source: IMF World Economic Outlook Database, Outlook from April 2020

Since 2002, GDP evolution in the European Union has been characterised by two medium-term business cycles reaching their peaks in 2006 and 2017, respectively. The GDP growth rates in the peak years were about 3.7% (2006) and 2.9% (2017). In the two years after 2017, GDP growth decelerated. Already before the outbreak of the COVID-19 pandemic, it was assumed that this evolution will continue in the following two years, due to the downswing of the business cycle between 2013 and 2020. Strong downward deviations from this trend will arise as a consequence of the pandemic.

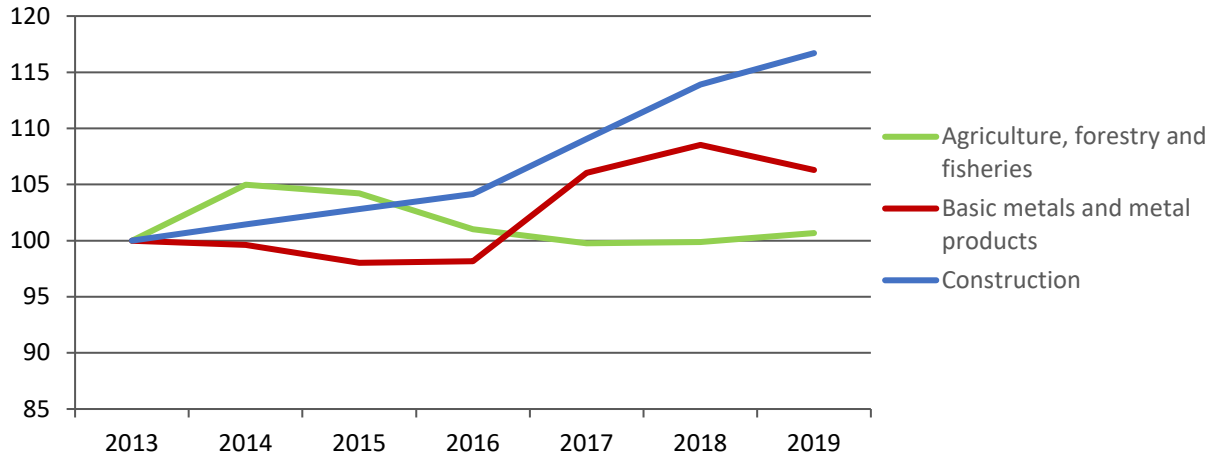
Figure 3: Average annual GDP growth between 2014 and 2019 in main European IWT countries (constant prices and exchange rates) *



*Sources: Oxford Economics, CCNR analysis. *For the year 2019, data for the 4th quarter of 2019 are forecasts.*

Eastern European countries experienced higher economic growth than western European countries with an average annual GDP growth over the last five years ranging from 3.3% to 4.7%, while western European countries' yearly GDP growth remained between 1.5% and 2.3%.

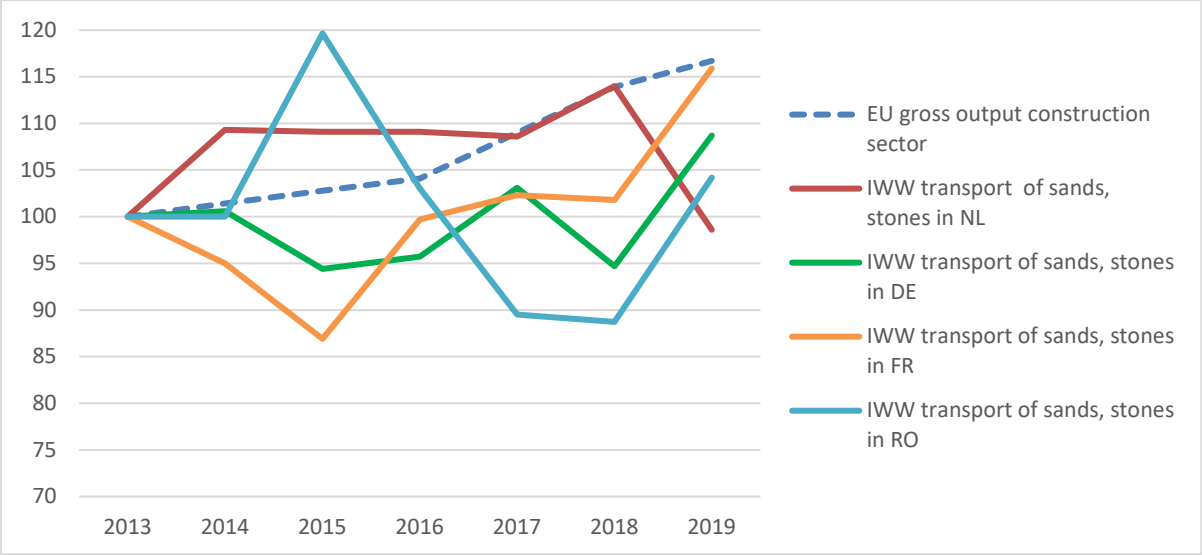
Figure 4: EU gross output of activities contributing to inland waterway goods transport (Index 2013 = 100 – based on EU gross output measured in US-$)



Sources: Oxford Economics, CCNR analysis

Economic sectors that are heavily reliant on inland navigation have not evolved in the same way over the last few years. While gross output of the construction sector has increased, on average, by about 2.8% annually between 2014 and 2019, gross output of basic metals and metal products has grown unsteadily and by only about 1.3% annually. Gross output of agriculture, forestry and fisheries has even decreased by about 0.8% annually.

Figure 5: EU gross output in the construction sector and inland waterway transport of sands, stones, gravel and building materials (Index 2013 = 100) *



*Sources: Oxford Economics, Eurostat [iww_go_atygo], CCNR analysis. * For Romania, due to missing data in 2013, the value for 2014 was assumed to hold also for 2013.*

The growth of the construction sector impacted IWT positively. This was especially the case in the Netherlands, where the upward trend materialised in an increase of IWW transport of sands, stones and building materials by 14% between 2013 and 2018. In 2019, the growth process was interrupted, due to strict governmental policies to limit emissions. This had an impact on IWW transports of sands, stones and building materials.

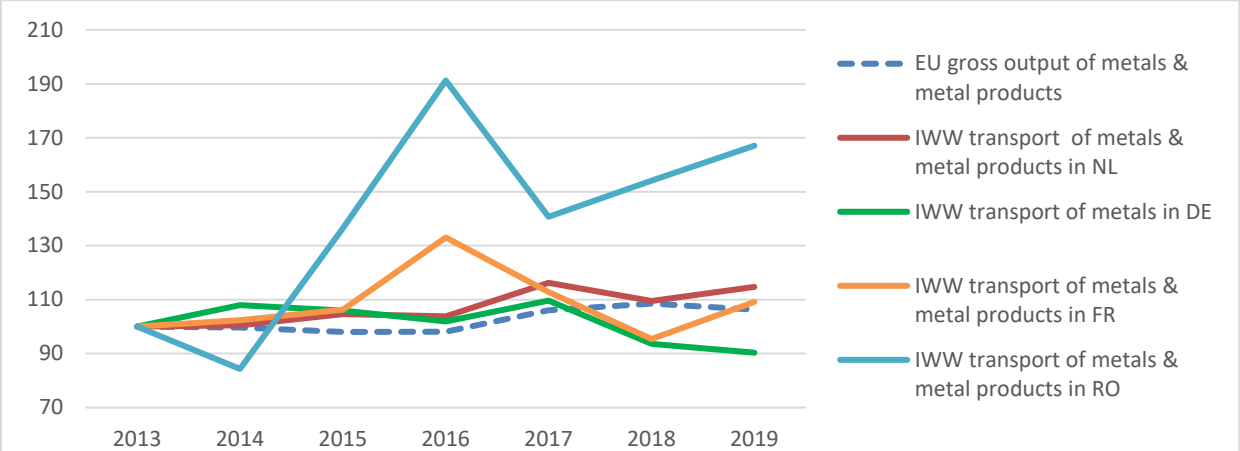
In Germany, transport of sands, stones and building materials fluctuated around a constant average value with no growth between 2013 and 2018. In 2019, they picked up strongly. The value in 2019 was 8.7% higher than in 2013. The trend in France was positive from 2015 onwards and was certainly influenced by construction projects in Paris such as the Grand Paris Express project which foresees the construction of new metro lines in Paris and in the surrounding region of the Île-de-France, as well as involving inland vessels for the logistics. The level was 15.9% higher in 2019 than in 2013. The evolution in France shows some common features with Germany, which reflects a common trend component in the EU construction sector. This is confirmed by data from the European forecasting group EUROCONSTRUCT, which conducts forecasts for the whole European construction sector twice a year per country in the EU. [5]

The transport evolution for metals was overall positive in the Netherlands, but rather negative on German waterways, although the decrease occurred entirely during 2018 and 2019. The decrease in steel production in Germany which took place in 2018 (-2%) and in 2019 (-7%) certainly played a decisive role. Iron ore transport also lost volumes in 2018 and 2019, both in the Netherlands and in Germany, after a rather constant evolution between 2014 and 2017.

[5] Data from the European forecasting group EUROCONSTRUCT show that all major EU countries exhibited a positive development in construction output between 2016 and 2019. The growth in the Netherlands was thus the highest in western Europe, followed by France, Germany and Belgium. The outlook for 2020 points to a strong decrease in France (drop from an index value of 110.4 in 2019 to 90.8 in 2020; index 2016=100). For the Netherlands, the expected drop is from 113.5 in 2019 to 105.6 in 2020, in Germany from 105.7 to 103.2, and in Belgium from 105.1 to 97.3. A recovery is foreseen for 2021 and 2022. Although all countries are expected to rebound in 2021 and 2022, the magnitude of the recovery until 2022 will be smaller than the fall in 2020. See: EUROCONSTRUCT press release from 12 June 2020.
http://www.euroconstruct.org/ec/press/pr2020_89

German steel production in 2019 was 8% lower than in 2014, French steel production was 10% below its 2014 level, and Dutch steel production 4% lower than in 2014. Only Belgian steel production had a higher value in 2019 than in 2014 (+ 6%). This represented a certain difference compared to Danube countries. Even if steel production in 2019 was lower in Austria and in Slovakia (by 6% in Austria and by 16% in Slovakia) than in 2014, the overall picture in Danube countries was more growth orientated. This was due to an increase in Romanian steel production (+ 9% between 2014 and 2019), as well as in Hungarian steel production (+ 54%) and especially in Serbian steel production (+231%).[6] The growth in steel production in Romania translated also into a growth in inland waterway transport of metals in Romania. Hereby it should be considered that the intense growth of metals transport on the Romanian part of the Danube also reflects an increase in steel production and metals transport in Middle Danube countries such as Hungary and Serbia, due to the export of metals from the Middle Danube downstream to the ports on the Black Sea.

Figure 6: EU gross output for basic metals and metal products and inland waterway transport of metals and metal products (Index 2013 = 100)



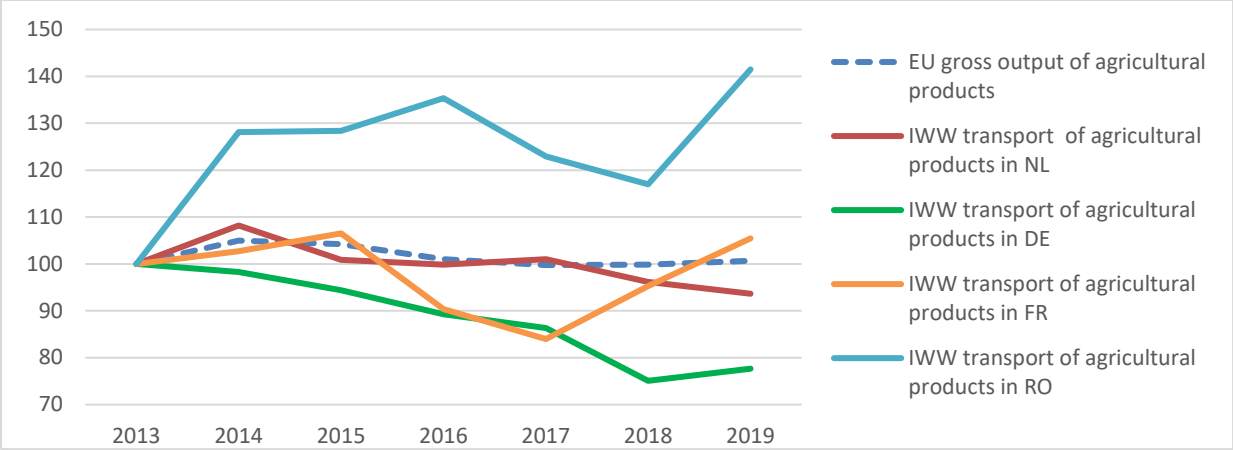
Sources: Oxford Economics, Eurostat [iww_go_atygo], CCNR analysis

The long run trend for IWW metals transport (data since 1990) is rather positive in France and in the Netherlands, but more negative in Germany. The absolute values are currently (2019) 10.1 million tonnes in Germany, 13.3 million tonnes in the Netherlands, and 3.2 million tonnes in France.

The transport evolution for agricultural products was also very positive in Romania, quite negative in Germany and volatile in France. In the Netherlands, the volumes of agricultural transport has followed a more or less negative trend since 2014. The development in Germany needs some explanation. When comparing the harvest results in Germany with IWW transport of agricultural products, it is indeed observed that harvest results had been on a downward path since 2013 and picked up only in 2019.

[6] Source: The European Steel Association (EUROFER), http://www.eurofer.org/Facts%26Figures/Crude%20Steel%20Production/All%20Qualities.fhtml

Figure 7: EU gross output for basic agricultural products and inland waterway transport of agricultural products (Index 2013 = 100)



Sources: Oxford Economics, Eurostat [iww_go_atygo], CCNR analysis

The following table summarises the comparisons made in the figures above.

Table 2: Comparison of 2014 and 2019 levels in cargo transport per goods segment and per country, and development in EU gross output in the related economic sector*

	Relationship between volumes in 2014 and 2019 in %				
Cargo segment	NL, IWW transport	DE, IWW transport	FR, IWW transport	RO, IWW transport	EU gross output
Agriculture, forestry	-13%	-21%	+3%	+10%	-4%
Metals & metal products	+14%	-16%	+7%	+98%	+7%
Construction	-10%	+8%	+22%	+4%	+15%

*Sources: CCNR analysis based on data from Oxford Economics, Eurostat [iww_go_atygo]. * NL = the Netherlands. DE = Germany. FR = France. RO = Romania.*

A certain tendency in the results can be seen. For example, construction is the sector with the most positive development in terms of EU gross output between 2014 and 2019. At the same time, three out of four countries had a positive development in IWW transport of related materials (sands, stones, gravel, building materials). The only country where volumes were lower in 2019 than in 2014 is the Netherlands. But we know that this segment had a positive trend in the Netherlands until 2018, and it was only due to national policies (restricting emissions) recently (in 2019), that the transport of sands, stones and gravel dropped in 2019 in this country.

Agriculture is the sector with a rather weak trend in terms of EU gross output (gross output was 4% lower in 2019 than in 2014). It can be seen that two out of four countries did show a decrease in IWW transport of related materials between 2014 and 2019. This share of 50% of countries showing a lower transport result in 2019 than in 2014 is the highest share within the three market segments that were analysed.

Even if the table and the related graphs contain only a limited number of countries and market segments, a kind of quantitative logic behind these results can nevertheless be observed, as they show some evidence of a common tendency between gross output trends and inland waterway transport trends. Of course, the exact strength of a trend can differ from one country to another.

1.3 Environmental context

It is important to highlight the evolution of water levels over the last years because of their impact on inland navigation. Having a direct influence on the available draught of vessels and on their maximum loading degree, water levels on rivers have an impact both on volumes transported and on freight rates. Before looking at the low water periods and their impact on Rhine navigation, some general hydrological features of the river Rhine shall be explained. [7]

The Rhine originates in the Alps and flows towards the North Sea. During its course from south to north, it receives inflow from several affluents, which influence its hydrological system. In the southern stretch of the navigable Rhine (Upper Rhine), before the inflow of major affluents, the hydrological regime of the Rhine is determined by the Alps: the interplay of winter snow cover as well as summer and glacial melt creates a hydrological regime known as "snow regime" or nival regime, characterised by relatively high-water levels in summer and relatively low water levels in winter. Therefore, within this regime, low water periods usually occur in the winter.

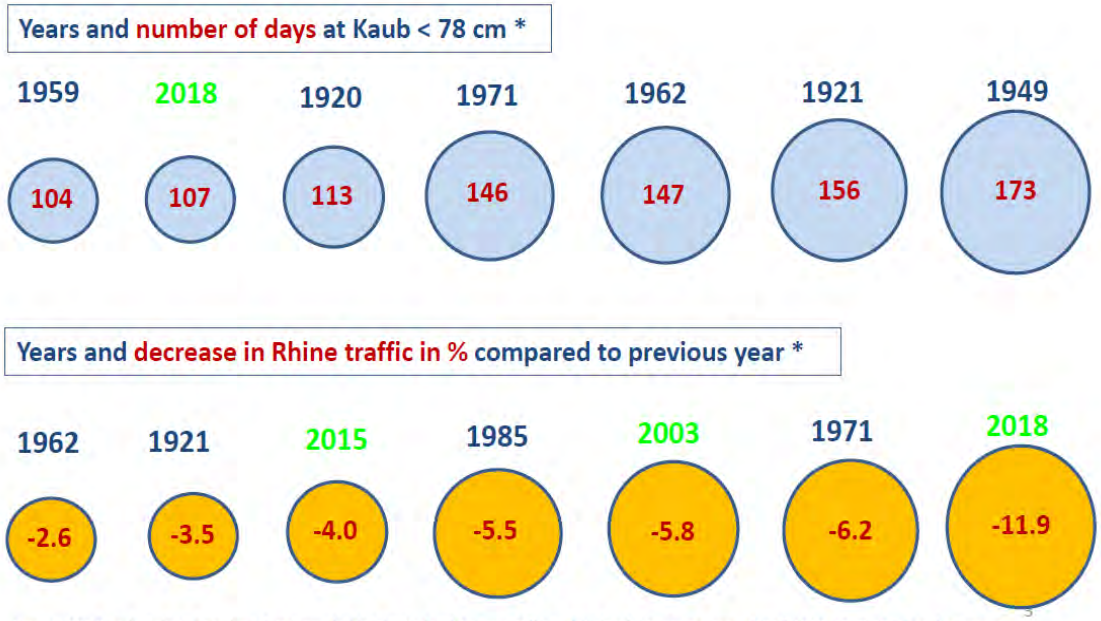
A different hydrological regime and typical for its affluents (Neckar, Main, Nahe, Lahn, Mosel) is the "rain regime" or pluvial regime. Within this regime, the winter period has a tendency towards floods, while the summer period has a tendency towards low waters. As the Rhine receives large amounts of water from its affluents - which have a pluvial regime - the Rhine develops a mixed or combined regime, which results in a more even distribution of the seasonal discharge over the year ("combined regime").

A long run analysis of low water periods on the Rhine (ICPR, 2018) for the period 1914-2015 revealed that the extreme historical low water events on the Rhine occurred in the autumn and winter months in the 1920s and 1940s. From a seasonal point of view, this would be rather consistent with the pluvial regime, but could also reflect the combined regime. The most recent low water periods occurred in September/October 2015, in winter 2016/2017, and in September/October/November 2018. These periods reflect the combined hydrological regime of the Middle and Lower Rhine.

Hydraulicity data for Kaub at the Middle Rhine show that the extreme low water phenomenon is not new. In 1920, 1921, 1949, 1962 and 1971, the number of days when the Kaub water level fell below 78cm (equivalent water level) exceeded the respective number of days in 2018.

However, the vulnerability of inland waterway transport towards low water seems to have increased. Indeed, despite 2018 being the second to last longer-lasting low water period out of the seven most severe episodes of low waters in the last 100 years, 2018 was also the year when, from an economic point of view, inland waterway transport suffered the most. Here ‘suffering’ is understood as the reduction in cargo transport, not in terms of freight rate levels. Indeed, freight rates increased sharply in 2018, which is not perceived as negative by most inland navigation companies, despite the possible negative effects on the IWT modal split share in the long term.

[7] Source: Study “Inventory of the low water conditions on the Rhine”, published by the International Commission for the Protection of the Rhine (ICPR) in 2018, page 16



Source: CCNR and analysis based on data provided by the Federal German Office of Hydraulicity. * war years (1914-1918; 1940-1945) and economic depression years (1919, 1923, 1931, 1932, 1975, 2009) are excluded.

In the following paragraphs, the impact that the three most recent low water periods on the Rhine had for cargo transport is examined. The impacts will then be compared between container, dry and liquid cargo transport.

For a Rhine voyage passing the gauging station of Kaub on the Middle Rhine (the most important indicator for low water level conditions on the Rhine), a large container ship 135 metres long and with a capacity of 500 TEU can be loaded to its full carrying capacity if the Kaub water level stands approximately between 250 cm and 260 cm.[8] The maximum loading rate then decreases continuously as the water level falls. At a Kaub water level of 135 cm, a large container vessel can be loaded to only half of its capacity. In order to transport the same amount of cargo, two vessels must then be put into service instead of one. At a Kaub level of 75 cm, already four container vessels are needed to transport the same amount of cargo.

These values are not only relevant for large container vessels but also for mass cargo transport. The German company RHENUS Logistics has its own fleet of vessels and push boats, and can charter more vessels if needed, so that its total fleet is around 350 vessels (ranging from small canal vessels to large, pushed convoys), with a tonnage per vessel (or convoy) between 700 and 6,500 tonnes. Its areas of operation are the whole European inland waterway network. According to a presentation given at the workshop on low waters, organised by the CCNR in November 2019 in Bonn[9], the available capacity of the RHENUS fleet is on average 50% lower, if the water level at Kaub reduces to 134 cm. In 2018, there were 153 days in the year when water levels at Kaub were at maximum 134 cm high. This means that on 42% of all days in 2018, the fleet of RHENUS Logistics could use only 50% of its capacity when passing the Middle Rhine at Kaub.[10]

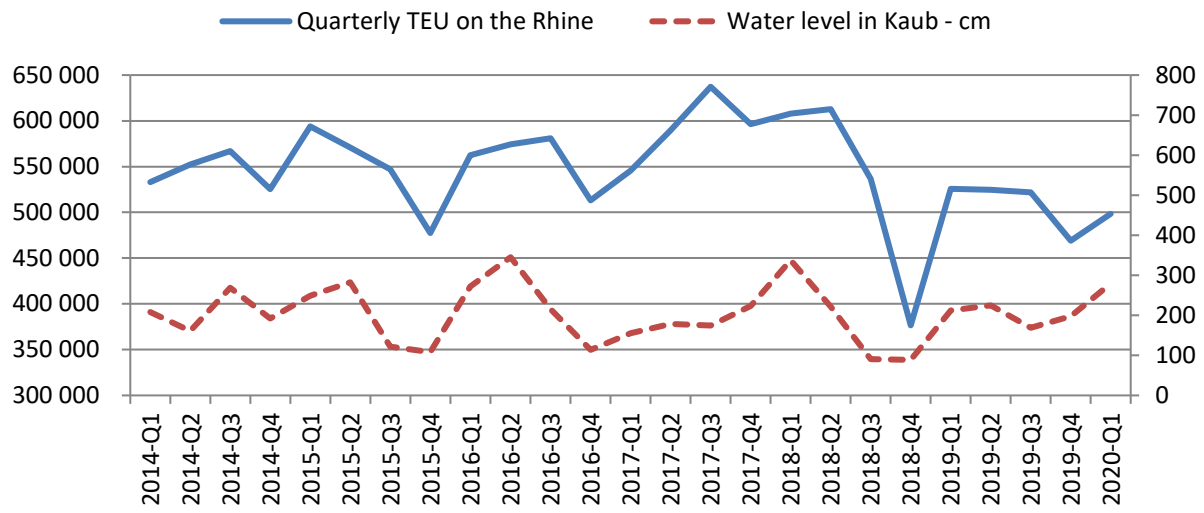
Low water periods increase costs and freight rates for barge owners and logistics companies, but this cost increase is also passed on to the shipper. Another reason for rising transport costs during low water periods is the higher number of vessels to be chartered (see examples above), which increases logistical and planning costs.

[8] These relations can be found in a brochure of the logistics operator Contargo. See: Contargo (2015), Kleinwasser Broschüre (Low water brochure).
[9] For more detailed information, presentations and reflection paper “Act now!” on low water and its effect on Rhine navigation available via the following website: https://www.ccr-zkr.org/13020151-en.html.
[10] See the presentation of Mr Philip Tomaskowicz of Rhenus PartnerShip given on 26.11.2019 in Bonn at the CCNR workshop on Low Water and its Impact on Rhine Navigation (Wirtschaftliche Folgen von Niedrigwasser für die Binnenschifffahrt; Economic consequences of low waters for inland navigation)..

From a hydrological point of view, in order to determine the severity of a low water episode, two factors are taken into account: the water level and the duration of the low water episode. Bearing these two factors in mind, it can be said that the 2018 low water period was more severe than the periods in 2016/2017 and 2015. The main difference was that water levels simply dropped to lower averages in 2018. The period in 2018 was also relatively long (stretching over two quarters), although a similar length was also observed in late 2015.

Despite these hydrological facts, the following graphical illustration suggests that the sheer extent of the decline in container transport, which took place in late 2018, cannot be explained by hydrological factors alone. It is at least very likely that the slowdown in macroeconomic development, which began in 2018 (declining growth rates for EU industrial production and EU exports/EU imports) must have played another role. Macroeconomic conditions acted as an amplifying force for the decline in container transport in 2018, compared to the situation of an upwards moving economy in 2015, 2016 and 2017 (see also chapter 1.2 Economic context).

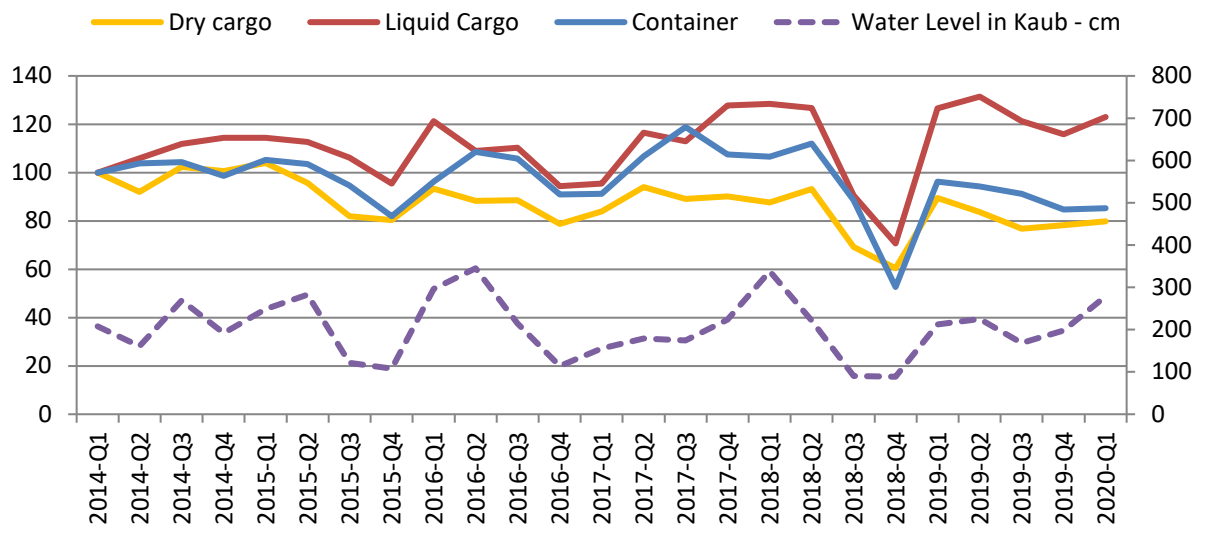
Figure 8: Container transport and water level on the Rhine at Kaub



Sources: Destatis, Federal Office for Hydraulicity, Waterway and Shipping Administration

Comparing the effects on container transport with mass cargo, a very different evolution between dry and liquid mass cargo is observed.

Figure 9: Dry cargo, liquid cargo and container transport and water level on the Rhine (Index 100 in 2014Q1 for Rhine transport – based on quarterly transport performance)



Sources: Destatis, Federal Office for Hydraulicity, Waterway and Shipping Administration

While all cargo segments were impacted, it can nonetheless be noted that after the first two of these three low water periods, liquid cargo and container transport quickly returned to their respective previous levels, while dry cargo volumes were lower. After the third low water period (in 2018), only liquid cargo returned to the pre-low-water-period level, while container transport and dry cargo transport settled on a lower level. This phenomenon reflects several factors:

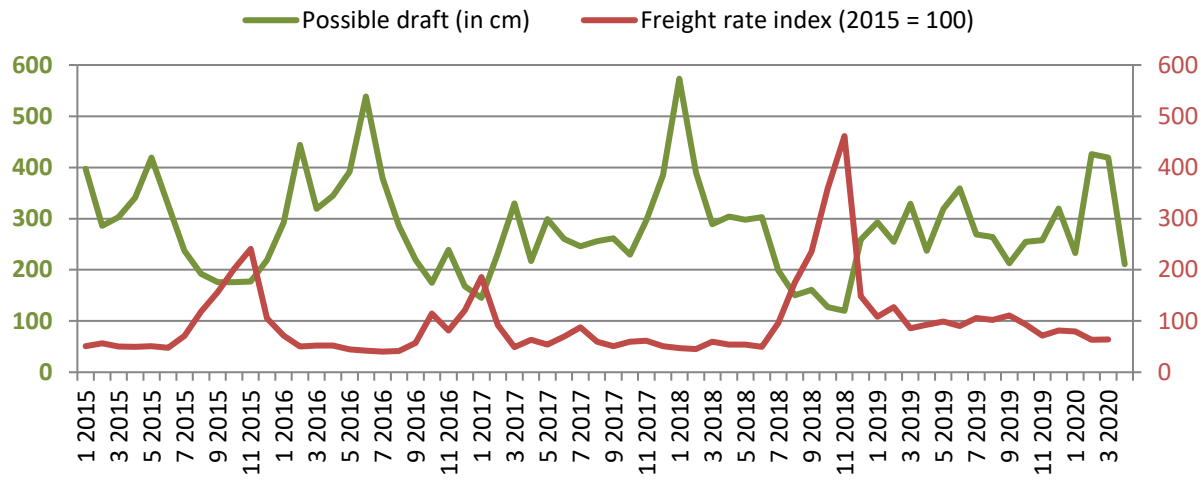
1) For transporting liquid cargo (chemicals and petroleum products), there are in fact few alternatives to inland waterway transport. IWT has a strong competitive position in the liquid cargo market, which was reinforced by the modernisation of the fleet towards double hull vessels. The transport demand evolution for the two main product segments taken together is characterised by rather stable volumes for the period between 2014 and 2019, despite structural declines in the demand for petroleum products which is underway in modern societies.
2) For container transport, the degree of competition between IWT and rail transport is high, as containers can be transported between seaports and the hinterland either by rail or by inland waterways. Several railway shuttle services for transporting containers between seaports and the hinterland have been put in place in recent years. The 2018 low water period led to a modal shift from the Rhine to rail transport, according to information from logistical companies active in Rhine container barging.[11]
3) For dry cargo, the degree of competition with rail transport is also higher than for liquid cargo, but this does not explain the entire evolution. There is also a negative trend component in dry cargo transport due to the phasing out of coal as an energy source. Other dry cargo segments (iron ore, agricultural products) were also reduced between 2014 and 2019.

The relation between the draught of vessels and the freight rate or transport price is shown in the following two graphs. The first graph shows the variations in water levels over time, that are translated into variations in possible draught of vessels. The impact of these fluctuations is then visible in the ups and downs of transport prices. The price increase during low waters can be explained by an increase in average or unit costs. A large part of operational costs in inland navigation are indeed fixed costs, which do not change when less cargo is transported. Therefore, unit costs (costs per unit of output) increase during low waters. This is compensated by a surcharge on freight rates.[12]

[11] Information provided by Danser France
[12] See the presentation of Mr Philip Tomaskowicz of Rhenus PartnerShip given on 26.11.2019 in Bonn at the CCNR workshop on Low Water and its Impact on Rhine Navigation (Wirtschaftliche Folgen von Niedrigwasser für die Binnenschifffahrt; Economic consequences of low waters for inland navigation.

The relation between the draught and prices is therefore conflicting: if water levels decrease (and the possible draught decreases), then freight rates go up. The price increase reflects also a change in the supply-demand relationship on the level of the whole fleet, as less capacity is effectively available for a given demand level.

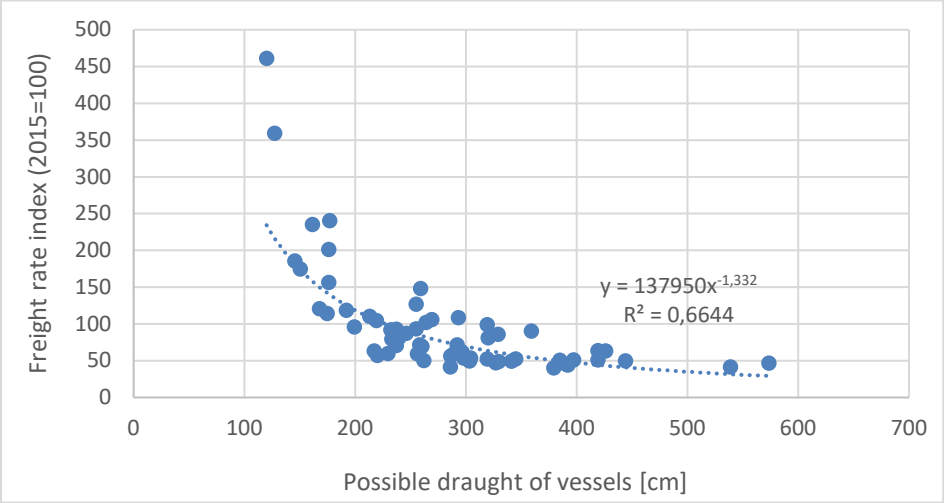
Figure 10: Possible draught of vessels at Kaub (Middle Rhine) compared with liquid cargo freight rate Index (2015 = 100) *



*Source: Destatis, CCNR analysis. * Index for gasoil transport between ARA region and Rhine hinterland*

The second graph contains the same data but presents them in a different way. This graph shows that the reaction of freight rates to the variations in water levels and the possible draught follows approximately a non-linear function. With water levels and the available draught decreasing, the reaction of freight rates becomes more and more intense.

Figure 11: Possible draught of vessels at Kaub (Middle Rhine) on the horizontal axis and liquid cargo freight rate index (2015 = 100) on the vertical axis



Source: CCNR based on data from the German Federal Waterways and Shipping Administration, provided by the Federal Institute of Hydrology (BfG); freight rates: CCNR based on PJK International. PJK collects freight rates (in Euro per tonne) for ARA-Rhine trade of liquid bulk. The CCNR transforms these values into an index with base year 2015. The freight rate data refer to ARA-Rhine transport of gasoil.

It is important to note that, despite all the impacts that low water periods have had in recent years for Rhine navigation, and despite public perception and articles written in the media, assuming a clear and direct link between low waters and climate change, hydrological research delivers quite different results.

According to several hydrological research projects, the occurrence of these periods currently shows no significant increase in frequency nor in magnitude. Such results emerge from detailed historical analysis of discharge data for different gauging stations along the Rhine. The following text is an excerpt of the summary of the study "Inventory of the low water conditions on the Rhine", published by the International Commission for the Protection of the Rhine (ICPR) in 2018: [13]

"*According to the analysis of historical discharge series, low flows on the Rhine were much more pronounced in the first half of the last century and occurred with lower discharges and longer periods of underflow than in the last 50 years. […] The current perception of low water events is influenced on the one hand by the long absence of significant low water events and on the other hand by an increase in the number of persons affected.*

The development of low water discharges due to climate change in the present discharge projections for the period 2021-2050 for the Rhine ranges from decreases of 10% to increases of 10% and does not allow a clear trend to be recognized. […] For the distant future (2071-2100), the discharge projections for the hydrological summer half-year show consistently significant low water discharge reductions. […]

The key message is that the low water events on the Rhine have not worsened in the last 100 years, but have now spread to numerous uses (shipping, industry, agriculture, energy production, etc.) in a more pronounced way."

The possible impact of climate change is also analysed within other research projects. Some analyses are conducted in the framework of the European Union financing such projects concerning climate change in the Danube Transnational Program[14] or the projects conducted by the Joint Research Centre[15].

Other projects such as the RheinBlick 2050 project[16] are coordinated by the CHR (International Commission for the Hydrology of the Rhine Basin). This scientific research project rendered the same conclusions in 2010 as the study of the ICPR from 2018: while impacts of climate change on river flows can be expected in the far future (between 2071 and 2100), no clear signal of increased periods of low flows and high flows can be derived from the analysis now, nor in the near future (until 2050).

As the research cited above suggests, even if the hydrological regime might not have changed so far, its interaction with the economic and logistical systems of today produces different outcomes than in the past. Ships are larger and heavier today than they had been in the 1920s, 1950s or 1970s, and the available draught and capacity utilisation of vessels is therefore more vulnerable to low waters today. This creates higher vulnerabilities in terms of volume losses, operational costs, and modal shift during low water periods.

Not only vessels' size and draught, but also the logistical systems are different today. Timely punctuality and just-in-time logistics (for example in container transport with its liner services), and a low storage level in order to reduce costs, are features of today's logistics which were not as relevant in the past. It is therefore important to develop new and apply existing adaptation measures, in mainly three areas (infrastructure, ship design, logistics and storage).

A summary of possible new and existing measures which would allow inland waterway transport to better adapt to low water situations can be found in the CCNR reflection paper '"Act now!" on low water and effects on Rhine navigation'. Such low water adaptation measures would rather be found in the short- and medium-term solutions presented in the document. However, the longer-term measures which are addressed in this document could be considered as climate change mitigation measures, given that climate change is expected to become an aggravating factor in the long term. [17] Important measures concern the infrastructure at the Middle and Lower Rhine. The Federal Transport Infrastructure Plan 2030, the central planning instrument for the German transport system, which covers

[13] The study can be downloaded on the website of the ICPR: https://www.iksr.org/en/topics/low-water
[14] http://climate-adapt.eea.europa.eu/countries-regions/transnational-regions/danube
[15] https://ec.europa.eu/jrc/en/research-topic/climate-change
[16] http://www.khr-chr.org/en/project/impact-regional-climate-change-discharge-rhine-river-basin-rheinblick2050
[17] The document is available on the following website: https://www.ccr-zkr.org/13020151-en.html

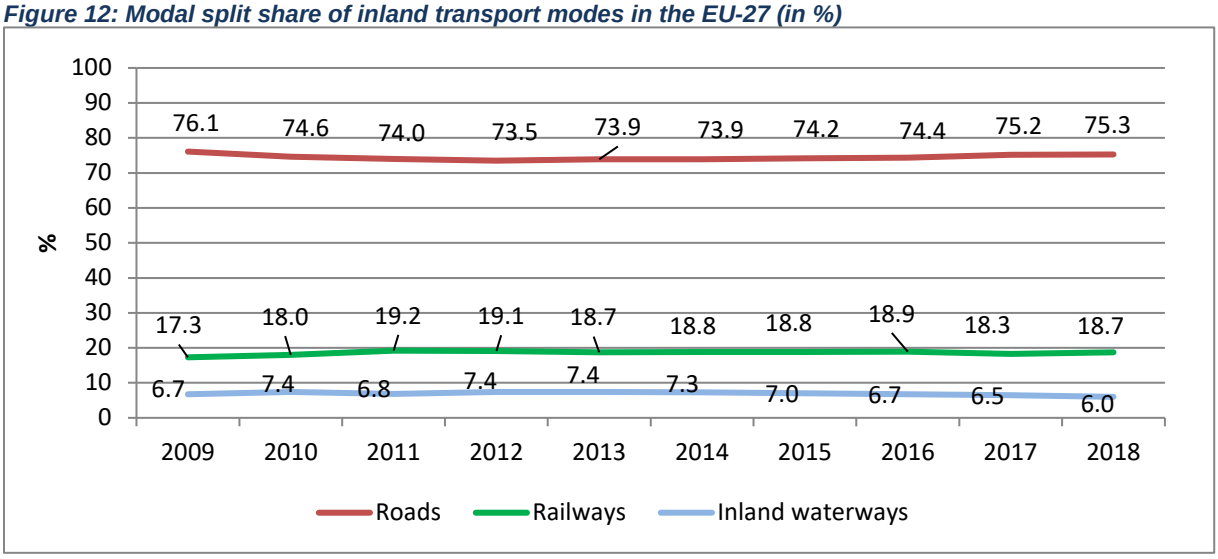
all modes of transport, lists measures to optimise the draught of loaded vessels on the German Rhine section.[18]

- The project "optimisation of the fairways on the Middle Rhine" should lead to an increase of the fairway depth from 1.90 m to 2.10 m in the most critical Middle Rhine section between St. Goar and Mainz.
- An improvement is also foreseen for the Lower Rhine ("Loading improvement and sole stabilization on the Rhine between Duisburg and Stürzelberg"), which shall lead to an increase of the fairway depth from 2.50 m to 2.70 m/ 2.80 m.

The inland navigation industry asks for a realisation of these projects as soon as possible. This was also pronounced at the low water workshop in Bonn mentioned above. According to current planning schemes, it is not expected that the upgrading works would be finalised before the year 2030.[19]

1.4. Multimodal context

Figure 12: Modal split share of inland transport modes in the EU-27 (in %)



Source : Eurostat [tran_hv_frmod]

Taking into account all types of goods and all countries in the European Union, the modal share of inland navigation (share within total transport performance by road, rail and inland navigation) has been declining since 2014. In 2018 it reached its lowest point (6.0%) within a period of ten years and was far behind road transport (75.3%) and rail transport (18.7%). During that same period, rail transport was able to at least hold its modal share which stood at 18.8% in 2014 and at 18.7% in 2018. Road transport even increased its modal share further, from 73.9% up to 75.3%.

The modal shift for freight transport in the European Union (EU) must still materialise[20]. However, the successive NAIADES action plans certainly contributed to maintaining the modal share of inland waterway transport at 6% in the overall transport mix, despite an economic crisis, low water periods, growing road transport, structurally changing markets (decline in steel industry, decarbonisation of energy markets), an imperfect policy framework and the lack of dedicated funding.

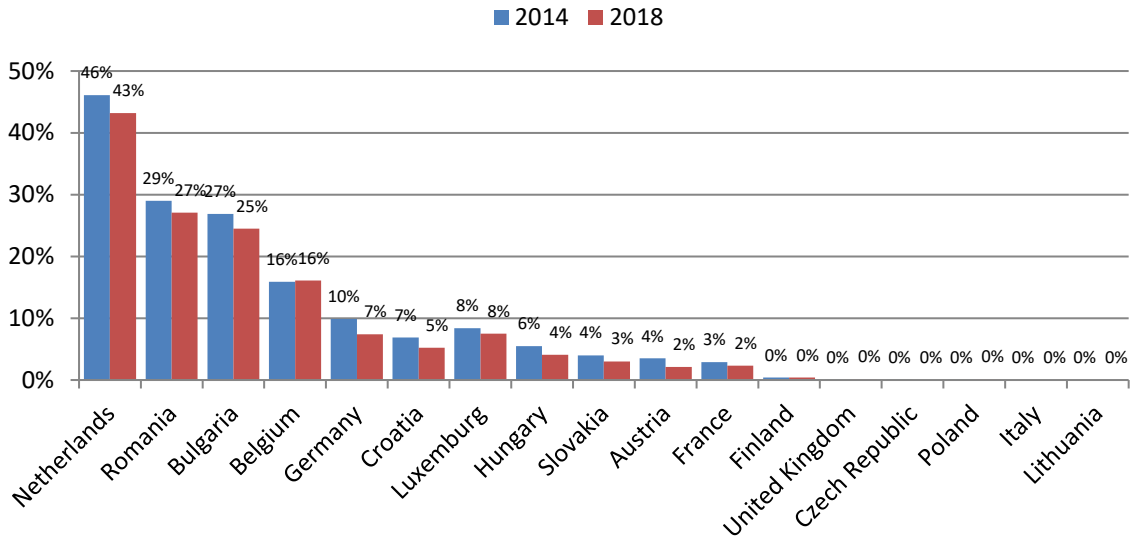
However, as many EU countries do not have inland waterways, the overall modal split share of IWT on the EU level should not be used as a performance indicator for the success of inland waterway transport

[18] Source: CCNR Reflection paper ""Act now!" on low water and effects on Rhine navigation" https://ccr-zkr.org/files/documents/workshops/wrshp261119/ien20_06en.pdf.
[19] See the article »Abladeoptimierung Mittelrhein – der Fokus richtet sich auf die gravierendsten Tiefenengstellen «from 1st October 2019 (in: ‚Binnenschifffahrt', https://binnenschifffahrt-online.de/2019/10/bds/11122/)
[20] In particular, the 2011 White Paper on Transport set the objective of shifting "30% of road freight over 300 km […] to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050".

in the EU. Indeed, more detailed information would be needed in order to draw conclusions since inland navigation modal share varies greatly from one country to another and from one product segment to another. In order to measure the success of IWT in the transport market, it is more relevant to look at the modal split share evolution of IWT in countries where there is a sufficiently dense inland waterway network, such as in the Netherlands, Belgium or Germany, or where inland navigation traditionally has a high importance for goods transport, for example in many Danube countries.

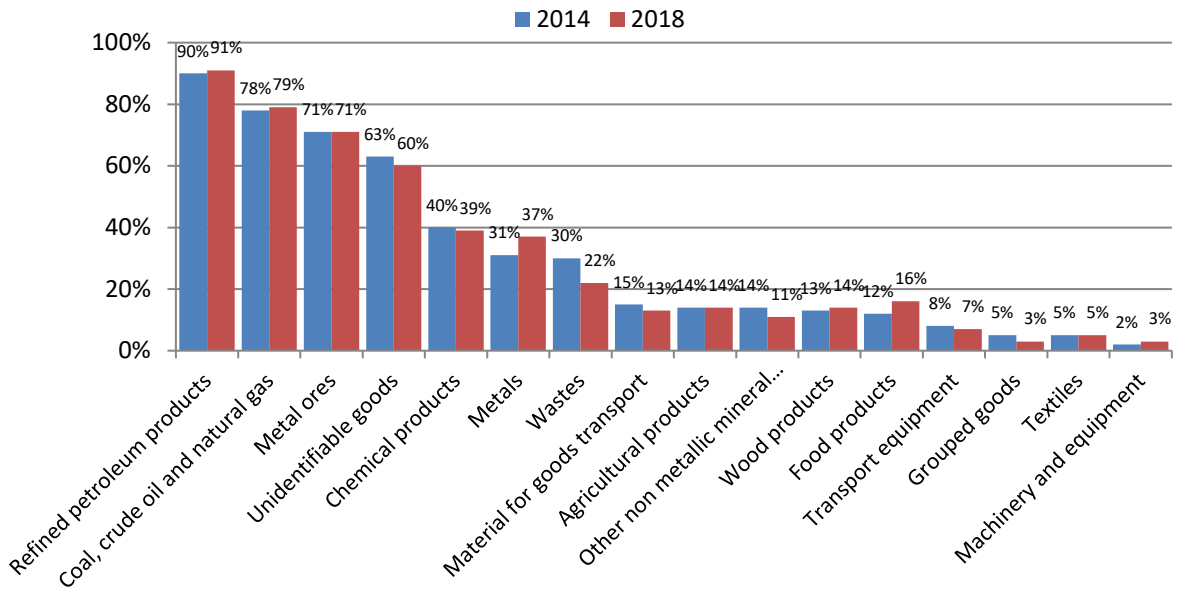
Similarly, the presence of industries requiring inland navigation transport is also essential for the success of inland navigation transport. This is shown in the two following graphs. A more specific analysis on modal share evolution will be conducted in chapter 2.5.

Figure 13: Inland waterway transport modal share per country (in % of total transport performance of inland waterway, road and railway transport)



Source : Eurostat [tran_hv_frmod]

Figure 14: Inland waterway transport modal share per type of goods in the Netherlands (in % based on total transport performance – inland waterway, road and railway transport) *

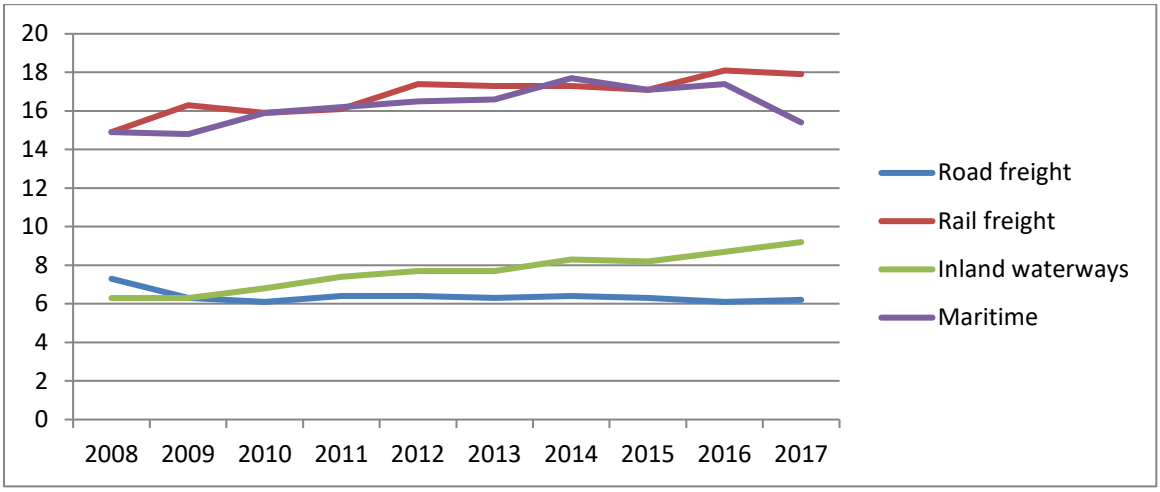


*Source: CCNR calculation based on Eurostat [rail_go_grpgood], [iww_go_atygo], [road_go_ta_tg]. * Share of inland waterway transport performance in total (IWT + Road + Rail) transport performance. For the first graph, road data*

include the transport performance of trucks registered in foreign countries, according to the new series [tran_hv_frmod] made available by Eurostat recently. Road data registered in the Eurostat database for the series [road_go_ta_tg] used for the calculation of modal split figures per goods and per country is based on nationality of registration of the vehicle and not on transport on national territory. This methodological difference has some significant effects on the modal split shares presented in the second graph. Despite this fact, this analysis per goods segment per country still allows to provide information on the evolution of the IWT modal share per goods segment per country.

Regarding the specific case of containers, data show that the unitisation rates vary greatly across modes. Short sea shipping and rail transport rates are indeed largely over and above the rates for freight transport by road and by inland waterways. However, the unitisation rate of goods transported by inland waterways increased overall between 2007 and 2017.

Figure 15: Share of containers in total goods transport by mode of transport 2007-2017 (% of total TKM)

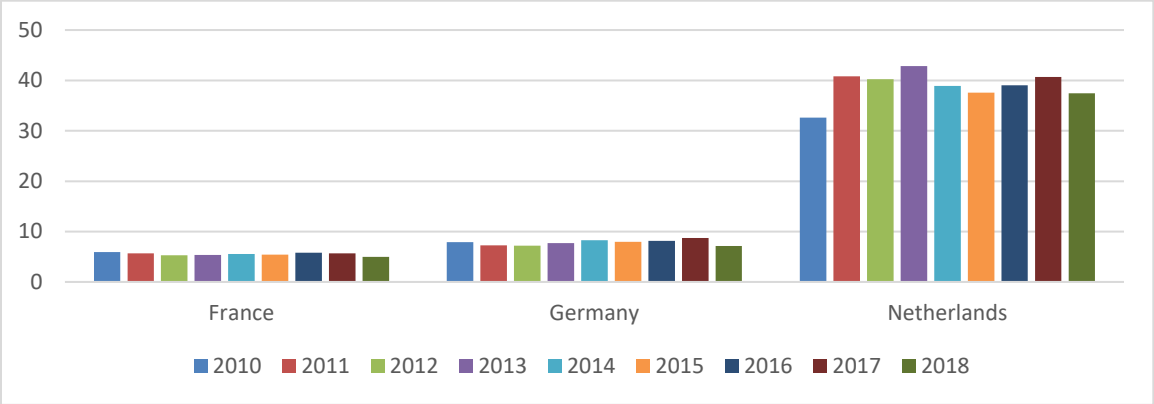


Source: Eurostat [tran_im_umod]

This is in line with the increasing trend observed in recent years for container traffic. Similarly, in the countries where IWW container transport is particularly significant, a constantly increasing IWT modal share for this segment can be observed, particularly in Belgium and in the Netherlands. The reasons are manifold: a dense and growing network of intermodal container terminals with an increasing number of services, a long network of rivers and canals, and heavily populated urban areas with a high market potential.

However, a slight decrease in modal split share evolution in 2018 can be observed, mainly attributed to the low water period at the end of 2018. A further slowdown of world trade, which began with the 2009 financial crisis and was exacerbated by the COVID-19 pandemic in 2020, is expected to influence the growth rates in container transport. Growth will continue, but at a slower pace.

Figure 16: IWT Modal split share evolution for container transport (%, based on transport performance)



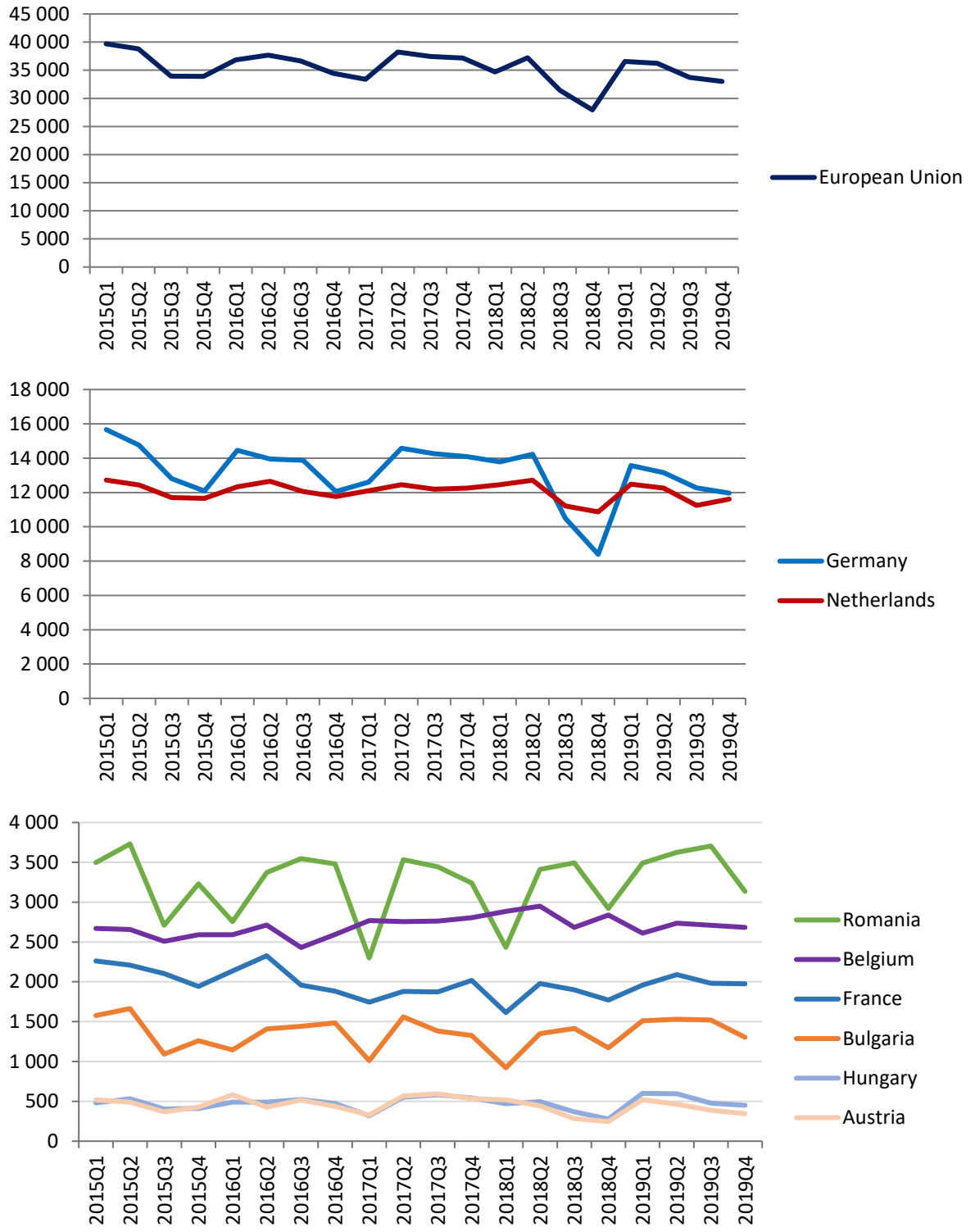
Sources: Eurostat [iww_go_actygo], [road_go_ta_tcrg], [rail_go_contwgt], CCNR analysis

2. FREIGHT TRAFFIC EVOLUTION

2. Freight traffic evolution

2.1 General traffic evolution per country

Figure 1: Quarterly transport performance evolution in the EU and in main IWT EU countries (transport performance in million TKM)



Source: Eurostat, series [iww_go_qnave].

The total IWW transport performance in the European Union reached 140.3 billion TKM in 2019, 132.0 billion TKM in 2018 and decreased by about 7 % between 2014 and 2019.

When comparing the annual figures of 2014 and 2019, it is found that inland waterway transport increased in most Danube countries, by 17% in Croatia, 17% in Hungary, 16% in Bulgaria, 19% in Romania, and 4% in Slovakia. Austria was the only Danube country where the figures for 2019 were lower than in 2014 (-21%).

In Rhine countries, however, inland waterway transport was mostly lower in 2019 than in 2014: by 14% in Germany, 3% in the Netherlands, 9% in France.

The reason for this difference between Rhine and Danube countries can be explained by macroeconomic factors and in structural changes at the level of goods segments. As was pointed out earlier, in chapter 1.2 (Economic context), eastern European countries experienced higher annual growth rates of GDP between 2014 and 2019 than did western European countries.

Regarding structural changes, coal and iron ore transport has fallen in recent years in Rhine countries, in the wake of energy transition and a stagnation or decline in steel production in western Europe. In Danube countries, steel production has increased in the last years, when the recovery from the financial crisis set in. Energy transition did not progress at the same pace as in western Europe.

The structural transition which has provoked a decrease in inland waterway transport in Rhine countries is also reflected by the evolution of transport on the Rhine itself. In the following section, Rhine traffic by cargo segment will be analysed for the time frame 2014 to 2019.

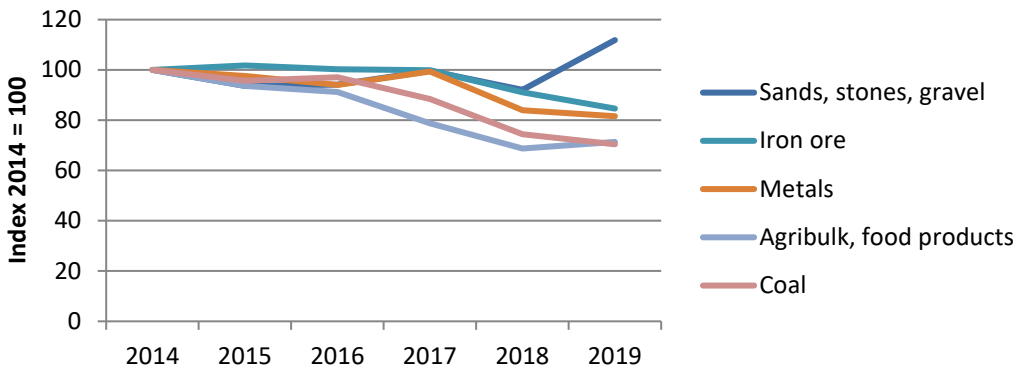
2.2 Rhine transport evolution

With regard to the Rhine, the transport evolution by cargo segment reveals differences between dry cargo on the one hand, and liquid cargo and container transport on the other hand. For dry cargo, the trend for almost all cargo segments (the only exception being sands, stones and building materials), was negative between 2014 and 2019. Several influencing factors played a role at that time.

For coal transport, the energy transition towards carbon-neutral economies led to a strong shift away from coal over the last years. In Germany, coal fired power plants are being phased out from the energy sector. The negative trend for coal will continue until 2038, at which time all coal fired power plants will be phased out.

A major reason for the reduction in iron ore and metal transport was the weakening of the economic conditions in the steel industry in 2018 and 2019. The steel industry suffered in those years because of trade barriers (extra tariffs on cars and on steel), and a general slowdown of world trade. Steel industry production in western Europe decreased, and this caused the decline in iron ore and metal transport on the Rhine, which was 15.4% (iron ore) and 18.4% (metals) lower in 2019 than in 2014.

Figure 2: Yearly evolution of dry cargo transport on the Rhine (Index 2014 = 100) per segment



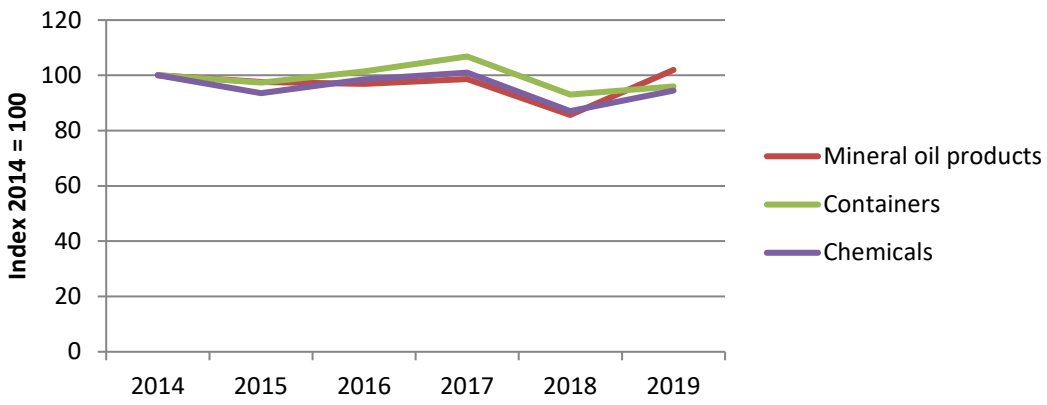
Sources: Destatis, CCNR analysis

As for agricultural products, a comparison with harvest results in Germany shows that agricultural output also declined between 2014 and 2018 and was followed by a small recovery only in 2019. In general, harvest results and IWW transports of agribulk are correlated, not only between the German harvest results and Rhine traffic, but also between French harvest results and waterway traffic of grain in France.[21]

The construction segment of sands, stones and building materials showed constant transport volumes figures on the Rhine between 2014 and 2017, against the general framework of an increase in the construction output in the EU in that time period (see chapter 1.2). Transport volumes reduced slightly in 2018, but this was due to the low waters in that year and not due to economic circumstances. Volumes then picked up very strongly in 2019 which confirms the positive overall economic conditions in the construction sector and in the transport of related materials.

Liquid cargo transports on the Rhine performed better between 2014 and 2019 than dry cargo. There was no downward trend to be seen, neither for mineral oil products nor for chemicals. But for chemicals and containers, the volumes in 2019 were still lower than in 2017. In both cases, weaker macroeconomic conditions (slowdown in industry production growth, slowdown in world trade) represented one part of the explanation. Modal shift effects were relevant for container transport, but not so much for chemicals.

Figure 3: Yearly evolution of liquid cargo and container goods transport on the Rhine (Index 2014 = 100)



Sources: Destatis, CCNR analysis

Container transport was 6.8% higher in 2017 than in 2014, but here also, as for chemicals, the recovery that took place in 2019 was incomplete. Container operators have reported that the Rhine lost market shares in the last years to rail transport, not only due to the 2018 low water period but also due to the other low water periods that occurred in 2015 and 2017. The macroeconomic evolution is also very relevant for container transport, especially world trade and industrial production. Both indicators grew

[21] See the 2020 annual market observation report of the CCNR/EC, chapter 8 (outlook)

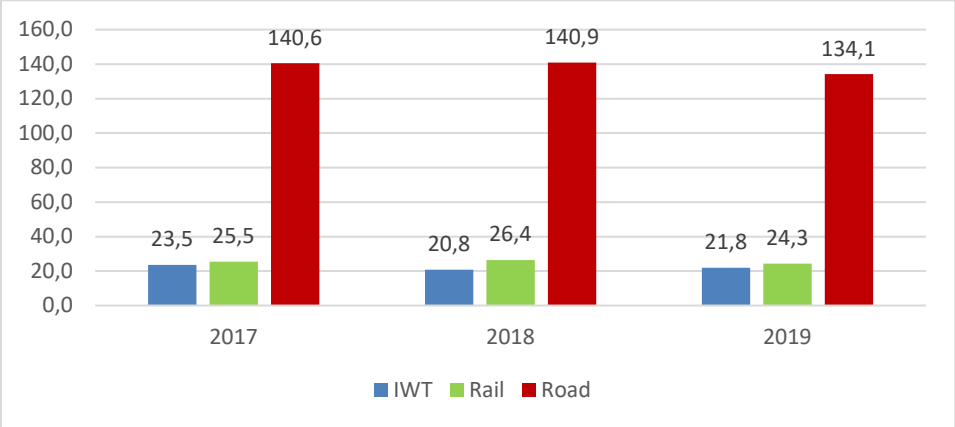
until 2017[22], and this is to a certain degree reflected in the above-mentioned growth rate of 6.8% for container transport between 2014 and 2017. The stagnation, that set in on the macroeconomic level from 2018 onwards, has certainly contributed to the reduction in container transport on the Rhine, in combination with the low water periods of 2017 and 2018.

➢ **Case study: Transport of chemicals on the Rhine and in Germany 2017-2019**

As far as chemicals are concerned, to estimate to what degree the overall macroeconomic conditions were responsible for the weaker chemical transports in 2019, and to what degree there were modal shift effects, multimodal figures must be analysed. For this purpose and for statistical reasons (in order to have comparable rail and road statistics), the whole German waterway network will be considered rather than solely the Rhine. However, the Rhine has a very high share in chemical transport in Germany. In 2019, 20.07 million tonnes of chemicals were transported on the Rhine, compared to 21.8 million tonnes on all German inland waterways. The Rhine's share in chemical transport is therefore 92%.

Data suggest that, although IWT lost volumes of chemical transport in 2018, railway transport took over only parts of these volumes. The chemical volumes lost by IWT in 2018 (2.8 million tonnes) were almost three times higher than the increase of railway transport of chemicals (0.96 million tonnes) in that year. Road transport of chemicals was only slightly higher in 2018 than in 2017 (0.3 million tonnes), and therefore could not have taken over significant volumes from IWT.

Figure 4: Transport volume of chemicals by mode of transport in Germany (IWT, rail, road) in million tonnes



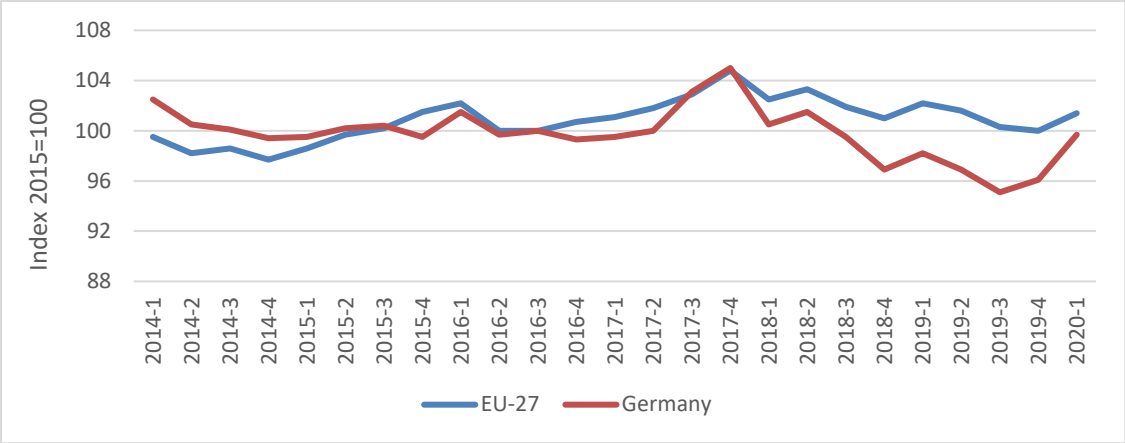
Sources: Destatis, Eurostat [road_go_ta_tg], CCNR analysis

In 2019, the IWT results were 1.7 million tonnes lower than in 2017, and the railway results 1.2 million tonnes lower. Figures for road transport in 2019 show a decrease of almost 6.5 million tonnes. According to these data, it seems indeed that the overall transport market volume for chemicals decreased between 2017 and 2019.

This would suggest that the macroeconomic slowdown and the decrease in chemical industry production played a major role for the incomplete recovery of chemical transports on German inland waterways and on the Rhine in 2019. Confirming evidence is seen in the following graph, showing the development of chemical industry production. The years 2018 and 2019 indeed saw a clear downward movement of chemical production in Germany and in the EU-27. Therefore, macro-economic and industrial factors would represent the predominant explanation for the incomplete recovery of chemical transports in 2019.

Figure 5: Quarterly development of chemical industry production in the EU-27 and in Germany (Index 2015 = 100)

[22] See the 2020 annual market observation report of the CCNR/EC, chapter 1 (Macroeconomic context)



Source: Eurostat [sts_inpr_q]

Overall, there are no clear quantitative indications for a permanent modal share loss of IWT in chemical transport. Basically, road transport of chemicals was barely higher in 2018 compared to 2017. Rail transport was higher but did not compensate for all of the volumes that IWT lost in 2018. Comparing the 2017 with the 2019 figures for rail, IWT and road, it can be seen that inland waterway transport of chemicals was 7% lower in 2017 than in 2019, rail transport was 5% lower and road transport 4.6% lower. Also, chemical production in Germany was 5% lower in 2019 than in 2017. Altogether, this points only to a very limited modal shift from IWT to rail transport and suggests that the industry development was the main reason for the decrease in IWW transport of chemicals between 2017 and 2019.

2.3 Specific cases

➢ **Main-Danube Canal**

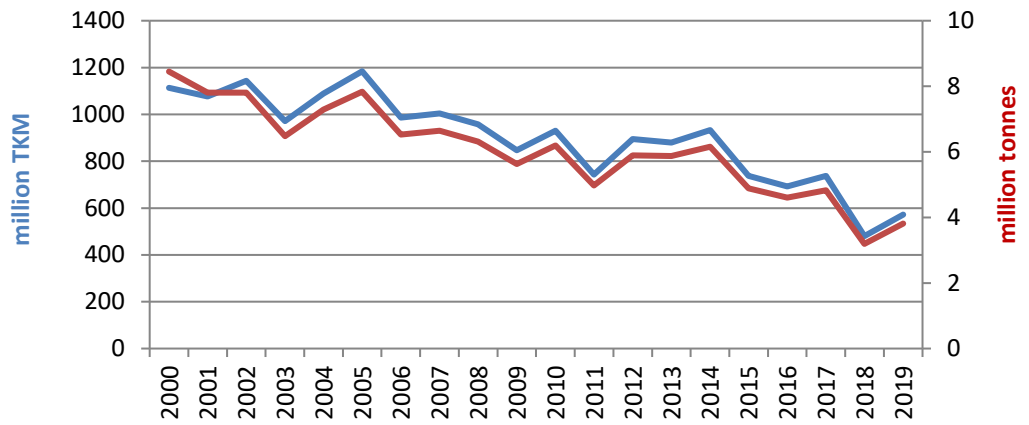
The Main-Danube Canal is 170.71 km long, and connects the Main and the Danube in Bavaria, in the south of Germany. This canal was built between 1960 and 1992, with building costs amounting to 2.3 billion Euro.[23] There are 16 locks along its entire length between Bamberg and Kelheim, and connects two major European river basins in Europe, the Rhine and the Danube basins.

The canal channel is adapted to vessels up to 110 metres long and 11.45 metres wide with a draught of up to 2.7 metres, which makes it possible for these vessels to go from the North Sea to the Black Sea via the Rhine, the Main and the Danube. Pushed convoys with a length of up to 185 metres and a width of 11.45 metres can also transit through the canal.

While the level of transport performance and volume was first aligned with initial forecasts and reached nearly 1.2 billion tonne-kilometres in 2005, and 7.7 million tonnes, both indicators have since been decreasing, reducing to 48% of the 2005 transport performance and to 49% of the 2005 transport volume until 2019. In 2019, the cargo traffic on the canal amounted to 3.8 million tonnes, compared to 3.2 million tonnes in 2018 and 6.1 million tonnes in 2014.

Figure 6: Main-Danube Canal transport performance in million TKM and transport volume (in million tonnes)

[23] Source: Deutscher Wasserstraßen - und Schifffahrtsverein Rhein-Main-Donau e.V. https://www.schifffahrtsverein.de/daten-und-fakten/

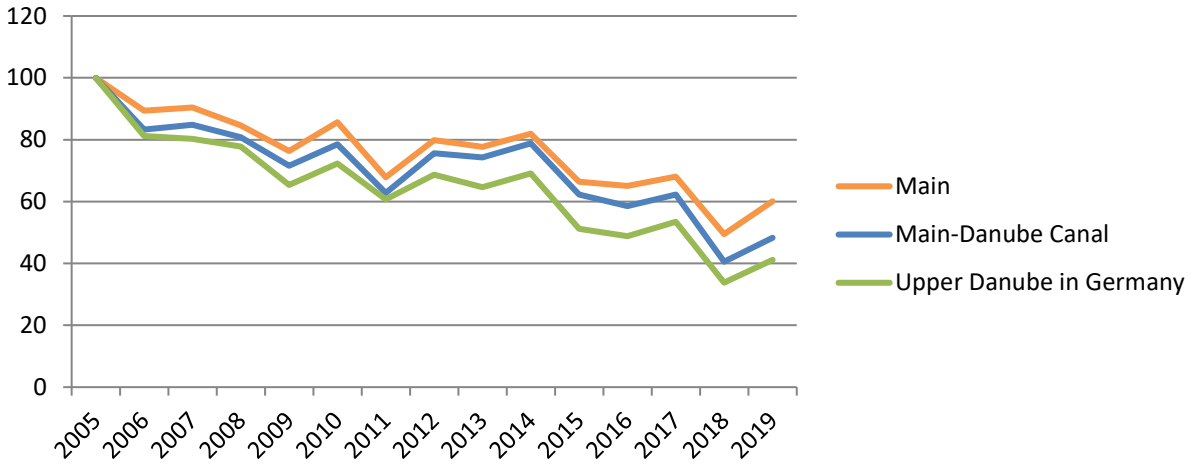


Source: Destatis

The four largest cargo segments decreased between 2014 and 2019. The largest cargo segment in 2019 were substances of vegetable oil with 0.59 million tonnes in 2019, compared to 0.66 million tonnes in 2014. Cereals followed on rank 2 in 2019 with 0.48 million tonnes compared to 0.86 million tonnes in 2014. On rank 3 were nitrogen compounds and fertilizers with 0.46 million tonnes in 2019 compared to 0.74 million tonnes in 2014. Basic iron and steel are also transported on the canal, with 0.38 million tonnes in 2019 (rank 4) compared to 0.65 million tonnes in 2014. Iron ore transport decreased as well between 2014 and 2019, from 0.65 million tonnes in 2014 down to 0.21 million tonnes in 2019. [24]

To compare the development with the neighbouring inland waterways, the Main, western neighbour of the Main-Danube Canal, and the Danube in Germany, eastern neighbour of the Main-Danube Canal, must be studied.

Figure 7: Main-Danube Canal, Main and German Danube transport performance (index) since 2005



Source: Destatis

At first, there was a parallel development for these three waterways. But a kind of recovery can also be seen between 2011 and 2014, present on all three waterways. This recovery stopped in 2015, and a falling trend set in again. This development can be explained by the low water periods in 2015, 2016/2017 and 2018. Although the Main-Danube Canal has locks, therefore being less dependent on low waters than free flowing rivers, low waters can still have an impact on IWT transport performance on this canal. Indeed, inland waterways are not isolated transport routes from a geographical point of view but are part of long-distance transport chains. Navigation conditions on neighbouring waterways (for example on the partly free-flowing Danube in Germany with its recurring low water periods) are therefore relevant for the Main-Danube Canal.

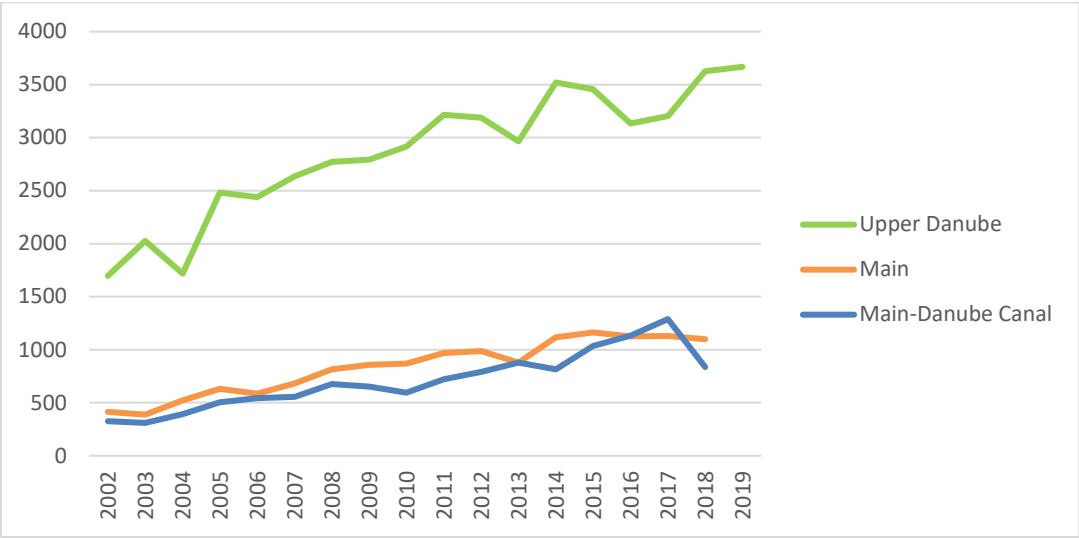
[24] Source: Destatis

Some other explanations are more specific to the Main-Danube Canal itself. The canal is subject to icy periods that can hamper traffic. The beginning of the years 2010, 2011, 2012 and 2017 were for example significantly impacted by ice barriers for periods ranging from 10 to 30 days (source: WSV).

When looking at the ten largest cargo segments on the Main-Danube Canal, it can be seen that between 2014 and 2019, the strongest drop was observed for non-ferrous metals (-84%), iron ores (-68%) and coal (-63%). All of these three materials are linked with steel production. The steel industry, which is nearest to the Main-Danube Canal, is located in Linz, Austria, on the Upper Danube. With extreme and long low water periods on the German stretch of the Danube, it is evident that iron ore deliveries from Rotterdam via the Rhine, Main, Main-Danube Canal, German Danube to the Austrian Danube have run into severe difficulties in recent years. Other transport routes (for example iron ore from the Lower Danube region on the Black Sea), or a combination of railway deliveries and iron ore from the Lower Danube, must have been one alternative for the Austrian steel industry in order to cope with the difficulties on the western delivery route.

While cargo transport on the Main-Danube Canal had not developed positively since 2014, passenger traffic had done so. The Main-Danube Canal is one of many waterways in Europe with a positive trend for river cruising.

Figure 8: Number of cruise vessel transits on the Upper Danube, the Main and the Main-Danube Canal *



*Source: German Waterway and Shipping Administration * number of vessels that have passed the locks. Upper Danube = lock of Jochenstein at the German-Austrian border. Main = lock of Mainz-Kostheim. Main-Danube Canal = lock of Kelheim. Partly no data for 2019 due to abolition of user charges on German waterways, resulting in less statistical registration.*

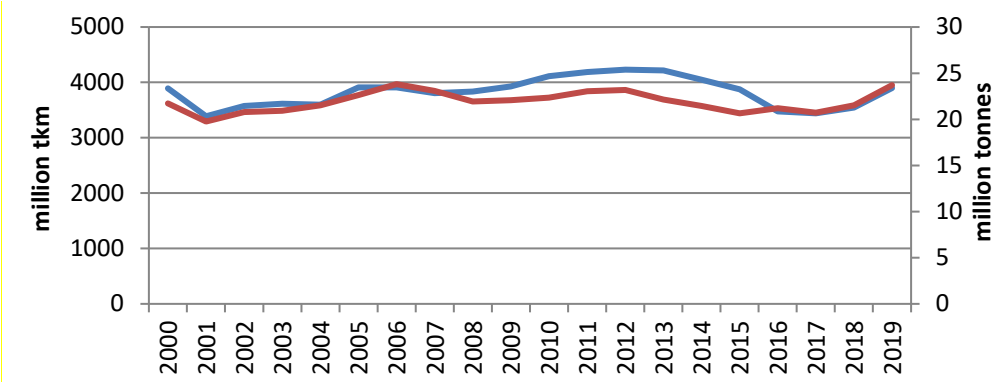
Cruise vessel transits increased by 58% between 2014 and 2017 on the Main-Danube Canal, from 816 to 1,289 transits. The year 2018 brought about a dropping activity. But overall, river cruising on the canal is important for the historical cities along the canal (e.g. Bamberg, Nürnberg) as river cruise passengers enjoy touristic excursions in these cities.

The canal is also important for the whole European river cruise activity, as it allows river cruise vessels to be transferred from the Rhine basin to the Danube basin, or vice versa. This has increased the flexibility of cruise operators and allows them to extend their touristic offers for clients. Despite a good upward dynamic until 2019, prospects for 2020 and possibly 2021 are quite pessimistic given the dramatic impact of the COVID-19 pandemic on the river cruise sector, throughout Europe. As national passenger transport is gradually reopening, in the long run the prosperity of river cruising on the Main-Danube Canal, and generally speaking in popular river cruise regions, can only be ensured if overseas passengers resume travelling on European waterways.

➢ The Seine river

In 2019, the Seine basin represented 23.7 million tonnes of cargo or 36.3% of total river traffic in France measured in tonnes. Its share in transport performance was even higher, with 3.9 billion tkm or 48.7% of total transport performance on inland waterways in France.

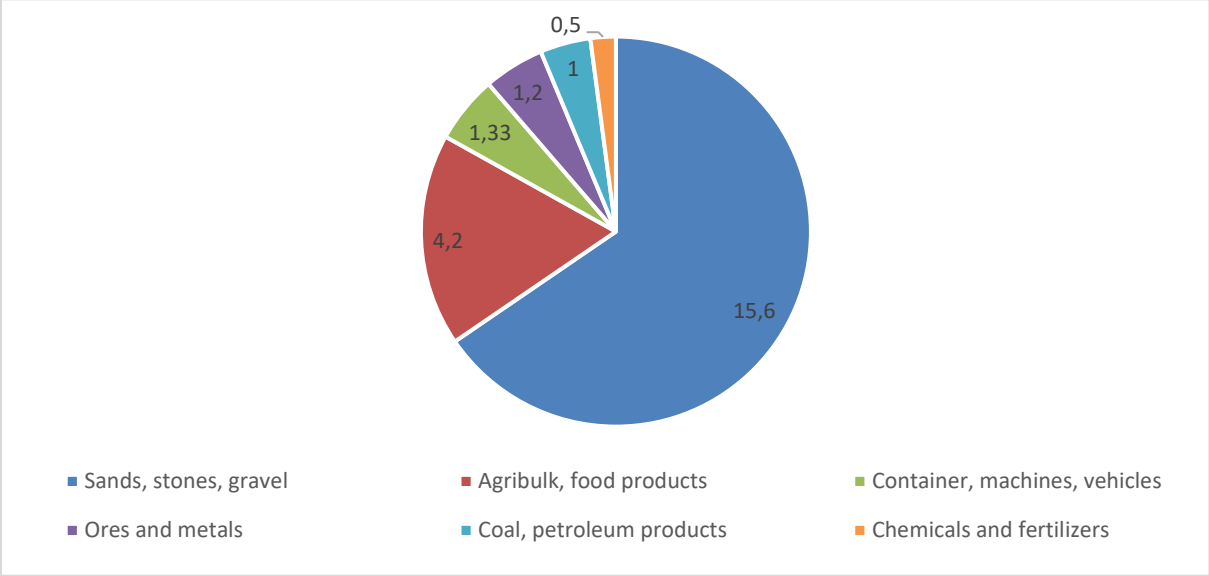
Figure 9: Seine basin transport performance in million TKM and transport volume (in million tonnes)



Source: VNF

By far the largest cargo segment on the Seine river is the construction segment (sands, stones, gravel, building material) with 15.6 million tonnes in 2019 or 65% of total cargo volumes. Agribulk and food products are on rank 2 with 4.2 million tonnes or 18% of total cargo traffic. Transport of machines, vehicles and containers amounted to 1.33 million tonnes in 2019, which was 6% of total Seine river transport.

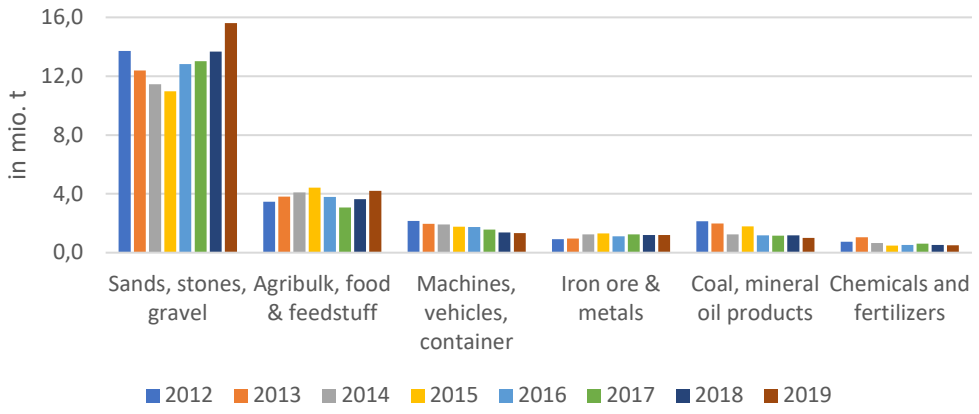
Figure 10: Seine basin river transport by cargo segment in 2019 (in million tonnes)



Source: VNF

The three largest cargo segments on the Seine experienced quite different developments in recent years. The construction segment performed very well, as its volume was 36% higher in 2019 than in 2014. Agricultural products, food products and feedstuff volumes were more or less stable (+2.5% in 2019 compared to 2014), and fluctuations occurred mainly due to differences in harvest results. However, for the important segment of machines, vehicles and containers, volumes dropped from 1.9 million tonnes in 2014 down to 1.33 million tonnes in 2019 (-30.6%). In 2019, 263 000 TEU containers were transported in the Seine basin (-0.7% compared with 2018).

Figure 11: Seine basin river transport by cargo segment 2012-2019 (in million tonnes)



Source: VNF

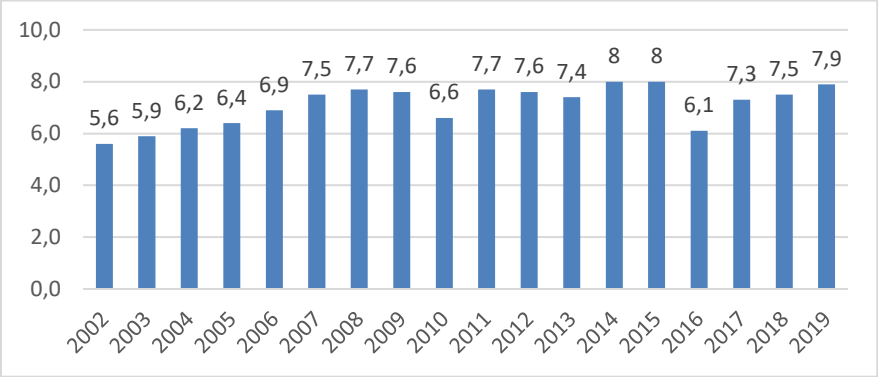
The underlying reason for the upward trend in the construction segment is the project *Grand Paris Express*, which foresees the construction of new metro lines in Paris and in the surrounding region of the Île-de-France. As part of the work on the *Grand Paris Express*, 1 million tonnes of soil were evacuated by inland vessels in 2019, which is the equivalent volume of 50,000 loaded trucks.

The French waterway administration *Voies Navigables de France* (VNF) is involved in the preparation of the Olympic Games in Paris in 2024 as the contracting authority for the Olympic works delivery company (SOLIDEO). A protocol of commitment between VNF, the Ports of Paris, Rouen and Le Havre (HAROPA), SOLIDEO and the Prefect of the Île-de-France Region was signed on 21 January 2020 to promote river logistics in the construction of the Athletes' Village in Saint-Denis: more than 500,000 tonnes of excavated material should thus be transported by river.

In total, the use of river transport could reach 1 million tonnes for all the Olympic construction sites along the Seine. In addition, VNF is working to develop partnerships to encourage the use of river transport in the logistics of the Games and for the aftermath. Despite the COVID-19 pandemic leading to the project being put on hold between March and the end of April 2020, the works started again from 20 April onwards, and the role given to IWT remains relevant today. [25]

Another market segment with a positive development between 2014 and 2019 is that of day trip excursions on the Seine. The number of passengers on day trip vessels in the Île-de-France region (Paris and surrounding region) increased from 6.1 million in 2016 up to 7.9 million in 2019. Between 2015 and 2016, passenger numbers dropped due to the terrorist attacks that took place in Paris in 2015.

Figure 12: Number of passengers on day trip vessels on the Seine river in Paris and in Île-de-France region (millions)

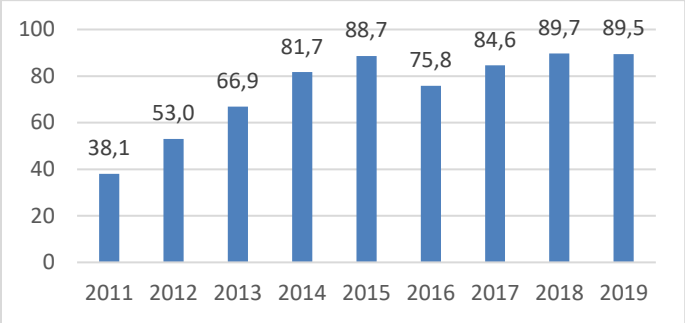


*Source: VNF * Region Île-de-France = Paris and surrounding area*

[25] See: VNF / Bassin de la Seine (2020) Rapport d'Activité 2019

The following graph shows the number of passengers on river cruise vessels in the Seine basin between 2011 and 2019. Similar to the situation for day trip vessels, the passenger numbers dropped in 2016. A recovery then took place, but the average annual growth rates of river cruise passenger numbers were not as high in 2017-2019 as they had been before 2016. The average annual rate of growth of passengers on river cruise vessels on the Seine river was 24% in the period 2012-2015, compared to 6% in the period 2017-2019. It is likely that the terrorist attacks in Paris in 2015 caused the slowdown of growth of river cruise demand on the Seine river.

Figure 13: Number of passengers on river cruise vessels on the Seine river in Paris and in Île-de-France region (thousands)



*Source: VNF * Region Île-de-France = Paris and surrounding area*

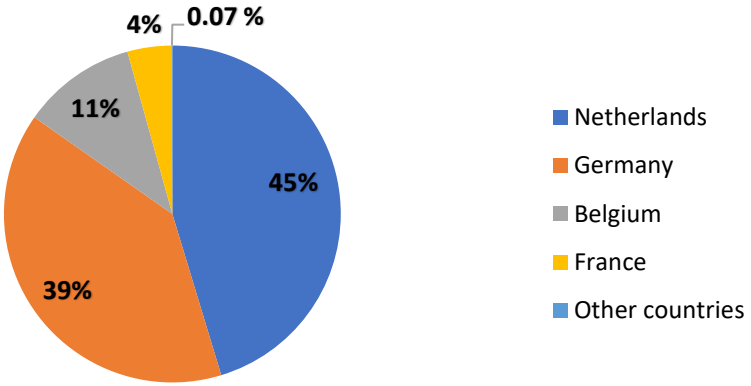
The figures on river cruises on the Seine include activities of large and small cruise vessels. Small cruise vessels are a market niche which exists mainly in France and in the Netherlands. In terms of passenger demand, 97% of all passenger numbers in 2019 came from the large river cruise vessels, and only 3% came from small cruise vessels.

As is the case for the Main-Danube Canal, river cruise and day-trip excursions on the Seine were and will be severely affected by the COVID-19 in 2020 and possibly in 2021.

2.4 Container traffic evolution

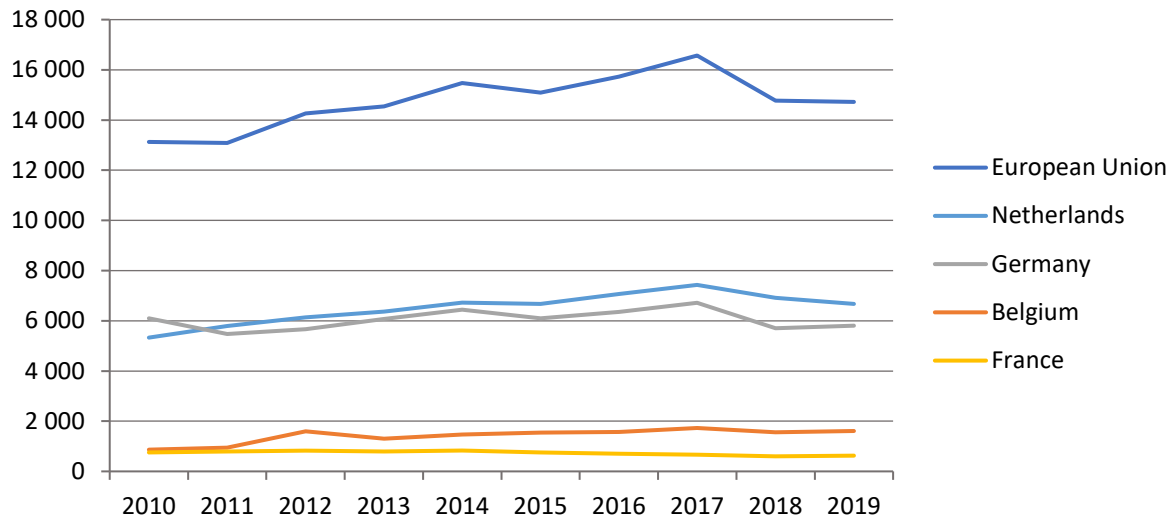
Container transport today is very concentrated in four countries (Netherlands, Germany, Belgium and France).

Figure 14: Distribution of container transport performance on inland waterways in 2019 in the EU *



*Source: Eurostat, series [iww_go_actygo]. * The 2019 result for Belgium is an estimation based on the increase in container traffic in Flanders and Wallonia (source: waterway administrations), due to missing national data.*

Figure 15: Container transport performance on IWW in the EU (transport performance in million TKM)



*Source: Eurostat, series [iww_go_actygo] * The 2019 result for Belgium is an estimation based on the increase in container traffic in Flanders and Wallonia (source: waterway administrations), due to missing national data.*

Container transport on inland waterways is almost exclusive in the Netherlands, Belgium, Germany and France with a share of European Union transport performance higher than 99.9%. Rhine area infrastructures and good connections with the two major European seaports for container traffic, Rotterdam and Antwerp, partly explain the dynamic container transport on inland waterways in the Rhine area until 2017. On the contrary, there is still very little container traffic in Danube countries.

Container traffic occupies a major place in the economy of inland navigation. On a European scale, nearly 15 billion tkm were generated on inland waterways in 2019, an increase of about 12% since the year 2010. Container traffic had a share of 10.3% of total IWW transport performance in the EU in 2019. Compared to 2018, however, the transport performance was lower by 0.4% in 2019. This reflects three main factors:

1) The severe low-water period on the Rhine in the second half of 2018, has resulted in a modal shift from inland waterways to rail. This modal shift was still influencing Rhine container transport in 2019.

2) The continued decrease in container transport of about 3.5% in the Netherlands in 2019, compared to 2018, points also towards potentially more sustained macroeconomic issues such as a slowdown of world trade and industry production worldwide.

3) Bottleneck issues, in seaports in particular, where congestion leads to containers being immobile for some time, thereby diminishing container throughput, played a further role.

The combination of these three influencing factors explains why container transport performance was 0.8% lower in the Netherlands, 10% lower in Germany and even 25% lower in France in 2019, compared to 2014.

2.5 Bottleneck management

As proved once more with the 2019 low water period and the current COVID-19 pandemic, inland navigation transport can be affected by economic and environmental external shocks. In order to remain resilient to such external effects, inland waterway transport requires diversification and adaptation.

In order to better understand how such a diversification may evolve in the future, an in-depth analysis of modal split evolution per goods segment can provide some insights. For instance, it is observed that the inland navigation transport modal split tendency for chemicals, petroleum products and containers is rather positive, meaning that this mode is quite successful in conquering new market shares within the liquid cargo and the container segments and that further growth rate potential is possible for such

segments. Chemicals can be regarded as the market segment with the most positive modal split trend for inland shipping in EU countries, at least since 2008.

However, longer term outlooks for major cargo segments also show that major transformations of our society may have an impact on the inland navigation transport sector, pointing to the need for this sector to adapt and to penetrate new markets to find new growth vectors. Indeed, energy transition will continue to have an important effect on transport volumes in inland navigation in the coming years. This concerns coal in particular. Liquid mineral oil products will continue to be an important component of the energy sector and of inland navigation volumes for the next decade, but a gradual decline is underway in certain regions.

For chemicals, the outlook is more positive. Regarding agricultural products, food- and feedstuffs, it is expected that a certain regionalisation of production and a change in consumer habits to more regional products will influence long-distance transport. A further slowdown of world trade is expected to have a negative influence on the growth rates in container transport. It is also important to note that the current Covid-19 crisis is expected to heighten these already existing trends.

In addition, anticipation, maintenance, multimodal cooperation and efficient bottleneck management are necessary to foster the resilience of IWW transport.

In the figure below, the transport volume on the Rhine per Rhine stretch (Lower, Middle and Upper Rhine) is shown. The largest volumes are transported in upstream direction on the Lower Rhine (almost 100 million tonnes in 2019).

Upstream transport on the Lower Rhine, which is the most important category within total Rhine transport, reflects the deliveries from the seaports in the ARA region, especially Rotterdam, to the industries located in north-western Germany (in particular the steel and (petro-)chemical industries in North-Rhine-Westphalia. The lower Rhine is therefore an important artery for industries in western Europe.

This concerns commodities related to the steel industry (which is located along the Lower Rhine) such as iron ore, coal, and to the petrochemical and chemical industries. Iron ore volumes transported upstream on the Lower Rhine amounted to 21.0 million tonnes in 2019, coal volumes to 20.7 million tonnes, petroleum products to 20.0 million tonnes and chemicals to 10.9 million tonnes.

Map 1: Transport volume in 2014 and 2019 on the Rhine

2014:

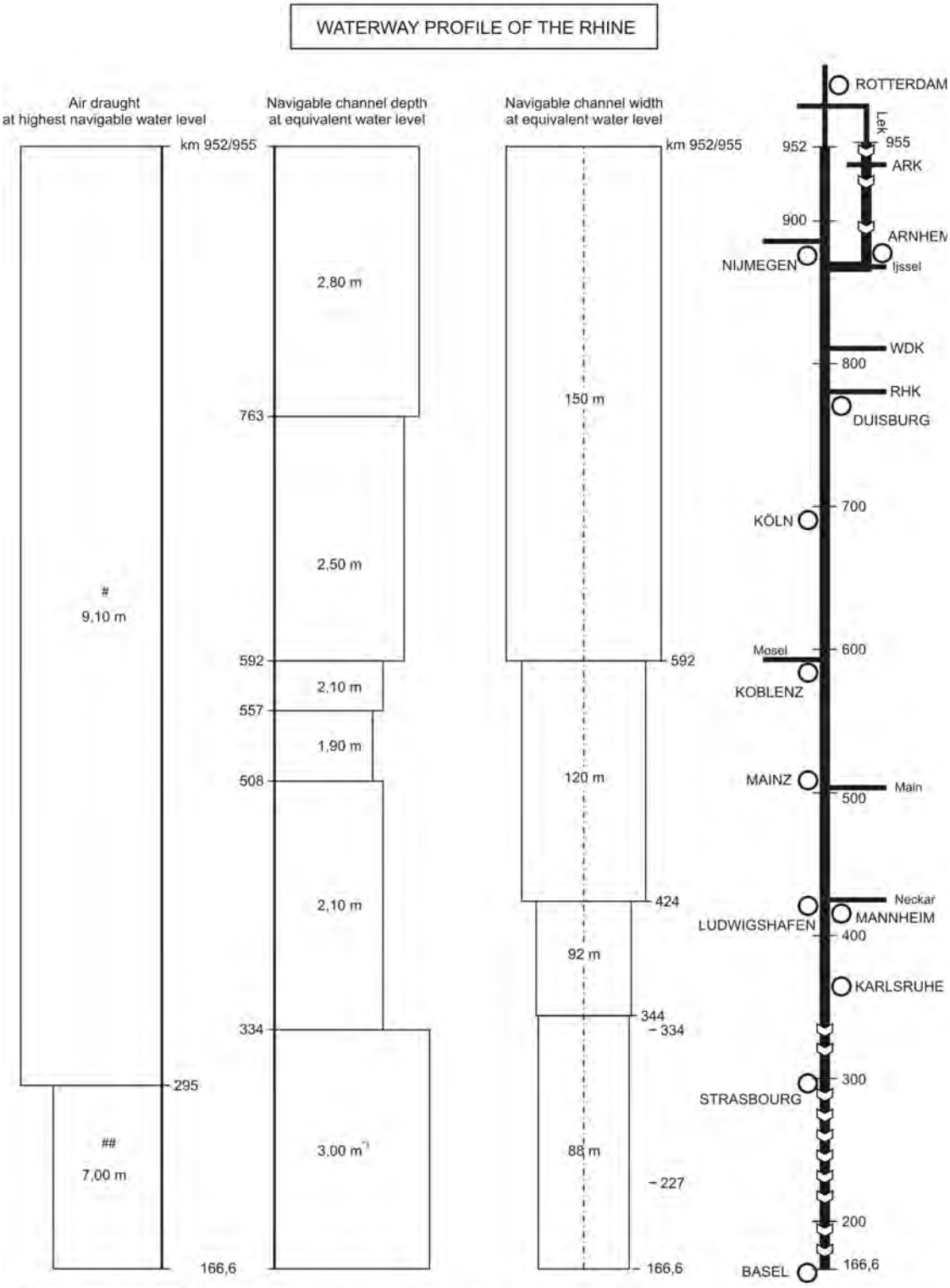
Rhine stretch	*Upstream transport in mio. t*	*Downstream transport in mio. t*
Lower Rhine	*115.53*	*62.00*
Middle Rhine	*45.15*	*33.58*
Upper Rhine	*27.03*	*23.99*

2019:

Rhine stretch	*Upstream transport in mio. t*	*Downstream transport in mio. t*
Lower Rhine	*98.37*	*58.29*
Middle Rhine	*38.35*	*33.21*
Upper Rhine	*25.41*	*23.60*

Source: CCNR based on Destatis

N Map 2: Waterway profile of the Rhine



[1] Guaranteed water depth

1. At the Josef-Kardinal-Frings-Brücke (Südbrücke Düsseldorf, Rhine km 737,10) the air draught of the bridge at HNWL is 8,61 m.
2. At the Kniebrücke Düsseldorf (Rhine km 743,57) the air draught of the bridge at HNWL is 8,82 m.
3. At the road bridge Rheinhausen - Duisburg-Hochfeld (Rhine km 775,29) the air draught at HNWL is 8,88 m.
4. At the road bridge Bonn-Beuel (Kennedy-Brücke Bonn, Rhine km 654,94) the air draught of 9,10 m above HNWL is only available over a width of 115 m.
5. At the road bridge Köln-Deutz (Rhine km 687,93) the air draught of 9,10 m above HNWL is only available over a width of 94 m.

At the Europabrücke (Rhine km 293,48) the air draught of the bridge at HNWL is 6,79 m.

Source: CCNR

The information provided regarding bottleneck management in the 2017 version of this report remains true in 2020. However, future developments regarding bottleneck management relate in particular to the ongoing review of the TEN-T policy and regulation. It is expected to lead to an improved management of transport networks, including inland waterways specifically, as well as bottlenecks.

A relevant aspect for bottleneck management, to which expert recommendations for the development of future TEN-T policy and the revision of the TEN-T regulation[26] point, is the need for inland waterway transport development to also take account of environmental protection, climate change adaptation and resilience, as well as other EU policies such as the Green Deal and Digital Europe. However, the NAIADES GNS sub-group also pointed out that the objectives set out in Article 15 (3) a of the TEN-T Regulation on Minimum Requirements, such as a draught of not less than 2.50m, are not suitable for free-flowing rivers such as the Rhine, the Danube and the Sava and suggested a further development of the TEN-T Regulation in a possible revision of the TEN-T Regulation.

Such recommendations also confirm that a corridor approach remains relevant in identifying and reducing bottlenecks on inland waterway networks and fostering coordination. Indeed, bottlenecks on the TEN-T network were identified in the context of the European Commission's corridor activities and can be found in the TEN-T corridor studies[27] and work programmes[28]. In order to avoid mis- or superficial understanding of bottlenecks' underlying issues, a broader definition will be used in this report, referring to capacity issues. This terminology is also adopted in the corridor work programmes regarding inland waterways. Capacity issues can cover non-compliance with TEN-T fairway criteria but also lack of berths and all other issues that lead to reduced inland waterway transport capacity.

Since 2014, bottlenecks persist in the Middle Rhine (relating to the rather low navigable channel depth of 1.90 metres, see waterway profile on the Rhine) as well as on the Mosel and Neckar (issues relating to lock capacity and length).

Although some parts of the Rhine may not comply with today's criteria laid down in the TEN-T Regulation for draught[29] and some parts were identified as bottlenecks in the respective corridor study, a significant transport volume can still be seen on the Rhine, both upstream and downstream. Hence, for identification of capacity issues, an analysis of fairway parameters such as navigable channel depth, headroom under bridges and navigable channel width might not be sufficient. In addition, although a 11% decrease of volumes can be seen on the Lower Rhine between 2014 and 2019, capacity issues and the absence of sheer compliance with today's TEN-T criteria on the Lower Rhine cannot be seen as the sole explanations for reduced transport volumes. Other parameters, such as market demand, environmental effects, for instance, low water periods, as well as structurally changing markets (steel industry) and a general slowdown in international trade, are also main explanations for this decrease in transport volumes between 2014 and 2019.

Another example which shows that a direct link between infrastructure improvements and transport performance / transport volume might not exist, can be seen in the completion of the 2001 major project on deepening of the Moselle fairway. Indeed, from 1992 to 1999, the sections from Koblenz to Richemont were deepened from originally 2.70 m to a depth of 3.00 m. Although fairway conditions improved on the Moselle, transport performance on the same river dropped in the following years[30]. Measures to alleviate impacts of identified capacity issues do not necessarily lead to an increase in transport performance / transport volumes but remain a relevant parameter to take into account when considering transport performance / volumes.

Maintenance has been identified as another key action towards inland navigation reliability. One should bear in mind that maintenance activity is a long-run activity and that one of the priorities so as to increase

[26] Developed by the NAIADES sub-group on Good Navigation Status (NAIADES GNS sub-group)

[27] For example: Rhine-Alpine Core Network Corridor Study, Final Report, December 2014, page 79

[28] For example: Rhine Alpine, Work Plan of the European Coordinator Paweł Wojciechowski, May 2015 and revised editions in 2016, 2018 and 2020

[29] Instead of referring to draught (measurement for ships), it is more appropriate to refer to depth of the navigable channel or fairway depth instead (measurement for infrastructure).

[30] See, specific analysis of the Moselle river, p. 18-19 of the market report 2014-2017 "main features and trends for the European Inland Waterway Transport sector

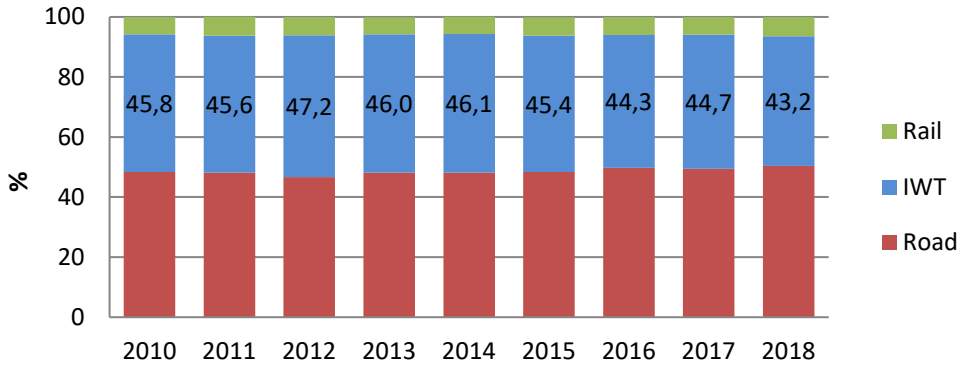
reliability is to ensure sustainable action modes for waterway maintenance. Today, it is the responsibility of Member States to maintain their inland navigation networks, core and comprehensive, which is crucial for the development of the sector.

2.6 IWT modal share evolution – focus on the Netherlands and Romania

➢ **Evolution of IWT modal share for the Netherlands**

In 2014, Germany was the country with the highest transport performance in inland shipping in the EU, with a share of around 39%. In 2018, Germany's share was around 35%, at the same level as the Netherlands. The Netherlands is also the country where the IWT modal share is the highest, with 43% in 2018, well above the EU average (6%). This is the reason why it was decided to study the Netherlands in this market report. Since 2014, the IWT modal share has slightly decreased but has remained at a rather high level.

Figure 16: Overall modal split evolution in the Netherlands (in %)

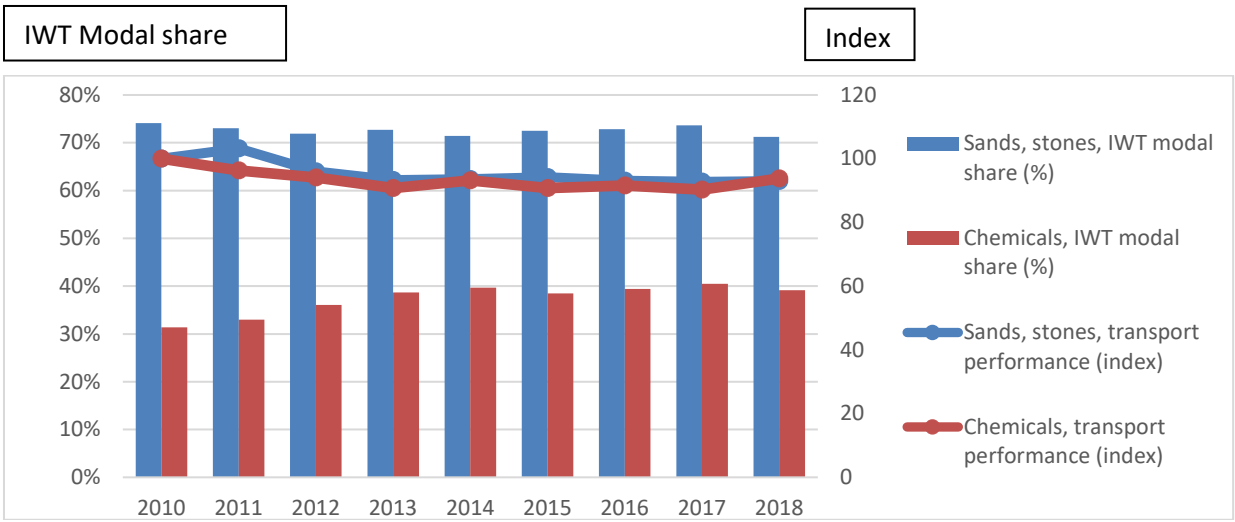


Source : Eurostat [tran_hv_frmod]

A detailed analysis of all 20 NST 2007 product segments reveals that between 2010 and 2018, IWT transport of sands, stones, building materials and metal ores (taken together) remained rather stable. This is rather a "hybrid" product segment related to both the construction activity on the one hand and to steel production on the other hand. A rather constant development for the total transport (IWT, rail, road) of ores, sands, stones, gravel, building materials is seen in the Netherlands. The modal share of IWT also remained rather stable between 2014 and 2018.

Since 2010, the IWT market share for chemical transport in the Netherlands increased by almost 10% but remained stable between 2014 and 2018. In Rhine countries in general, road transport for chemicals has been decreasing for several years with quite a robust trend. For example, in the Netherlands, the share of road transport for chemicals fell from 65% in 2008 to 55% in 2017. Such a decrease can be partly explained by safety issues. Indeed, higher safety standards apply today to tanker shipping, which is an advantage compared to other transport modes in this segment. At the same time, the overall transport performance of these two NST 2007 segments were more or less constant during the same period.

Figure 17: IWT modal share evolution for sands, stones, building materials, metal ores, and chemicals, transport performance evolution for these segments (sum of IWT, rail, road) in the Netherlands

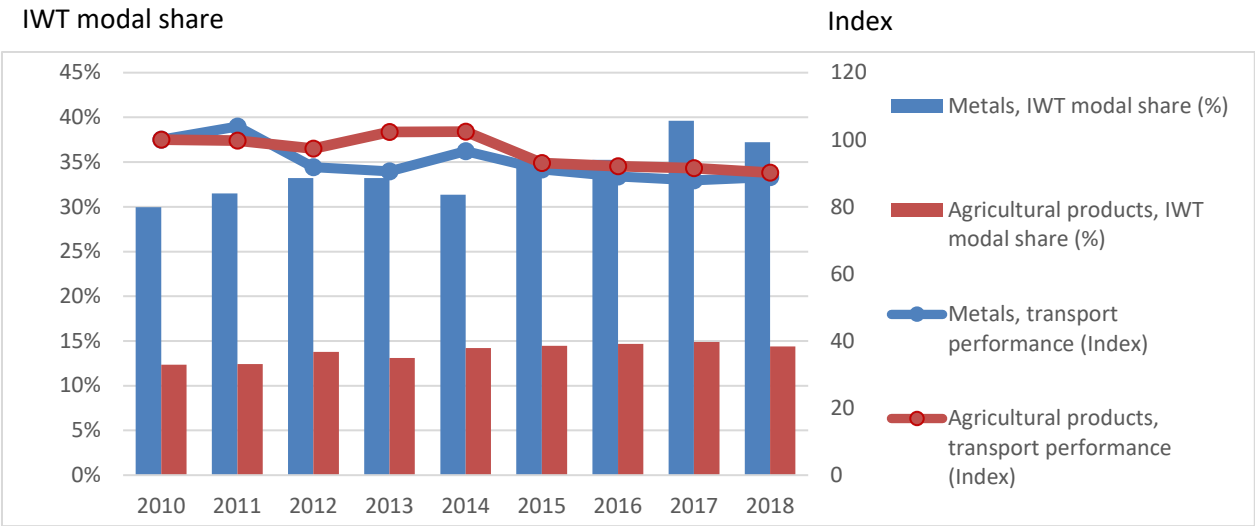


Source: CCNR based on Eurostat [iww_go_atygo], [rail_go_grpgood], [road_go_ta_tg]

Two segments where IWT has gained market shares since 2010 are metals and agricultural products. While for metal transport, IWT transport has almost continuously gained market shares since that date, for the transport of agricultural products, the trend has remained rather stable since 2014.

For both segments, the rising IWT market share is taking place against the background of a slightly shrinking overall transport market, mainly driven by a decreasing performance in road transport since 2014.

Figure 18: IWT modal share evolution for agricultural products and metals, transport performance evolution for these segments (sum of IWT, rail and road) in the Netherlands

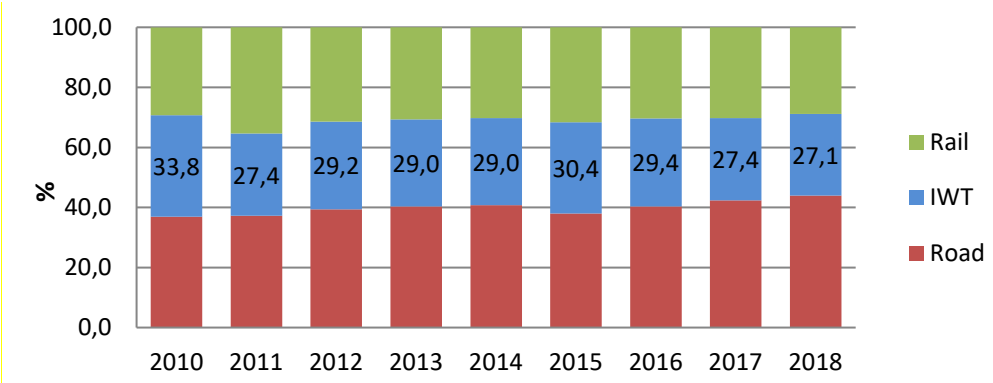


Source: CCNR based on Eurostat [iww_go_atygo], [rail_go_grpgood], [road_go_ta_tg]

➢ Evolution of IWT modal share for Romania

Romania is the country with the highest IWT transport performance of all Danube countries. In 2018, it had a share of 7% in overall EU transport performance compared to 6% in 2014. The overall modal share of IWT has decreased since 2014 (1.9 percentage points).

Figure 19: Overall modal split evolution in Romania



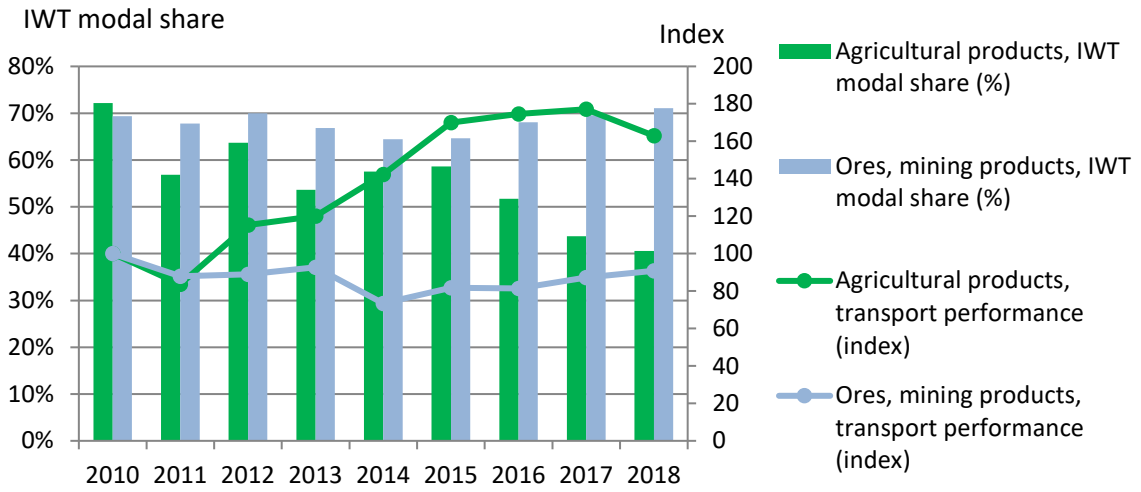
Source : Eurostat [tran_hv_frmod]

The two most important segments of Danube navigation are agricultural products and steel industry related products. In the following figure it can be seen that the same conclusion can be drawn as for the previous edition of this report. Indeed, IWT has lost market shares within agricultural products transport, while - in parallel - the total transport market for agricultural products has continuously increased in Romania. Indeed, its value more than doubled between 2011 and 2017 (+25% between 2014 and 2017).

This increase was mainly driven by road transport performance while the IWT performance increased up until 2015 and has since been decreasing. A slight decline in the overall transport market in 2018 (road, rail, IWT) can be observed, which could be explained by the lower imports of grain coming from the Middle Danube region in that year. Due to the loss of market shares, IWT could not benefit sufficiently from the overall growth in the transport market for agricultural products.

The total transport performance for ores and mining products was following a decreasing trend until 2014, which was mainly explained by the crisis of the steel industry in the Lower Danube area in the wake of the financial crisis 2008/2009. However, since 2014, both the overall transport performance and the IWT modal share have increased, reflecting the economic recovery of the steel industry in the Danube region.

Figure 20: IWT modal share evolution for agricultural products, ores and mining products and transport performance evolution for these segments (sum of IWT, rail and road) in Romania

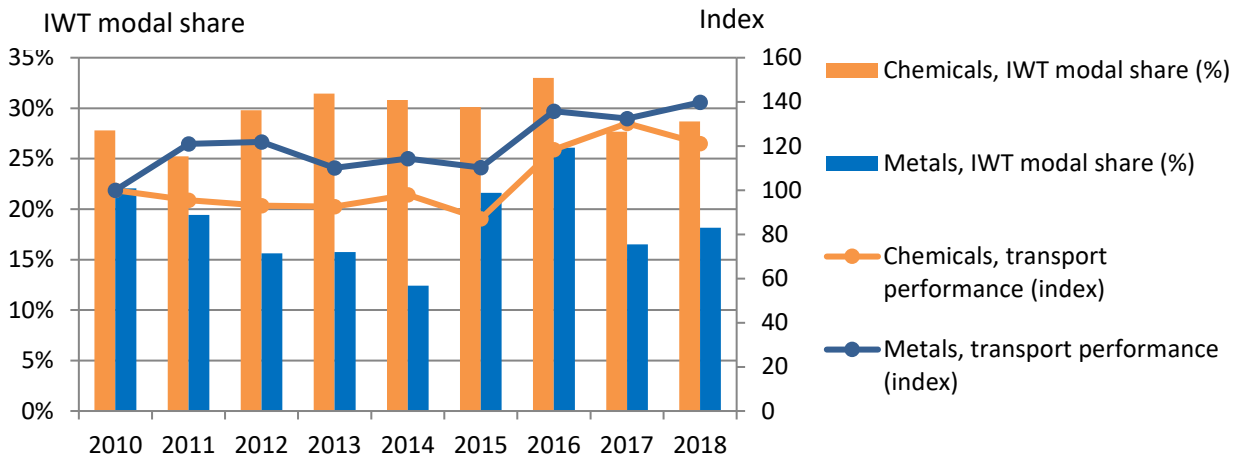


Source: CCNR based on Eurostat data on transport performance [iww_go_atygo], [rail_go_grpgood], [road_go_ta_tg].

In Romania, IWT gained market shares for chemical products until 2016. However, in 2017, this share fell, which is in line with a decrease in volume of chemicals transported by inland vessels in this country. In 2018, the IWT market share picked up again to reach a level slightly higher than in 2010. In parallel, the total transport market for chemicals has been growing since 2014 in Romania, mainly driven by an increase in road transport performance. On the contrary, rail transport of chemicals fell strongly until 2015 but started to pick up again afterwards.

Metals transport is important both in the Rhine and in the Danube regions due to the steel industries in both of these parts of Europe. While the modal split of IWT evolved more positively in the Rhine basin than in the Danube basin, it can be observed that IWT gained market shares for the transport of metals in recent years in Romania, particularly between 2014 and 2016, but lost some market shares in 2017 and 2018. The total transport performance for metals suffered heavily from the economic crisis 2008/2009, then stabilised until 2016, and has increased again since 2016.

Figure 21: IWT modal share evolution for chemical products, metals and transport performance evolution for these segments (sum of IWT, rail and road) in Romania



Source: CCNR based on Eurostat data on transport performance [iww_go_atygo], [rail_go_grpgood], [road_g_ta_tg].

3. PORT TRANSHIPMENT

©Upper Rhine Ports

3. Port transhipment

3.1 Inland waterway traffic in main seaports

➢ **Seaports in western Europe**

Map 1: inland waterway traffic in main western Europe seaports*

Sources: Port Statistics, Eurostat [iww_go_aport], Panteia, CBS
** North Sea Port is the name of the port formed by the cross-border merger between Zeeland Seaports (Flushing, Borsele and Terneuzen) in the Netherlands and Ghent Port Company in Belgium, signed on 8 December 2017. The cross-border merger port started to operate on 1 January 2018.*

Large seaports are important transhipment places, not only for maritime vessels, but also for inland vessels, as they represent the interface between maritime trade and hinterland transport. Their role is crucial for the modal share of inland shipping within the transport market.

Given their important role, ensuring a faster and more efficient inland vessel cargo handling in seaports is essential to reinforce the role of inland navigation as an economically relevant means of transport. Currently, particularly in western ports such as Rotterdam and Antwerp, inland vessels are still faced with long waiting times in seaports. Several projects are currently ongoing to address this issue, such as the NOVIMOVE project, co-financed by the EU.

In the three largest European seaports, Rotterdam, Antwerp and Hamburg, inland shipping has high modal shares for bulk traffic, and partly also for container traffic. In Rotterdam and Antwerp, IWT's share in hinterland traffic varies between 35% and 45% while it is lower in Hamburg.

In 2019, in the port of Antwerp, inland waterway transport had a share of 44.7% within hinterland traffic (compared to road, 47% and rail, 8.4%). This share was 46% in 2018. A comparison with 2014 cannot be made as a new methodology was set up in 2018.

In Hamburg, hinterland traffic (all modes) increased by 7.4% between 2018 and 2019. Within this hinterland traffic, inland waterway transport lost market shares to rail. It had a share of 9.2% in 2019, compared to 10.1% in 2018, while rail transport's modal share was 49.4% (compared to 47.1% in 2018). The road modal split share decreased from 42.8% to 41.4%.

In 2019, inland waterway traffic in the three biggest European seaports amounted to 263 million tonnes in total, which corresponded to the level in 2018, but was 1% lower than in 2014, and 3% lower than in 2017. In Hamburg and Rotterdam, IWT transport decreased between 2014 and 2019 while it increased in Antwerp.

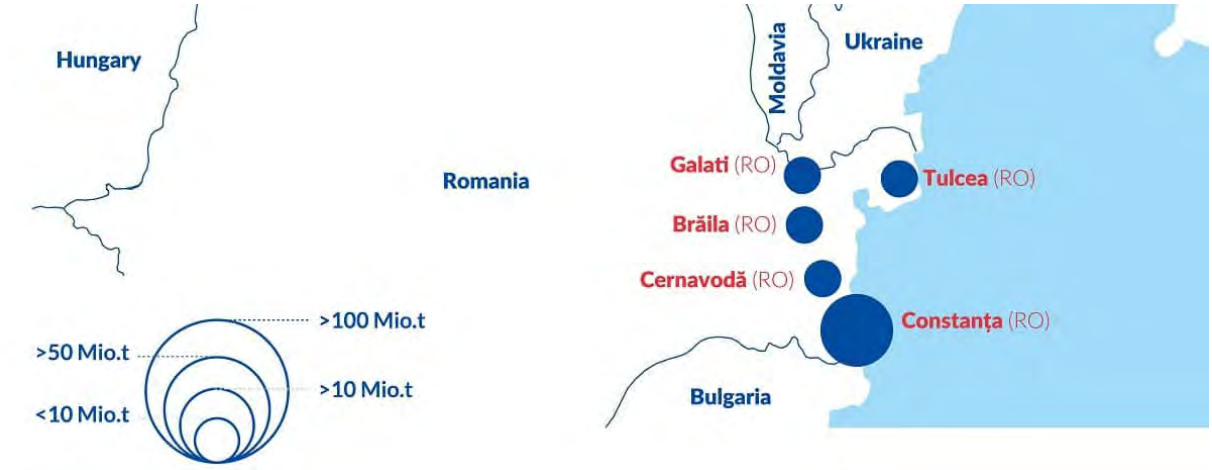
Table 1: Evolution of inland waterway traffic in the three major European seaports (mio. tons)

	2014	2016	2017	2018	2019	2019/2014 in %
Rotterdam	157.1	157.4	159.2	152.8	152.8	-3
Antwerp	96.5	97.2	102.3	99.3	101.3	+3
Hamburg	11.6	11.3	10.7	9.9	8.9	-2.3
Total	**265.2**	**265.9**	**271.2**	**262**	**263**	**-1%**

Sources: Port of Rotterdam, Port of Antwerp, Statistical Office of Hamburg and Schleswig-Holstein

➢ Seaports in the Danube region

Map 2: inland waterway traffic in main seaports of the Danube region



Source: Romanian national Institute of Statistics

The port of Constanţa is the main seaport on the Black Sea, playing an important role as the transit node for the landlocked countries in central and south-east Europe. It is a very significant port for the export of grain and for the import of iron ores and coal. The connection of the port with the Danube is made through the Danube-Black Sea canal, which represents one of the main key points of the port of Constanţa.

With regard to river traffic, it has constantly increased since 2010 (a 21% increase between 2014 and 2019). Container traffic on the Danube is still relatively low. Three other ports are important for the region, the ports of Galati, Braila and Tulcea. These are in fact river-sea ports, to which seagoing ships coming from the Black Sea sail upstream on the Danube, and where they can load or unload cargo. The port of Galati is the third-largest seaport of Romania. Inland waterway traffic in the port of Galati has followed an upward trend in the last years.

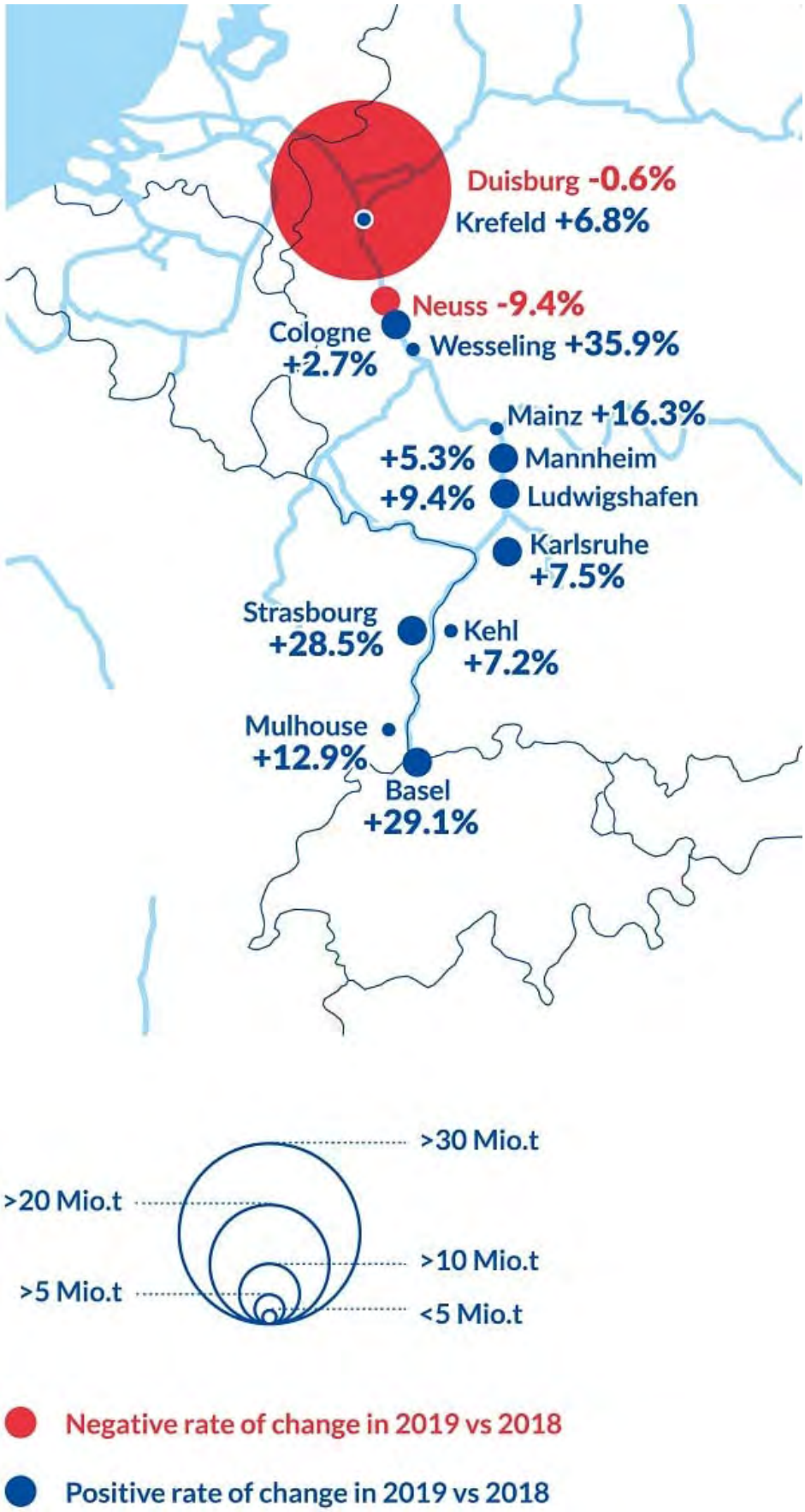
3.2 Inland waterway traffic in main inland ports

➢ **Rhine ports**

Table 2 and map 3: Waterside traffic in major Rhine ports (million tonnes)

	2014	2015	2016	2017	2018	2019	2019/2014 in %
Duisburg	52.4	54.1	55.6	52.2	48.1	47.8	-8.8
Cologne	12.0	11.1	11.0	10.7	8.9	9.1	-24.2
Mannheim	8.5	8.2	8.7	9.7	7.5	7.9	-7.1
Strasbourg	8.1	7.4	7.5	8.0	5.9	7.5	-7.4
Neuss	7.1	7.2	7.7	8.0	7.6	6.9	-2.8
Karlsruhe	6.6	6.6	6.3	7.2	6.4	6.9	4.5
Ludwigshafen	7.3	7.0	6.6	5.6	6.1	6.6	-9.6
Basel	6.0	6.3	5.9	5.8	4.7	6.1	1.7
Mulhouse	5.3	4.9	4.9	4.8	4.4	4.9	-7.5
Kehl	3.3	3.3	3.5	3.5	3.9	4.2	27.3
Mainz	3.2	2.9	3.2	2.9	3.2	3.7	15.6
Krefeld	3.2	3.0	3.2	3.4	3.3	3.6	12.5
Wesseling	3.4	3.1	2.7	2.6	2.0	2.7	-20.6
Total	**126.4**	**125.1**	**126.8**	**124.4**	**112.1**	**118.1**	**-6.7**

Sources: Destatis. Port de Strasbourg, Swiss Rhine ports, Port de Mulhouse, Association Française des Ports Intérieurs (AFPI). The "total" relates only to the ports mentioned in the table, not to all Rhine ports.



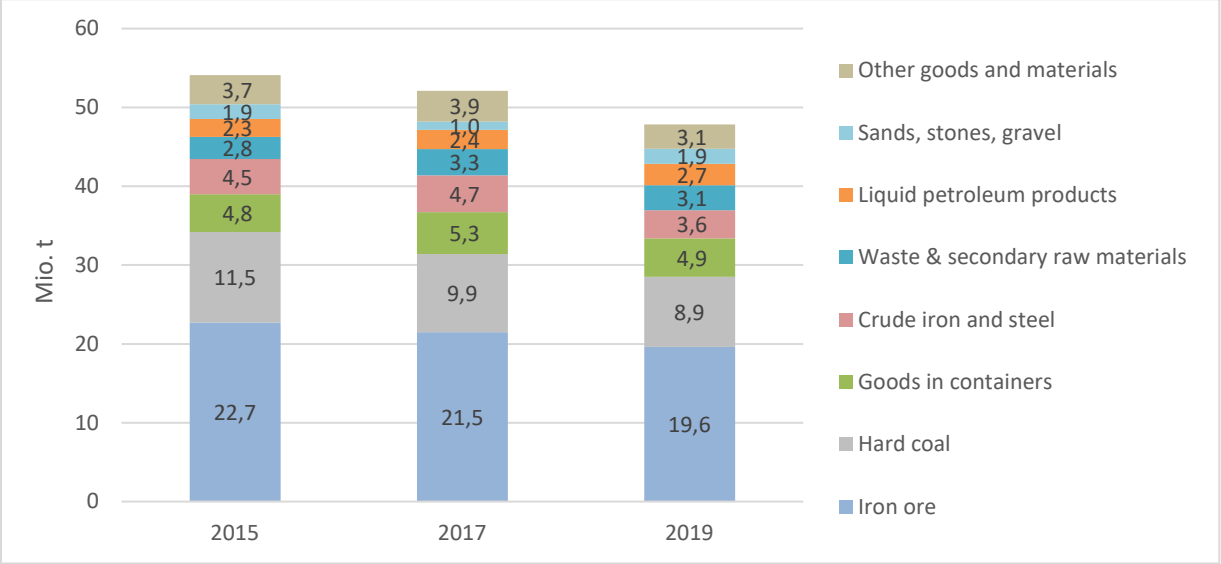
In the following section, the more detailed evolution will be presented for the two largest Rhine ports (Duisburg and Cologne).

Port of Duisburg

The largest European inland port showed a decreasing waterside traffic between 2014 and 2019. In order to reveal the reasons for this, a closer look at the waterside traffic in Duisburg per goods segment must be taken. The data come from the German Statistical Office and include transport in all harbours and transhipment places in Duisburg (not only those of the port company Duisport AG, but also transhipment at private ports of the steel industry).

As the next figure shows, volumes of waterside traffic for steel related commodities and end products (iron ore, hard coal, crude iron and steel) fell between 2015 and 2019. The reduction for iron ore was 14%, for hard coal 23%, and for crude iron and steel 20%. It should be noted that the decrease already started before the low water period of 2018. It can be explained by a structural decline in steel production in western Europe.[31] Another reason is the role played by the slowdown in world trade and macroeconomic framework conditions which took place in 2018 and 2019, and the low waters in 2018. The total share of steel related commodities and end products within waterside traffic in Duisburg decreased from 73% in 2015, to 71% in 2017, and 68% in 2019.

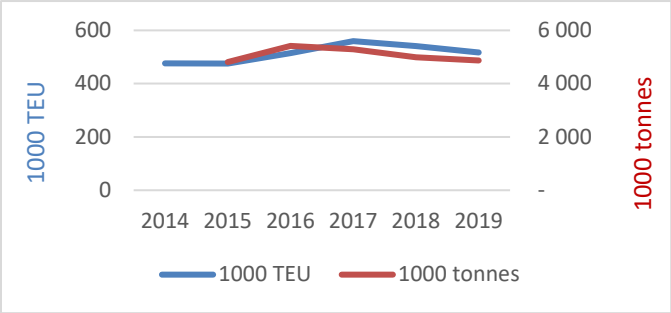
Figure 1: Waterside traffic in the ports in Duisburg per product segment (million tonnes)



Sources: Destatis and CCNR analysis

Container transport in Duisburg amounted to 517,200 TEU in 2019, which was 4% lower than in 2018, and 8% lower than in 2017.

Figure 2: Waterside container traffic in the port of Duisburg (1000 TEU / 1000 tonnes)



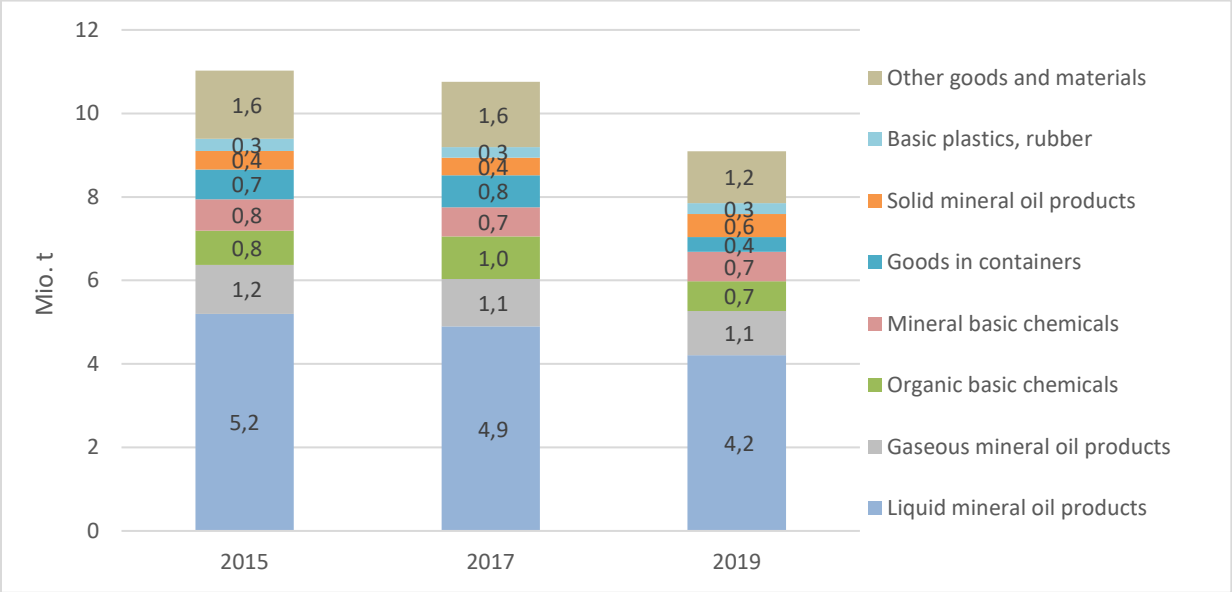
Source: Destatis

[31] According to forecasts, it is expected that steel production in western Europe will decline in the next 20 years. This is the outcome of projections of Oxford Economics.

Port of Cologne

Waterside traffic in the port of Cologne is strongly concentrated on liquid cargo, chemicals and mineral oil products. All kinds of chemicals and mineral oil products taken together had a share of 83% of total waterside traffic in 2015 and in 2017, and even 87% in 2019. However, transports of liquid mineral oil products decreased quite strongly between 2015 and 2019 (by 1 million tonnes).

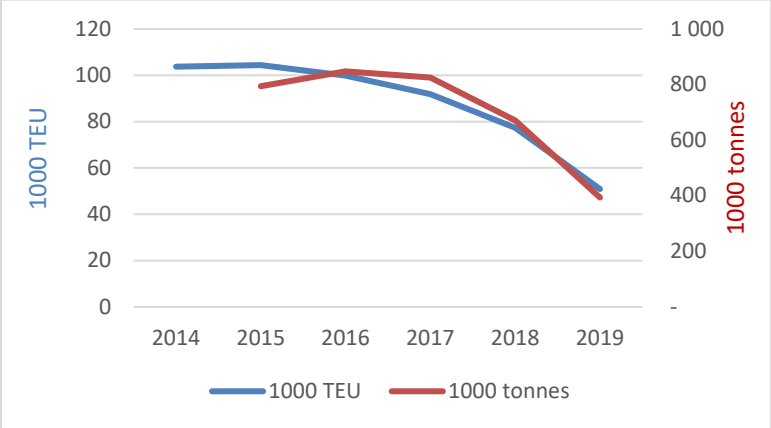
Figure 3: Waterside traffic in the ports in Cologne per product segment (million tonnes)



Sources: Destatis and CCNR analysis

Waterside container traffic in Cologne was rather stable between 2014 and 2017, but it started to decrease in 2018. The drop continued also in 2019. Neither in terms of TEU, nor in terms of tonnes, did container transport in Cologne recover to its 2017 level in 2019.

Figure 4: Waterside container traffic in the port of Cologne (1000 TEU / 1000 tonnes)



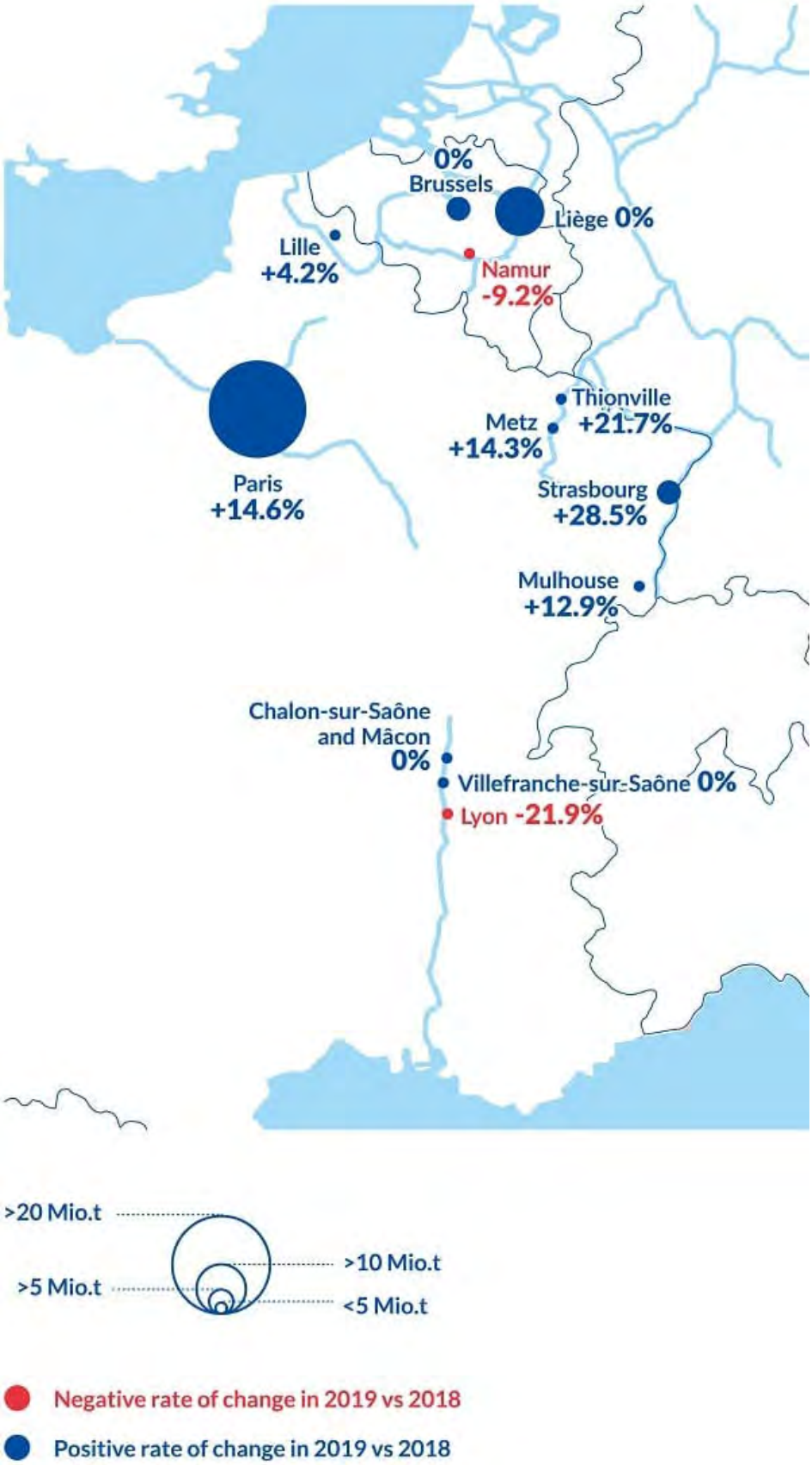
Source: Destatis

➢ French and Belgian inland ports

Table 3 and map 4: Waterside traffic in major French and Belgian inland ports (million tonnes)

	2014	2015	2016	2017	2018	2019	2019/2014 in %
Paris	20.1	20.2	20.4	21.2	22.1	25.3	25.9
Liège	13.5	14.6	15.5	15.9	16.0	16.0	18.5
Strasbourg	8.1	7.4	7.5	8.0	5.9	7.5	-7.4
Brussels	4.3	4.4	4.4	4.8	5.2	5.2	20.9
Mulhouse	5.3	4.9	4.9	4.8	4.4	4.9	-7.5
Namur	5.4	5.4	5.2	5.3	5.1	4.6	-14.8
Metz	2.2	2.1	1.6	1.7	1.8	2.2	0.0
Lille	1.6	1.5	1.7	1.8	1.8	1.9	18.8
Lyon	1.6	1.4	1.4	1.5	1.4	1.1	-31.3
Villefranche-sur-Saône	0.7	0.7	0.7	0.8	0.8	0.8	14.3
Chalon-sur-Saône and Mâcon	1.0	0.9	1.0	1.1	0.8	0.8	-20.0
Thionville	1.4	0.8	0.6	0.6	0.6	0.7	-50.0
Total	**65.2**	**64.3**	**64.9**	**67.4**	**66.0**	**70.9**	**+ 8.7%**

Sources: Ports de Paris, Port de Liège, Port de Strasbourg, Port de Mulhouse, Association Française des Ports Intérieurs (AFPI), Port de Bruxelles, Port de Namur, Nouveau port de Metz, Port de Lille, VNF. The "total" relates only to the ports mentioned in the table, not all French and Belgian inland ports.



In the following section, the more detailed evolution will be presented for the two largest ports in France and Belgium (Paris and Liège).

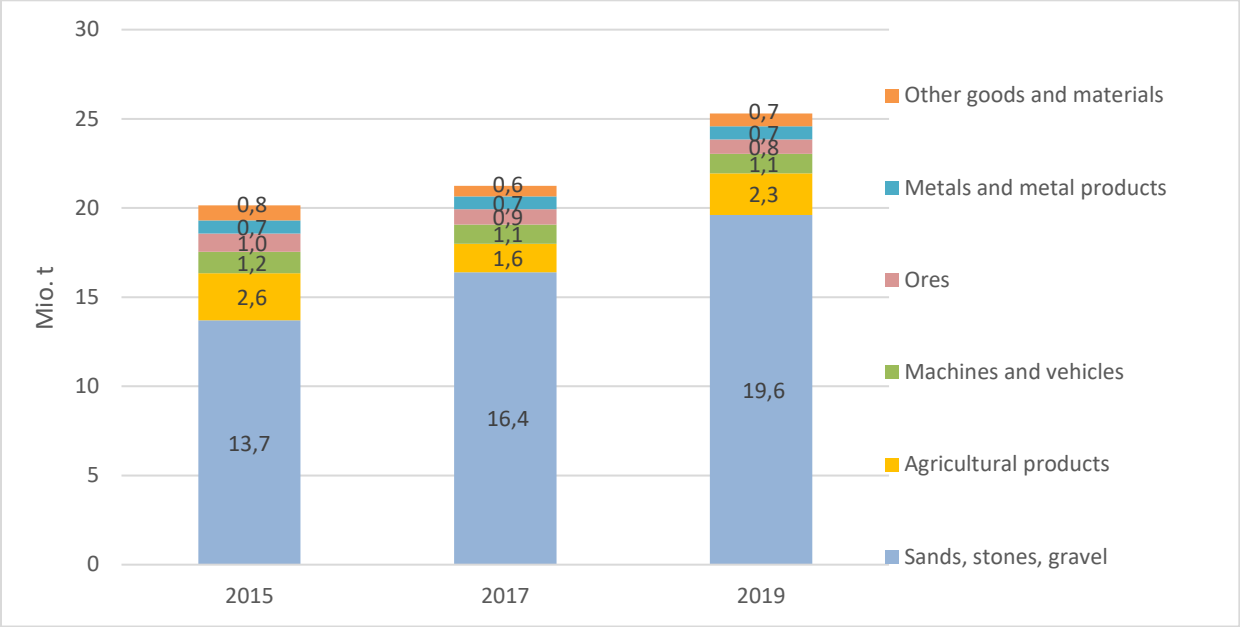
Ports of Paris

In the Ports of Paris, the segment of sands, stones and building materials is by far the most important one. In 2015, it represented 68% of total waterside traffic, and this share increased further to 77% in 2017 and to 78% in 2019. These materials are required for the building industry in the agglomeration of Paris, and with the further demographic and urban growth in Paris, a positive evolution can be foreseen for the future.

In addition to this, the construction of new metro lines within the urban project “Grand Paris Express” leads to a further increase in the transport demand for these materials. Inland shipping is involved in the delivery of sand and building materials for this construction work, as well as in the transport of the excavation material. The ports of Paris have signed an agreement with the public company that is in charge of delivering the project “Grand Paris Express”, and due to this agreement, a certain share of volumes has to be transported on the river Seine. Further transports of sands, stones, gravel and building materials are expected to be generated by the construction works for the Olympic Games 2024 in Paris.[32]

The Ports of Paris also launched initiatives to promote urban container transport on the rivers Seine and Oise: best practice-examples include the delivery of goods for supermarkets in the heart of Paris. The benefits for the city of Paris include a reduction of emissions, fewer traffic problems as well as fewer accidents and related social costs.

Figure 5: Waterside traffic in the Ports of Paris per product segment (million tonnes)

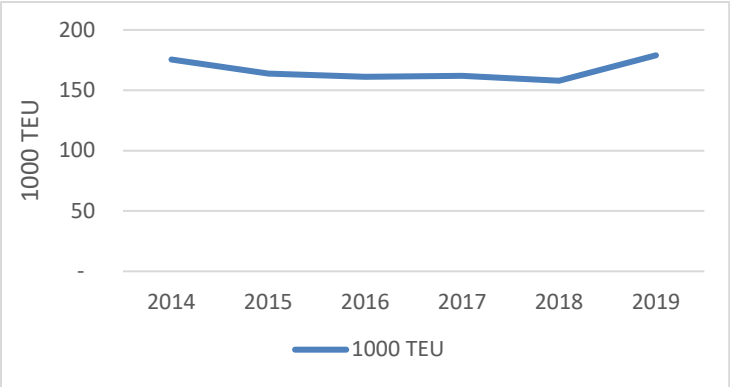


Source: Ports de Paris

After several years of stagnating waterside container traffic, the year 2019 saw a strong 13.3% (based on TEU) rise in traffic to the Ports of Paris, compared to 2018.

[32] See chapter 2.3, special case “Seine river”

Figure 6: Waterside container traffic in the Ports of Paris (1000 TEU)



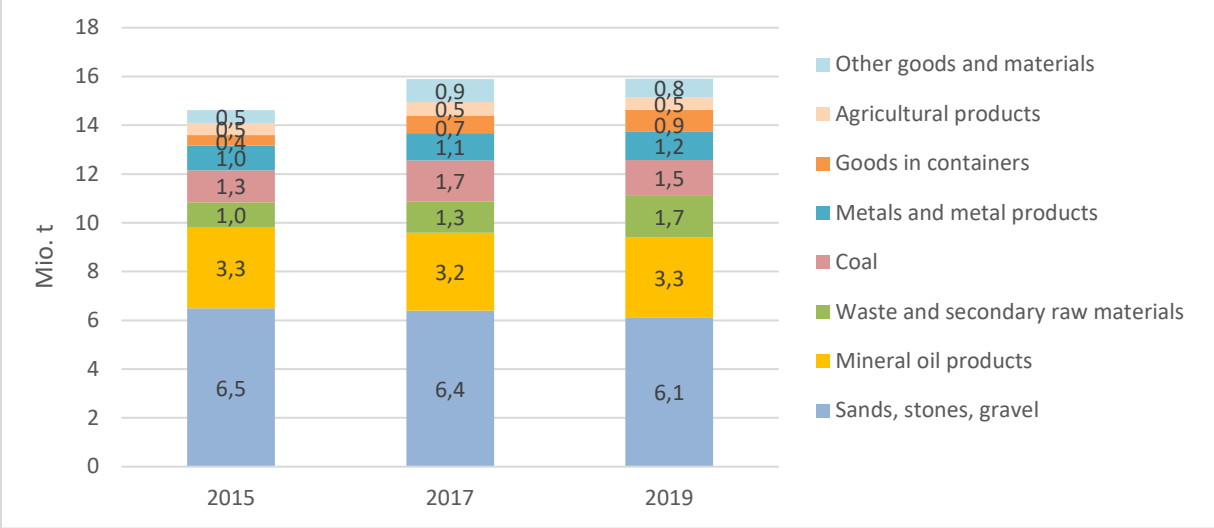
Source: Ports de Paris

Port of Liège

The Belgian port of Liège is in a favourable geographical position, integrated in the heart of the European inland waterway network. Between 2014 and 2019, the modal split share of IWT rose from 75.1% in 2014 to 75.6% in 2017, fell to 74.7% in 2018, and rose again to reach 75.1% in 2019.

The cargo structure in the port of Liège lies largely on two traditional market segments: sands, stones, gravel, representing 38.3% of total waterside traffic, and mineral oil products (20.7%). Apart from these two large segments, which did not grow in volume between 2015 and 2019, there are two smaller cargo segments with a positive growth trend: 1) the category of waste and secondary raw materials and 2) goods in containers.

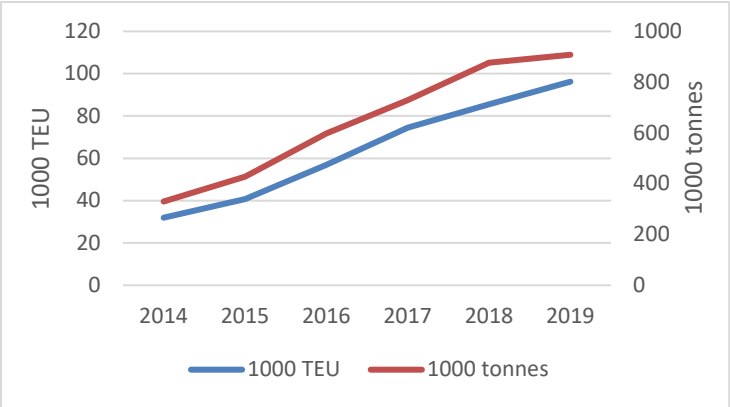
Figure 7: Waterside traffic in the port of Liège per product segment (million tonnes)



Source: Port autonome de Liège

Container transport has increased very significantly since 2014, with a rather linear trend. The TEU volumes were 3.0 times higher in 2019 than in 2014, and the volume of goods (in tonnes) was 2.75 times higher.

Figure 8: Waterside container traffic in the port of Liège (1000 TEU / 1000 tonnes)



Source: Port autonome de Liège

➢ Danube ports

Table 4 and map 5: Waterside traffic in large Danube ports (million tons)

	2014	2015	2016	2017	2018	2019	2019/2014 in %
Constanta	12.6	12.7	13.2	12.8	12.7	15.2	+21%
Galati	4.3	4.3	4.4	6.3	6.4	5.9	+37%
Ismail	3.1	4.8	5.7	5.1	4.7	4.3	+39%
Smederovo	1.5	1.8	2.5	3.2	3.6	4.0	+167%
Linz	4.3	3.8	4.0	4.2	3.2	3.4	-21%
Bratislava	1.4	1.4	1.5	1.6	1.1	1.7	+21%
Tulcea	1.2	2.5	1.5	1.3	1.7	3.3	+175%
Pancevo	1.3	0.7	1.0	1.1	1.4	1.5	+15%
Novi Sad	1.3	1.0	1.3	1.2	1.0	1.4	+8%
Regensburg	2.2	1.6	1.3	1.5	1.1	1.3	-41%
Reni	1.5	0.9	1.0	1.1	1.3	1.3	-13%
Vienna	1.4	1.0	1.1	1.1	1.0	1.2	-14%
Drobeta Turnu Severin	0.9	0.9	1.0	1.2	1.1	1.2	+33%
Călăraşi-Chiciu	0.5	0.5	0.5	0.7	0.7	1.1	+120%
Prahovo	0.3	0.4	0.7	0.9	1.0	1.1	+267%
Budapest-Csepel	0.8	0.8	1.0	1.1	0.9	1.1	+38%
Măcin-Turcoaia	1.1	1.4	1.2	0.8	0.8	0.9	-18%
Baja	0.7	0.7	0.5	0.6	0.3	0.5	-29%
Total	**40.4**	**41.2**	**43.4**	**45.8**	**44.0**	**50.4**	**+25%**

Sources: Danube Commission market observation, Romanian Statistical Institute, Port of Constanţa, Hungarian Statistical Office, Destatis, Statistik Austria, Port Governance Agency of Serbia. The "total" relates only to the ports mentioned in the table and not to all Danube ports. The total waterside traffic of the Danube ports in 2019 amounted to 69 million tonnes (+13% compared to 2018).

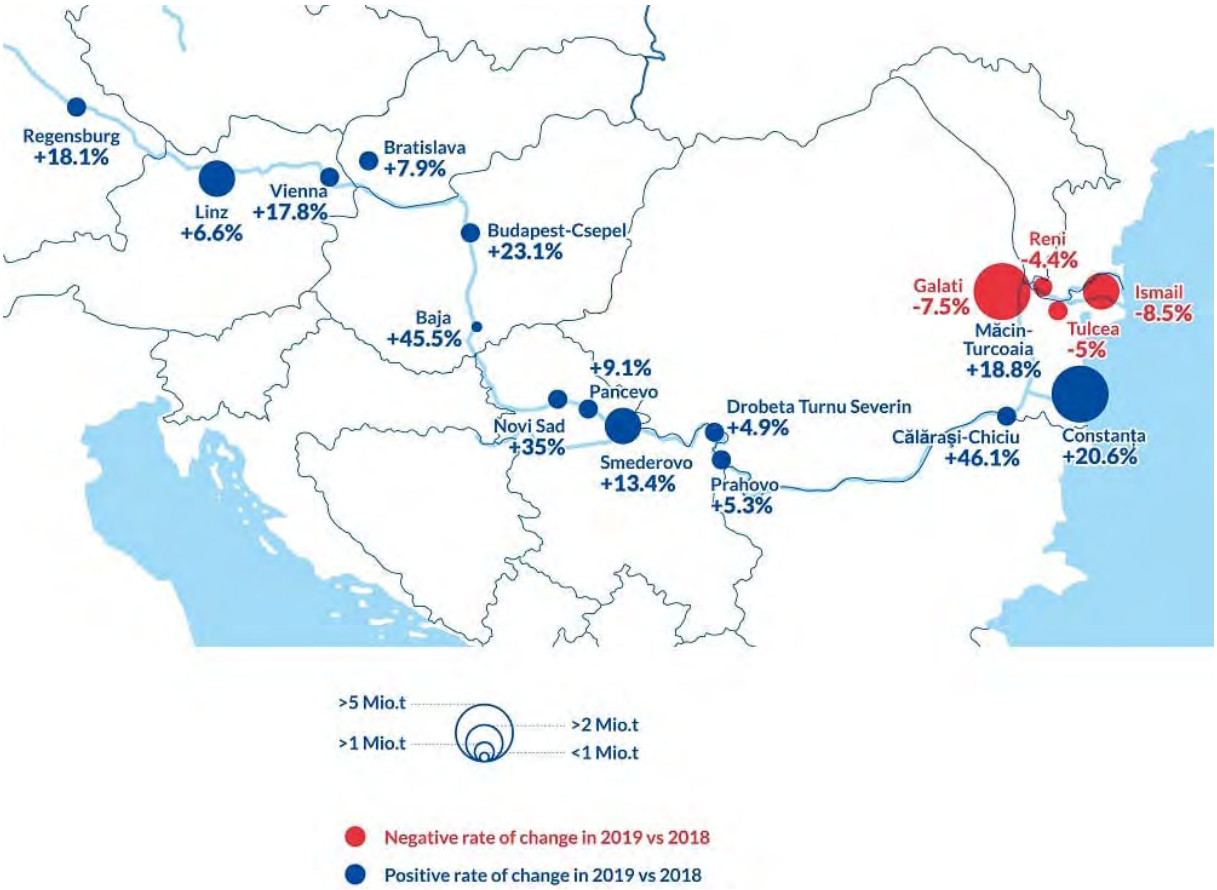


Table 4 showing the Danube ports data shows that waterside traffic has grown strongly in the Danube region between 2014 and 2019. For these large 18 Danube ports, which represent 72.5% of total waterside ports traffic in the Danube basin, the level of waterside traffic was 25% higher in 2019 compared to 2014. This growth in port traffic confirms the results obtained on a country level for Danube countries. As was seen in chapter 1.2 (Economic context), Romania had a more growth orientated evolution of inland waterway transport for metals, metal products, and agricultural products than Rhine countries between 2014 and 2019. In chapter 2.1 (General traffic evolution), the overall results on a country level also showed that most Danube countries experienced a growth in overall waterway transport between 2014 and 2019.

What we can see in the ports table, is that growth existed for almost all Romanian Danube ports (Constanţa, Galati, Tulcea, Drobeta Turnu Severin, Călăraşi-Chiciu), the only exception being Măcin-Turcoaia. Also, Serbian inland ports (Smederovo, Pancevo, Novi Sad, Prahovo) have increased their activity in a clear way. On the other hand, the waterside traffic evolved less positively in Austrian (Linz, Vienna) and German Danube ports (Regensburg).

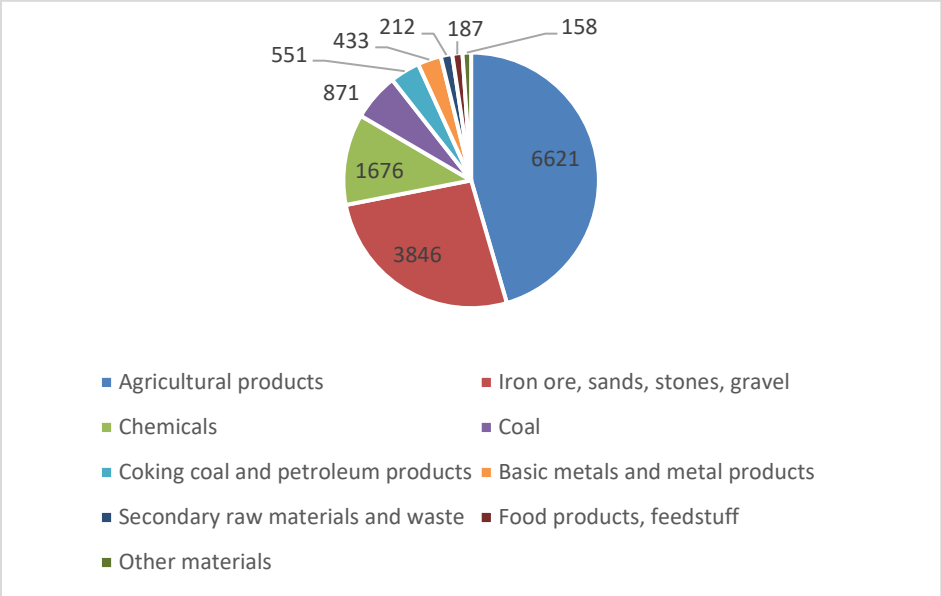
This regional differentiation – a strongly positive development on the Lower and Middle Danube and a more negative development on the Upper Danube – reflects also different economic dynamics between 2014 and 2019. Economic driving factors such as the rising industrial activity in the Lower and Middle Danube region thus played a role. For example, the steel industry in Serbia (located in Smederovo) more than tripled its production level between 2014 and 2018, in the wake of a Chinese direct investment into the Serbian steel industry. This had of course beneficial effects on the waterside traffic of iron ores, coal and metals in the region.[33] The growth rate of 167% of ports traffic in Smederovo (see table) confirms this. Romanian steel production grew by 9% between 2014 and 2019.

Macroeconomic and industrial development in the Middle and Lower Danube region was more growth orientated than in the Upper Danube and in the Rhine region. The hydraulicity (low waters) did have

[33] See: CCNR / European Commission (2020), Market Insight April 2020 – European Inland Navigation, page 10.

negative effects on waterside traffic of Danube ports in 2018, but – in contrast to the Rhine region – the levels in 2019 recovered very well and were far above the levels of 2017.

Figure 9: Port of Constanţa, river waterside traffic by goods segment in 2019 (1,000 tonnes)



Source: Romanian Statistical Institute, series Harbour transport of goods and passengers in the year 2019 [34]

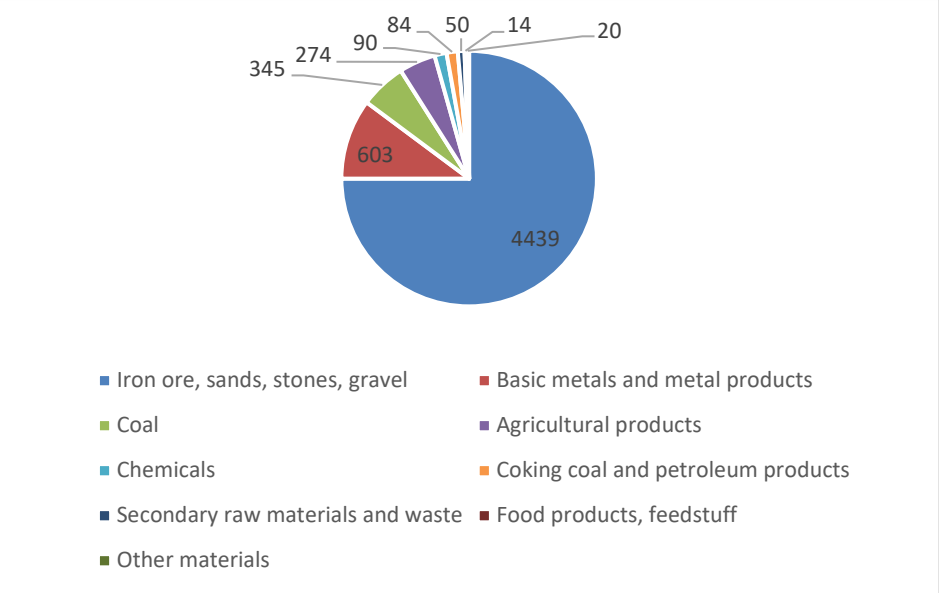
The agricultural segment alone represents already 45% of total waterside river traffic in Constanţa. Together with iron ore, sands, stones and gravel, this share rises to 72%. Even if the name of the goods segment is iron ore, sands, stones and gravel, this category contains predominantly iron ore in Constanţa, as the steel industry is of great importance in Romania. There are, unfortunately, no detailed data available for earlier years.

River container transport in Constanţa is still very low and amounted to 2,000TEU in 2019, according to the Romanian Statistical Institute.

The river traffic in the port of Galati is dominated by iron ore. The reason is that Galati hosts the largest steel plant of Romania, which makes intensive use of river and river-sea-traffic for its logistics. Together with metals, metal products and coal, the share of the steel related materials rises to 91% of total waterside traffic in Galati.

[34] To be found here: https://insse.ro/cms/en/publicatii-statistice-in-format-electronic?field_categorie_publicatie_value_i18n%5B0%5D=13&created=All&field_cuvinte_cheie_value=&items_per_page=10&page=1

Figure 10: Port of Galati, river waterside traffic by goods segment in 2019 (1,000 tonnes)



Source: Romanian Statistical Institute, series Harbour transport of goods and passengers in the year 2019 [35]

The following table contains the data on steel production in important steel producing countries in the Rhine and Danube basins between 2014 and 2019.

Table 5 and 6: Steel production in important producer countries in the Rhine and Danube basin (Mio. t)

Year	Germany	France	Belgium	The Netherlands
2014	42.9	16.1	7.3	7.0
2015	42.7	14.4	7.2	7.0
2016	42.1	14.4	7.7	6.9
2017	43.3	15.5	7.8	6.8
2018	42.4	15.4	7.9	6.8
2019	39.6	14.4	7.7	6.6
2019/2014 in %	**-7.6%**	**-10.5%**	**+5.8%**	**-4.4%**

Year	Austria	Slovakia	Romania	Hungary	Serbia
2014	7.9	4.7	3.1	1.1	0.6
2015	7.7	4.5	3.3	1.6	1.0
2016	7.4	4.8	3.2	1.2	1.2
2017	8.1	4.9	3.3	1.9	1.5
2018	6.9	5.2	3.5	2.0	2.0
2019	7.4	3.9	3.4	1.8	1.9
2019/2014 in %	**-5.7%**	**-16.5%**	**+9.2%**	**+53.6%**	**+231%**

Source: World Steel Association

[35] To be found here: https://insse.ro/cms/en/publicatii-statistice-in-format-electronic?field_categorie_publicatie_value_i18n%5B0%5D=13&created=All&field_cuvinte_cheie_value=&items_per_page=10&page=1

4. FLEET AND MARKET STRUCTURE

4. Fleet and market structure

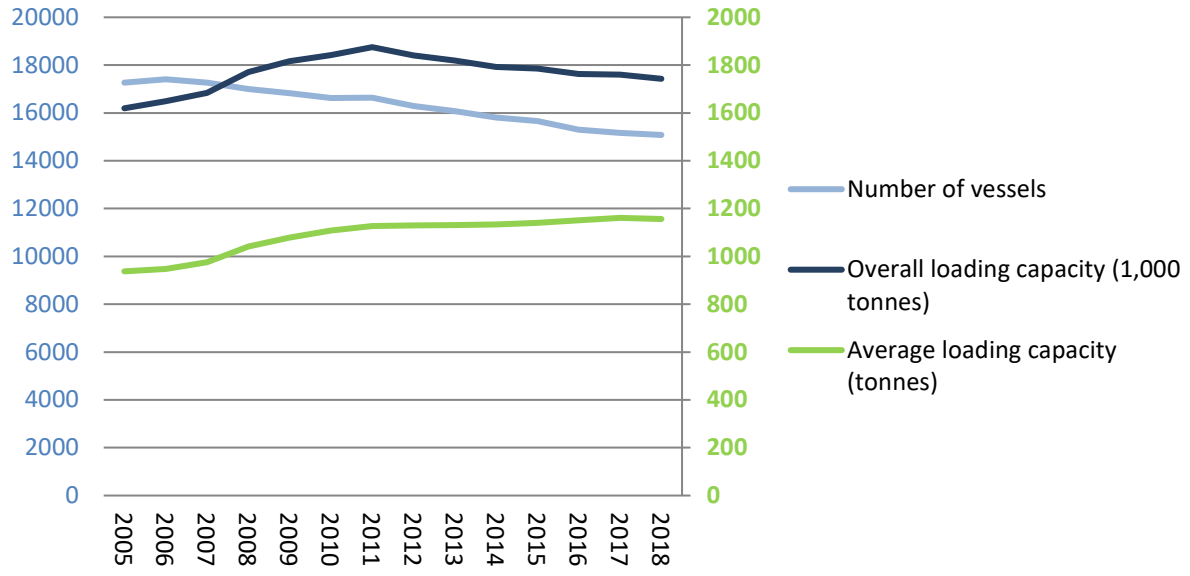
4.1 Fleet size evolution and structure

In Europe, there are over 15,000 freight vessels offering inland freight transport services (dry cargo, tanker cargo and push & tug vessels) with a total loading capacity of more than 17 million tonnes.

Since 2005, the evolution of the fleet has been marked by a reduction in the total number of vessels operating (-13%) but an increase in the total loading capacity (+8%) and the average loading capacity (+23%). This is explained by the fact that smaller vessels left the market and new vessels with a higher loading capacity entered the market, particularly between 2007 and 2009, when vessel construction rates were very high.

The year 2011 constituted a turning point in the fleet size development. From that year onwards, the available loading capacity has fallen continuously. However, up until 2017 there was a stronger decrease in the number of vessels. As a consequence, the average tonnage of European vessels has increased by about 3% since 2011. This development is particularly driven by the Rhine dry cargo fleet that experienced a further strong increase in average loading capacity from 2018 to 2019.

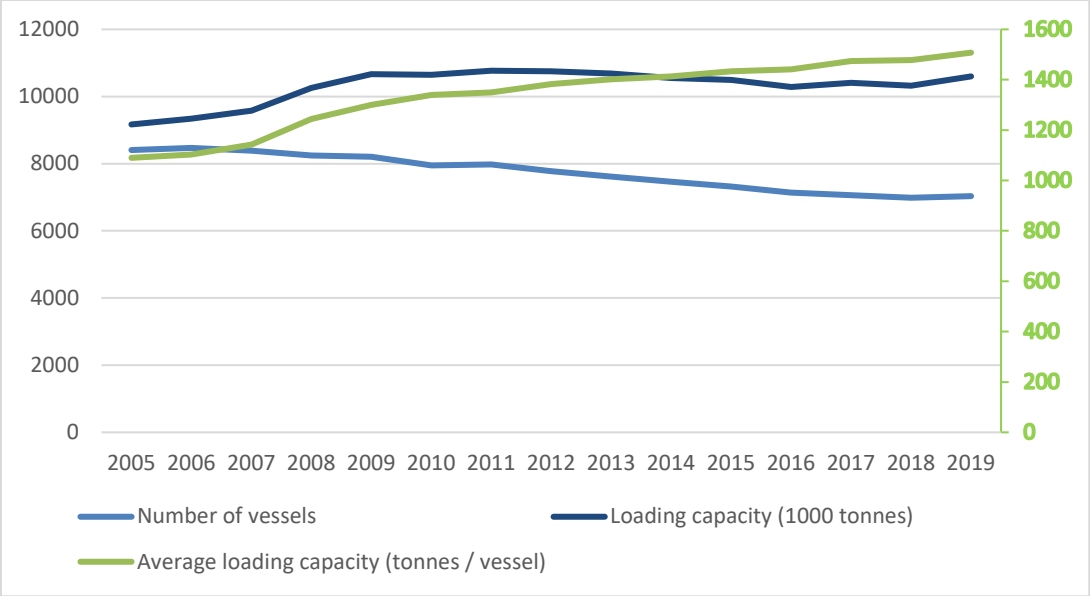
Figure 1: Evolution of the total (dry cargo, tanker cargo and push & tug vessels combined) fleet in Europe (number, total loading capacity (both left axes) and average loading capacity (right axis))



Sources: Danube Commission, National Offices, Eurostat, CCNR calculation. Note: Fleet registered in Rhine and Danube countries, Poland, the United Kingdom, Finland, the Czech Republic and Lithuania. Data for the dry and liquid cargo fleet in the Danube countries assumed to be the same in 2018 as in 2017.

The current main sector of activity of the European inland fleet is dry cargo. In 2018, In Rhine countries, about 72% of the fleet were part of this segment. In 2019, there were about 7,000 active dry cargo vessels in Rhine countries. The average loading capacity of these vessels has increased every year since 2005 and by nearly 7% since 2014, due to the overall capacity staying more or less constant while the number of vessels fell by about 6%.

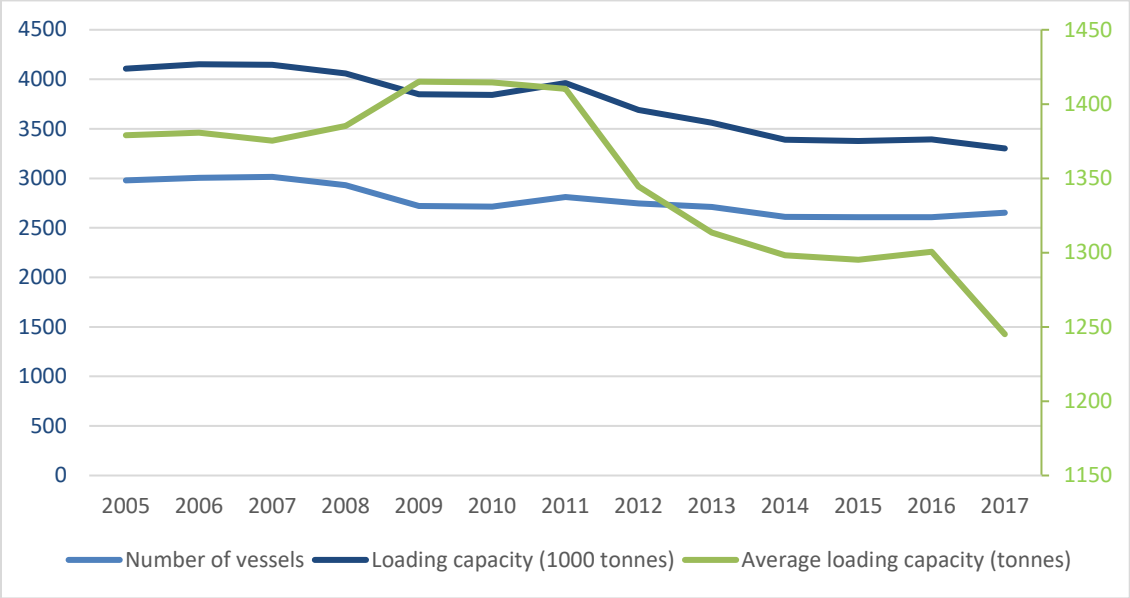
Figure 2: Evolution of the dry cargo fleet (number, total loading capacity (both left axis) and average loading capacity (right axis) in Rhine countries *



*Sources: National Offices, CCNR calculation. * Number of vessels and loading capacity = left axis. Average loading capacity = right axis.*

In Danube countries, about 2,700 vessels, which represents 77% of the whole fleet, operated in the dry cargo segment in 2017, the most recent year with detailed data available for this region.[36] The recent development of the average loading capacity is different from that in the Rhine countries as, since 2010, it has decreased (-12%). Between 2014 and 2017, that reduction amounted to about 4.1%, resulting from a 1.5% increase in the number of vessels and a simultaneous decrease of 2.6% in the total loading capacity.

Figure 3: Evolution of the dry cargo fleet (number, total loading capacity (both left axes) and average loading capacity (right axis) in Danube countries

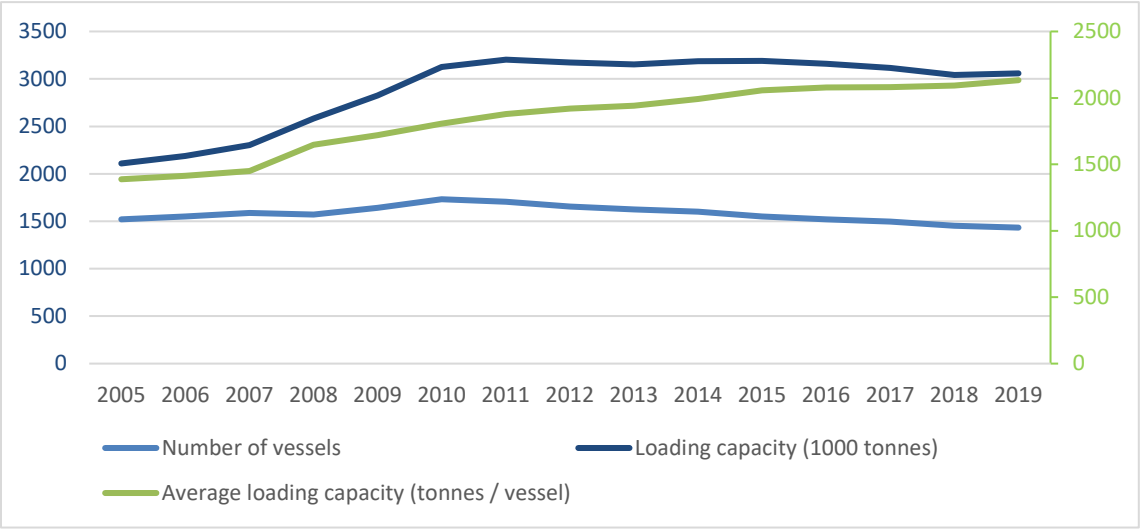


Sources: Danube Commission, CCNR calculation.

[36] The source of these data is the Danube Commission. Although fleet data for 2018 from Eurostat exist, these Eurostat data are not differentiated according to dry and liquid cargo vessels.

In tanker barging, the structure differs slightly because the market dominance of the Rhine region over the Danube region is even more pronounced. About 1,400 tanker vessels were active in Rhine countries in 2019. As in the dry cargo segment, the average loading capacity in the tanker barge sector in Rhine countries has also increased every year since 2005 and by about 7% from 2014 to 2019. This was caused by the reduction in the total loading capacity of about 4%, being smaller than the decrease in the number of vessels of about 10%.

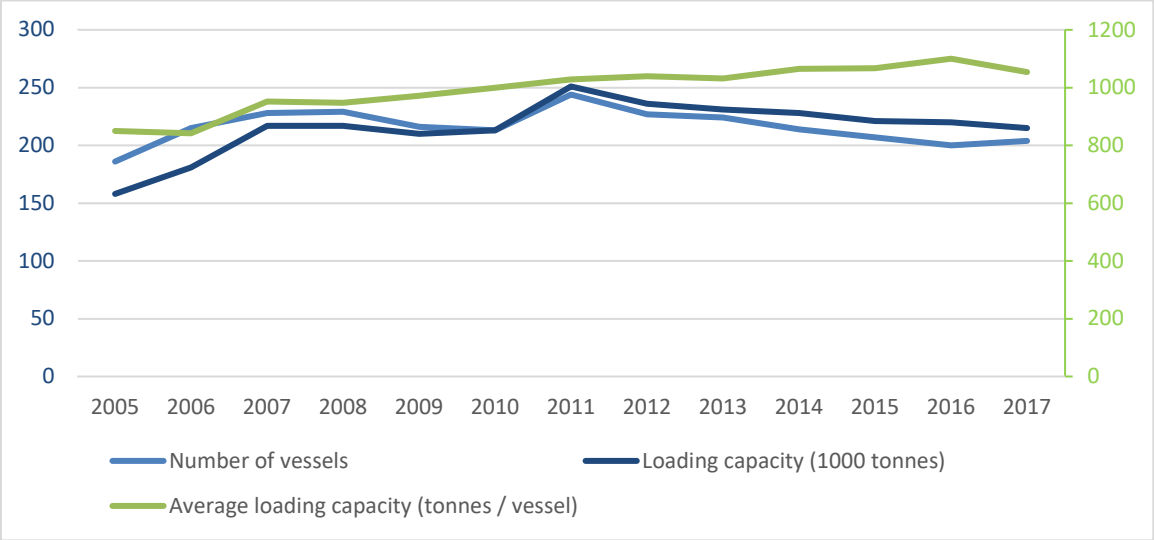
Figure 4: Evolution of the tanker cargo fleet (number, total loading capacity and average capacity) in Rhine countries *



*Sources: National Offices, CCNR calculation. * Number of vessels and loading capacity = left axis. Average loading capacity = right axis.*

Only about 200 tanker vessels operated in Danube countries in 2017. As well as for the dry cargo segment, the average loading capacity in Danube countries decreased between 2014 and 2017, albeit only slightly by 1.1%. In that time period, the total capacity shrunk by 5.7% while the number of vessels fell by 4.7%.

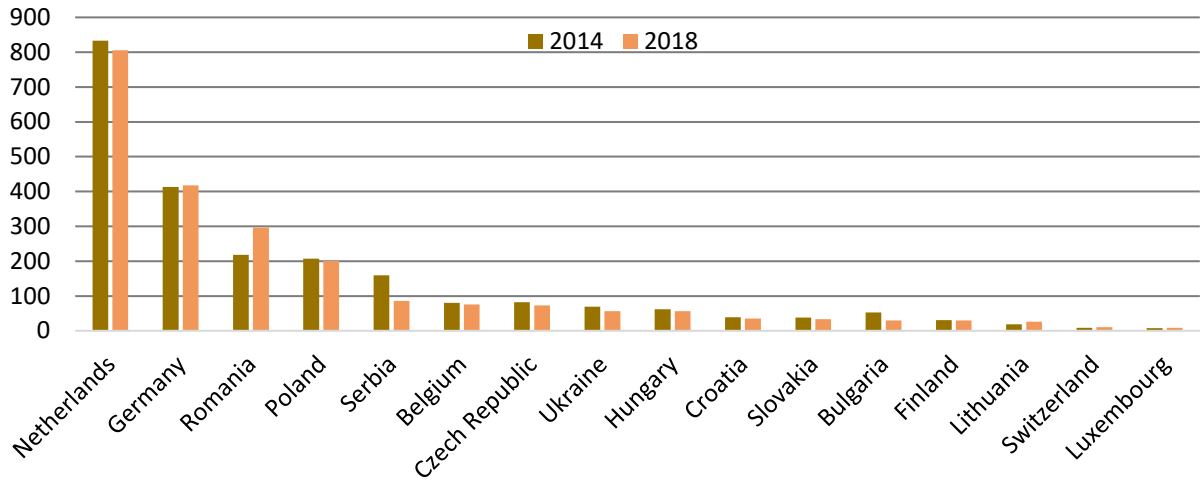
Figure 5: Evolution of the tanker barge fleet in Danube countries: number, overall loading capacity (both left axes) and average loading capacity (right axis)



*Sources: Danube Commission, CCNR calculation. * Number of vessels and loading capacity = left axis. Average loading capacity = right axis.*

In Danube countries, the push & tug fleet was nearly three times as large as the tanker vessel fleet, showing that push & tug shipping is still a predominant market in the Danube region, in particular for iron ore transport. However, Romania is the only Danube country that saw an increase in the number of push & tug vessels from 2014 to 2018 (+36%). In that time period, the size of the whole European push & tug fleet decreased by about 3%.

Figure 6: Number of push & tug vessels in 2014 and 2018 by country



Sources: Danube Commission, National Offices, Eurostat [iww_eq_age], CCNR calculation.

In **tanker shipping**, the evolution of the fleet in the last decade has been influenced by the change from single hull to double hull vessels. Safety requirements make it mandatory to use only double hull vessels for almost all dangerous goods transports from 2019 onwards. This regulation was anticipated many years before, so that double hull vessels were introduced in great numbers, especially before 2010. Over the years, the single hull vessels have been gradually phased out.

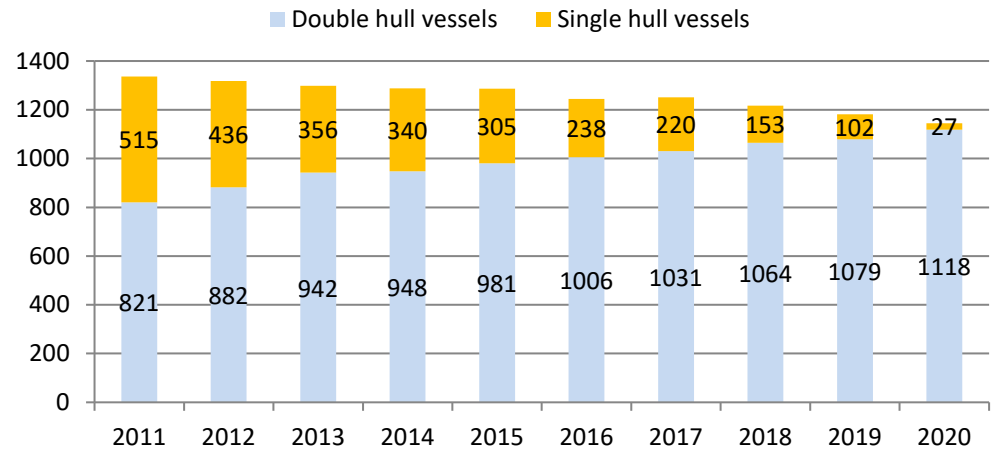
The restructuring can be followed by looking at the data from the European Barge Inspection Scheme (EBIS). The EBIS scheme has been developed by oil and chemical companies as part of their commitment to improve the safety of tanker barging in Europe. Barging is an important means of distributing oil and chemical products within Europe and safe and well-run barges play an important part in reducing the risk of accidents or pollution. Therefore, EBIS has developed a common questionnaire that is used for barge inspections. The organisation currently inspects 1,145 tanker vessels.

Vessels in the EBIS system do not represent all tanker vessels in Europe. There are, for example, 322 tanker vessels in Rhine countries which serve as freshwater vessels for seagoing vessels in ports, or as vegetable oil tankers, as cement (concrete) tankers, as waste good tankers, or as older bunker vessels. These vessel types are not covered by the EBIS control system. If these 322 vessels are subtracted from the total European tanker fleet of 1,663 vessels, the coverage of EBIS is 85% (share of EBIS inspected vessels in total European tanker fleet).[37]

In 2020, 99% of the 1,145 vessels inspected by EBIS were double hull vessels, compared to 91% in 2019, 87% in 2018 and 74% in 2014. In 2011, the share of double hull vessels was only 61%. Due to this restructuring from single to double hull, the European tanker fleet has been modernised and now fulfils higher safety standards.

[37] The exact share might be even higher, as an unknown number of tanker vessels in the Danube fleet is also used for similar purposes as the mentioned 322 vessels in the Rhine region.

*Figure 7: Conversion from single hull to double hull tanker vessels in Europe **



*Source: EBIS. * Number of vessels in the EBIS database on 1st of January of each year*

The EBIS database also indicates that there were nine LNG dual fuel tanker vessels sailing in the Rhine region at the beginning of 2020.

4.2 Age of the fleet

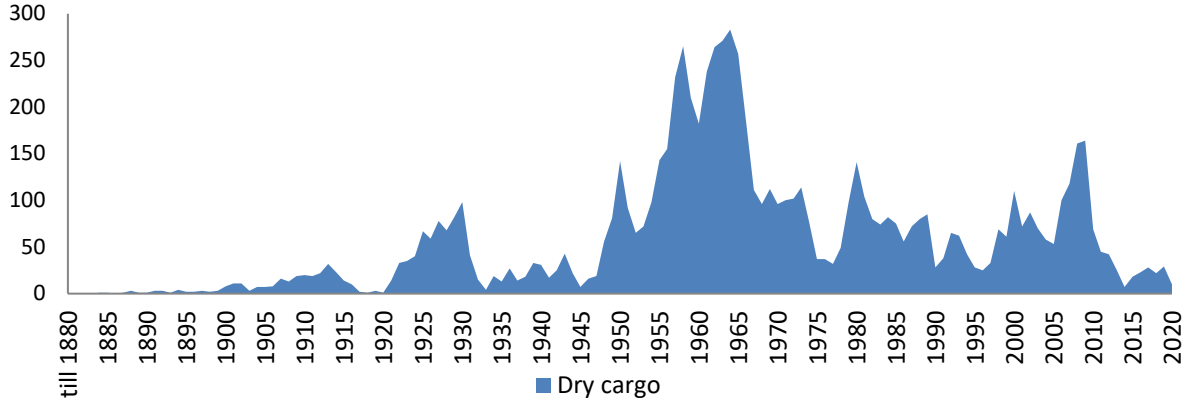
➢ **Rhine countries**

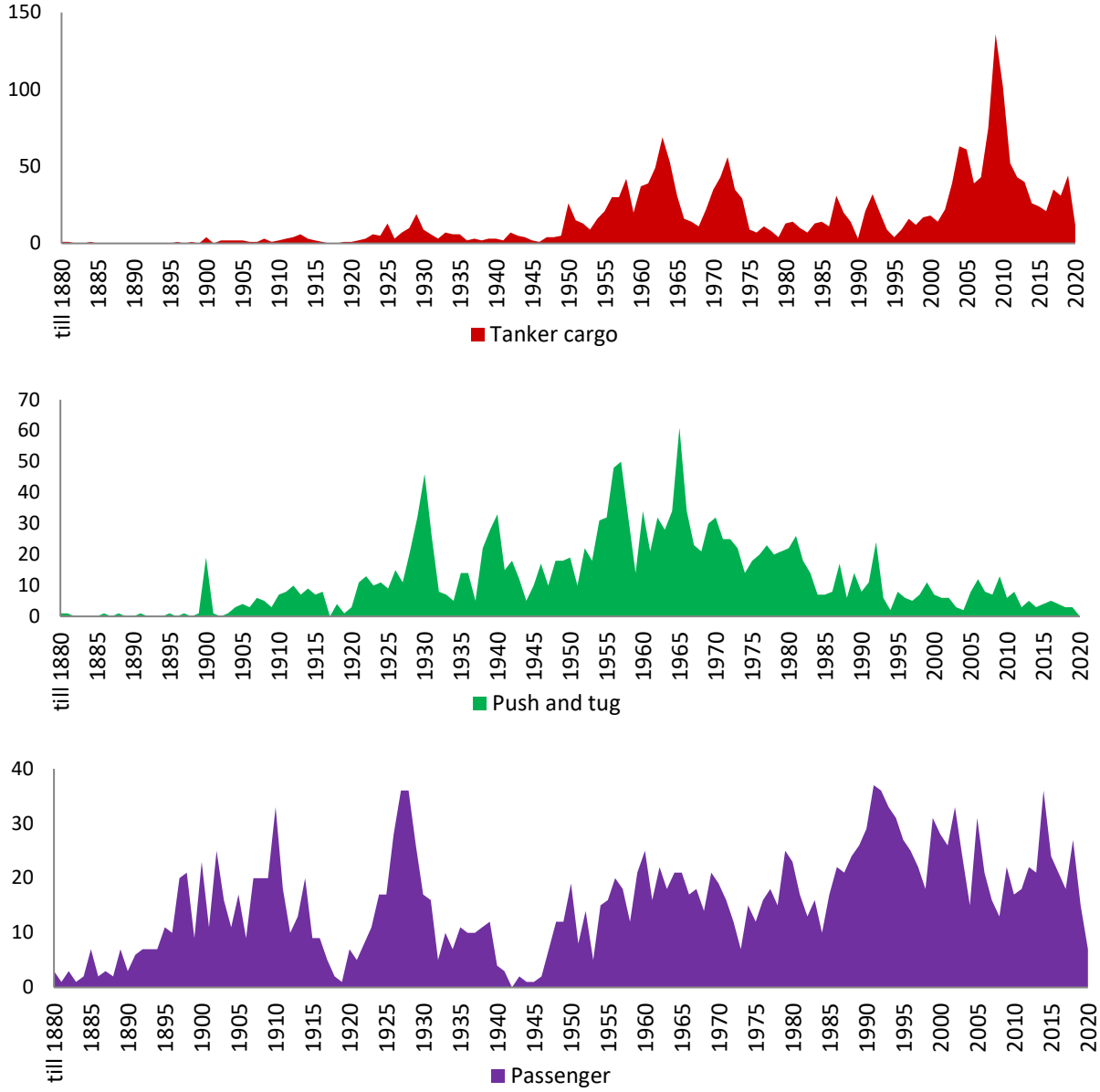
Overall, the European inland navigation market is characterised by a relatively old fleet. This is particularly the case for dry cargo vessels, day trip vessels, and push & tugboats. Tanker vessels, however, have a younger age structure, due to the conversion from single hull to double hull (see previous part).

Based on the IVR fleet database, about half of the active vessels in Belgium, Germany and the Netherlands were built more than 50 years ago. In France, these vessels represent approximately 80% of the total fleet. There are still some vessels (19% of the European fleet) which were built before 1940, particularly present in the Netherlands and in Germany.

Switzerland is the country with the newest fleet (83% of the vessels have been built in the last 35 years) which is mainly due to a wave of new river cruise vessels and tanker vessels in the last decade. The fleet registered in Luxembourg is also fairly modern (77% of the vessels have been built during the last 35 years) and the new vessels were mainly tankers.

Figures 8, 9, 10 and 11: The Rhine fleet in 2020* by sector of activity and year of construction (number of vessels)



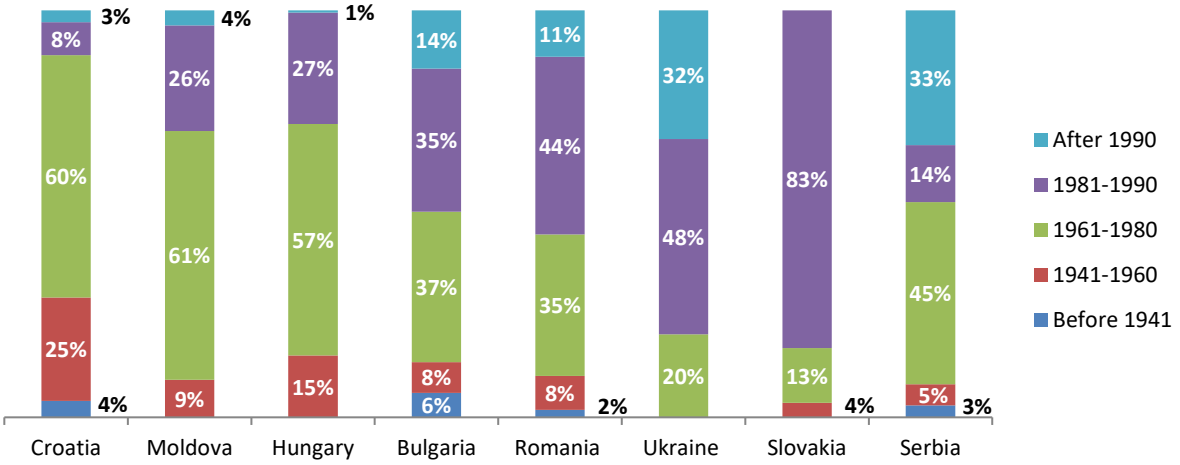


*Sources: IVR, CCNR calculation. Note: Rhine fleet here meaning the fleet registered in Rhine basin countries (Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland). *On 28 April, 2020.*

➢ Danube countries

In the eastern European market, some countries are characterised by an older fleet (Croatia, Moldova and Hungary) and others by a newer fleet (Bulgaria, Romania, Ukraine, Serbia and Slovakia).

Figure 12: The Danube fleet in 2017 by year of construction (% based on number of vessels)*



*Source: Danube Commission. Note: Moldova as of 2008, Bulgaria as of 2015. 1 Croatian, 2 Slovakian and 10 Serbian vessels with unknown years of construction. * On 31 December, 2017. (http://www.danubecommission.org/uploads/doc/STATISTIC/de_stat_2016_2017.pdf)*

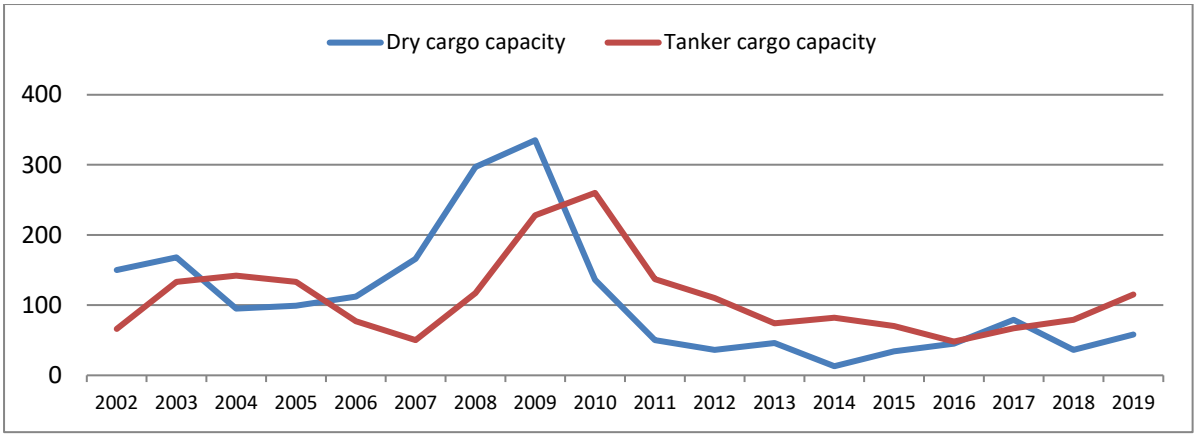
In Danube Countries, the percentage of the oldest vessels (those which were built before 1940) is much lower than in Rhine countries, representing only 2% of the total fleet. However, only very few vessels have been built recently, only 20 after 2010 (19 for Serbia, 1 for the Ukraine) and 91 between 2001 and 2010; 60% of all vessels were built between 1971 and 1990.

In Bulgaria, Romania and Serbia, about half of the fleet was built over the last four decades. In these countries, most of the companies operate in dry cargo freight transport, and their vessels are relatively new compared to the dry cargo fleet in Rhine countries. The Ukraine and Slovakia have the lowest percentage of old vessels; most of the existing vessels are less than 40 years old.

4.3 New vessel construction

Based on IVR data, the new building activity during the last two decades was concentrated on western Europe and was marked by a wave that had its peak in the years 2008 and 2009 for dry cargo vessels, and in 2009 and 2010 for tanker vessels. After these years, the newbuilding activity fell for several years. It was only in 2015 and 2016 that recovery set in for the dry cargo vessels, and a certain stabilisation for the tanker vessels. Until 2019, this recovery continued at a relatively low level.

Figure 13: Newbuilding activity in dry cargo and tanker barging (new loading capacity in 1000 t)



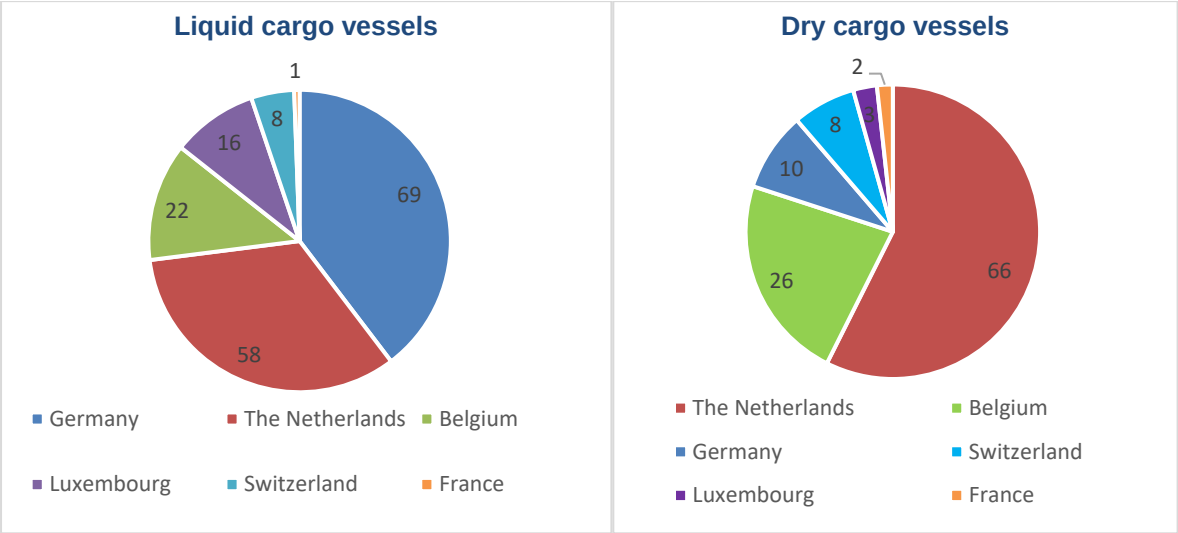
Source: IVRPage

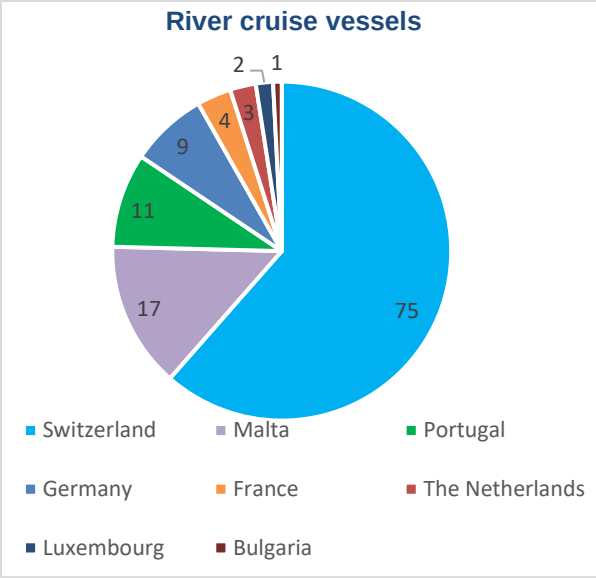
Table 1: Newly built inland vessels 2014-2019 in Europe by type of vessel

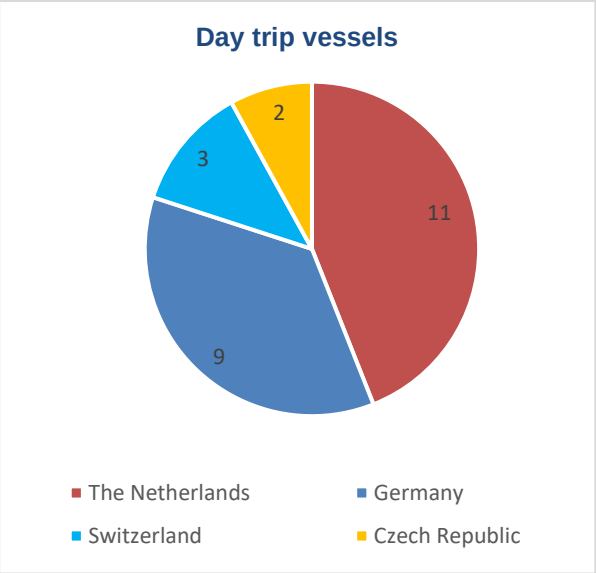
Vessel type	2014	2015	2016	2017	2018	2019	**2014-2019**
Liquid cargo vessels	39	17	21	29	28	40	**174**
River cruise vessels	31	27	20	17	10	19	**124**
Dry cargo vessels	17	10	16	29	17	20	**109**
Day trip vessels	2	1	3	6	9	4	**25**
Push boats and tugs	2	1	4	4	3	3	**17**
Ferries	0	0	2	3	4	0	**9**
Other vessel types #	6	0	1	4	1	1	**13**
Total	**97**	**56**	**67**	**92**	**72**	**87**	**471**

Sources: IVR and Hader River Cruise Handbook # includes 1 Ro-Ro general cargo ship, 1 container vessel, 1 bunker vessel, 1 patrol vessel, 2 floating equipments with propulsion and 7 other vessels not specified further.

Figures 14, 15, 16 and 17: Newly built inland vessels 2014-2019 in Europe by type and by country of register







Sources: IVR and Hader River Cruise Handbook

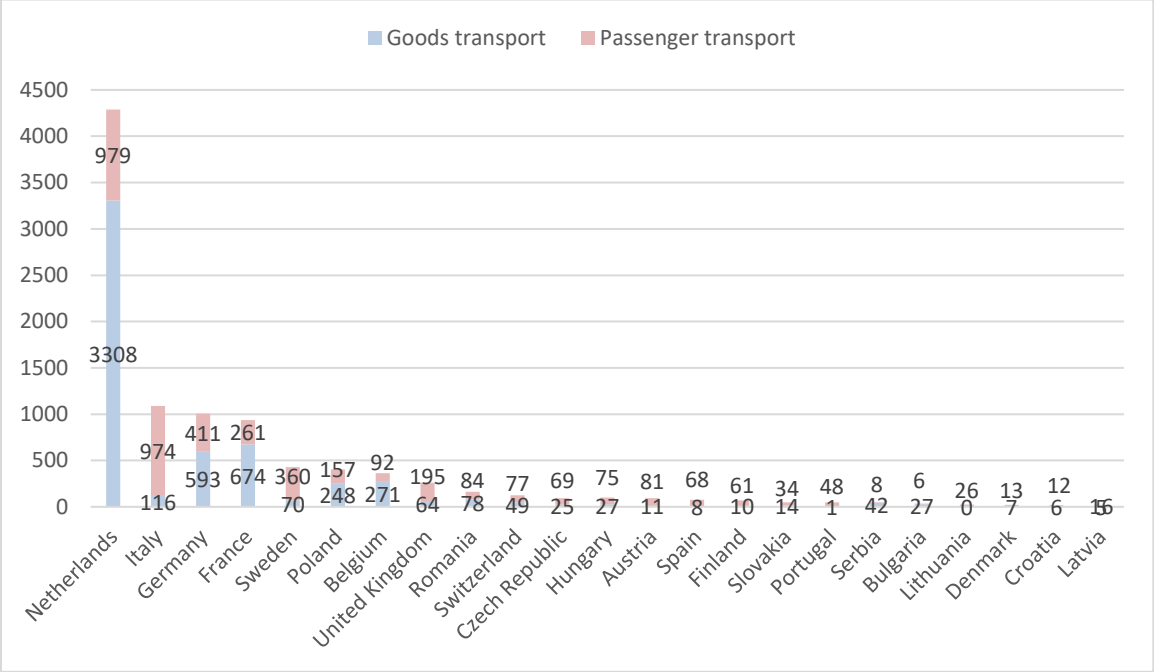
5. COMPANY ACTIVITY

5. Company activity

5.1 Overall structure

In Europe, around 9,700 inland waterway companies were in operation on the market in 2018. In the EU overall, about 59% of the companies are active in goods transport and about 41% in passenger transport. The share of companies active in goods transport and in passenger transport differs from one country to another.

Figure 1: Number of companies in European IWT countries in 2018 by activity (units)

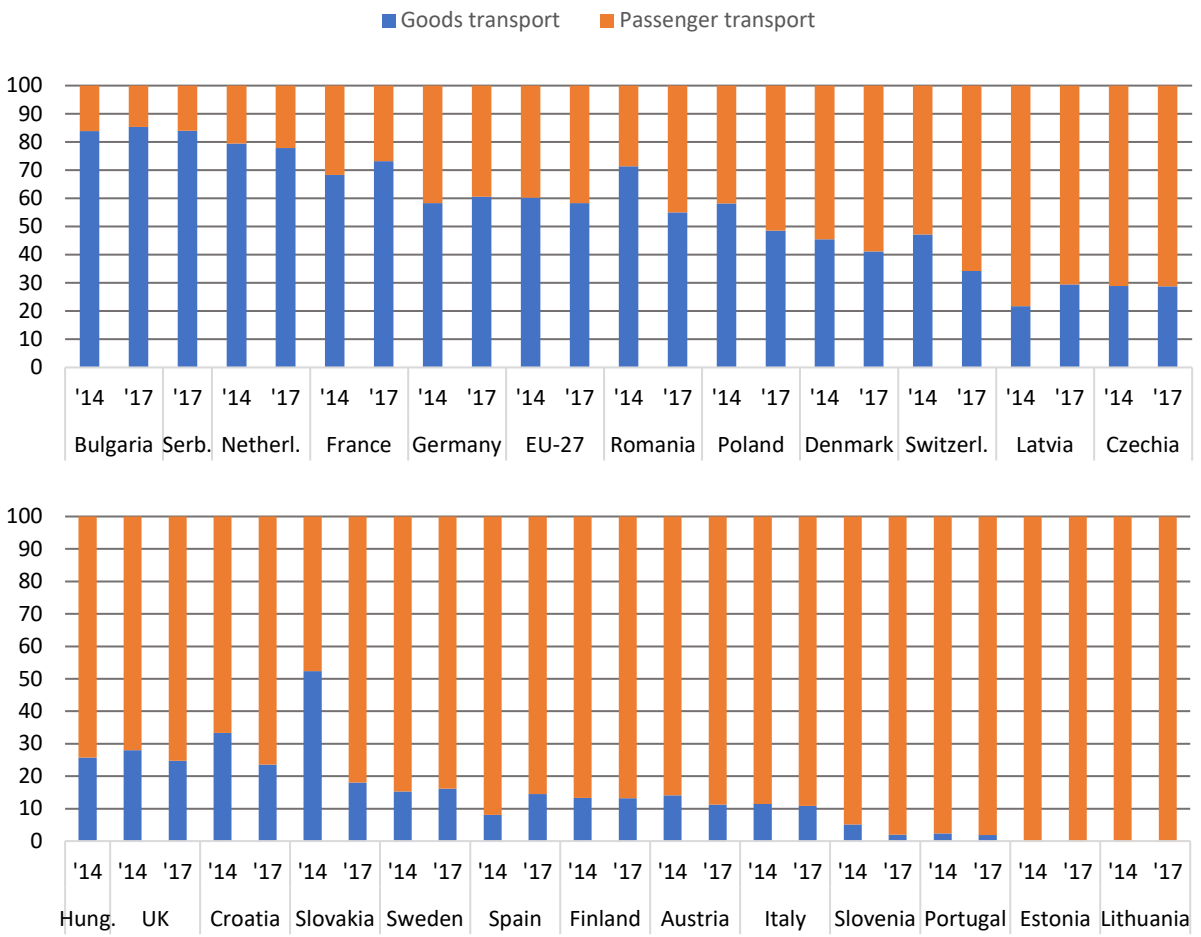


Source: Eurostat (sbs_na_1a_se_r2)

Countries where goods transport companies have a high share in the total number of companies are found in the Rhine region (the Netherlands, France, Germany, Belgium) and in the Danube region (Romania, Bulgaria, Serbia). Passenger transport companies have a high share of overall company activity in Mediterranean countries (Italy, Portugal, Spain), in Scandinavian countries (Finland, Sweden) and in Austria.

Regarding recent developments, it can be seen that in many countries, the passenger sector gained in relative importance between 2014 and 2018, particularly in Switzerland, Croatia, Slovakia, Romania and Poland.

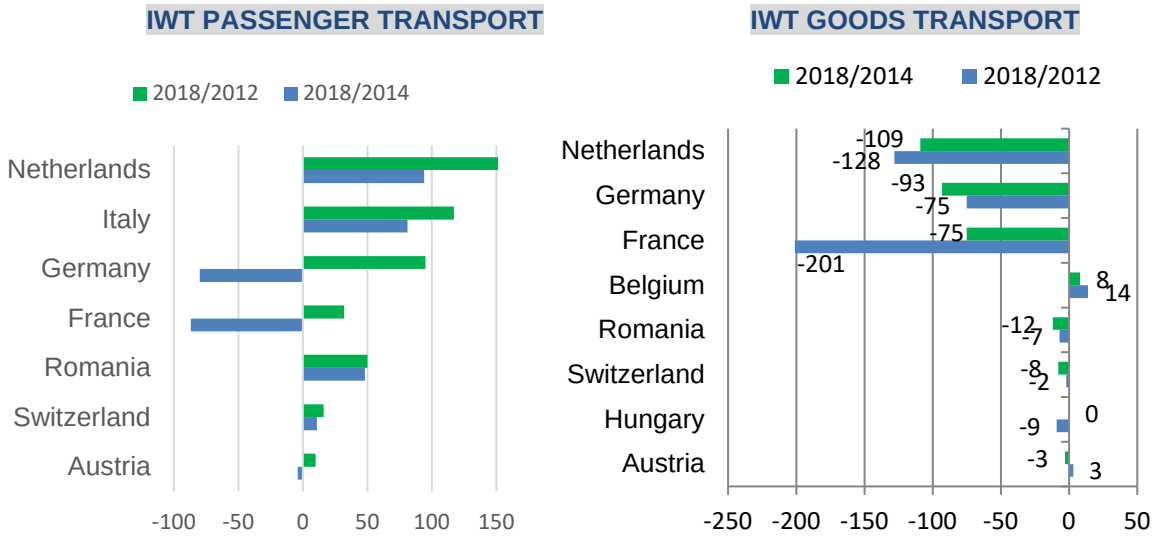
Figures 2 and 3: Share of companies active in goods transport and in passenger transport in European IWT in 2014 and 2017 (%)



Source: Eurostat (sbs_na_1a_se_r2)

In Europe overall, both the number of IWT companies active in goods transport and in passenger transport slightly decreased between 2014 and 2018, to a relatively strong extent for goods transport, and to a very small extent for passenger transport (*Source: Eurostat Structural Business Statistics*). These trends are different according to country, and may be highlighted for particularly important IWT countries:

Figure 4 and 5: Evolution of the number of companies active in IWT (units)



Sources: Eurostat (sbs_na_1a_se_r2) and Federal Office for Statistics (Switzerland)

During the time period 2012-2018, the evolution in the number of companies active in goods transport was overall far less positive than in passenger transport. This was certainly the case for France, Germany and the Netherlands, where many freight companies ceased their activity between 2012 and 2018. The number of goods transport companies in Austria, Belgium, Hungary and Romania was relatively stable.

Regarding passenger transport companies, the previously positive trend came to a halt after 2014 in Germany, France and Austria, whereas it persisted in Switzerland and in Romania. In the Netherlands, growth in that sector remained positive but weakened in the period 2014-2018.

The rising number of passenger companies in Rhine countries (France, Germany, the Netherlands, Switzerland) between 2012 and 2018 (+323) did not compensate for the reduction in the number of goods transport companies (-392). However, when comparing 2014 with 2018, both the number of passenger (-62) and goods (-277) companies in Rhine countries decreased.

On the contrary, the overall evolution for both sectors between 2014 and 2018 was positive in the Danube region (Bulgaria, Austria, Croatia, Romania, Slovakia)[38] with an additional number of 58 units. The number of passenger transport companies increased by 69 units while the number of goods transport companies decreased by 11 units.

The western European inland shipping sector is characterised by high fragmentation, with the majority of companies being small family businesses owning or operating one or two vessels. On the other hand, most of the companies in the Danube region are bigger, mainly for historical reasons: in the Danube region, the previously state-owned enterprises became privately owned but the large size of the companies remained.

The fragmentation in western Europe can be measured by the structure of the company sector in the Netherlands, Germany and France. In these countries, the number of companies that employ up to nine persons is significantly high. The share of German enterprises employing up to nine persons decreased from 86% to 82% between 2014 and 2017, reflecting a certain consolidation in the company sector. However, the shares in the Netherlands and in France remained approximately at their former level.

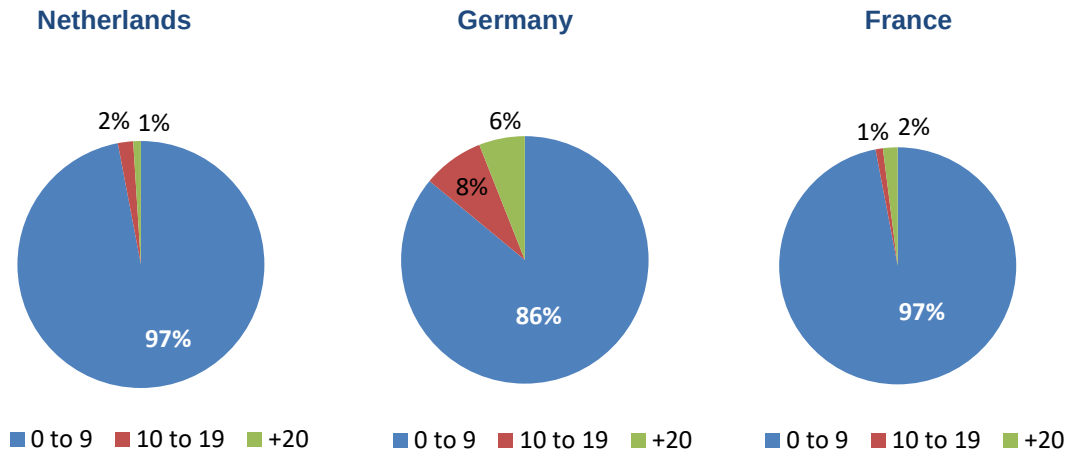
Data for the Netherlands are also available for 2019, and they show that the structure was the same in 2019. This applies to the company structure in goods and passenger transport taken together (as shown

[38] Without Hungary due to a lack of recent data for passenger companies.

in the graphs below), but also to freight and passenger transport taken separately. Within freight transport, 98% of all Dutch companies active in dry cargo transport employed up to nine persons, and 94% in liquid cargo transport. In 2019, these shares were almost identical to 2014.

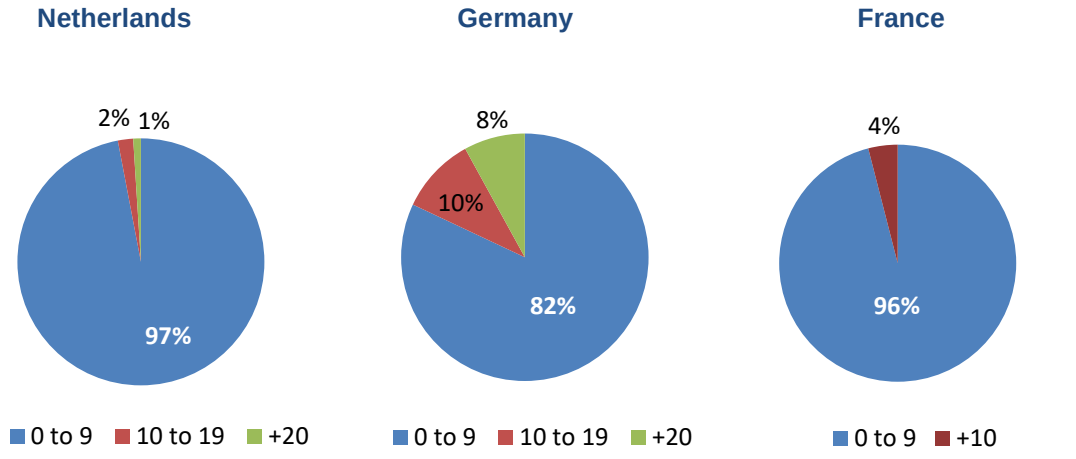
In Switzerland, companies employing less than nine persons represent about 63% of the total number of IWT entities. Switzerland has a different market structure, due to a higher share of larger companies, mainly active in passenger shipping (more than half of all Swiss IWT companies) and in liquid cargo transport.

Figure 6: Companies by number of persons employed in 2014 (in %) *



Sources: CBS, Destatis, INSEE

Figure 7: Companies by number of persons employed in 2017 (in %) *



Sources: CBS, Destatis, INSEE.
** Figures for 2018 and 2019 not available for all countries.*
** Persons employed are self-employed, helping family members and employees.*

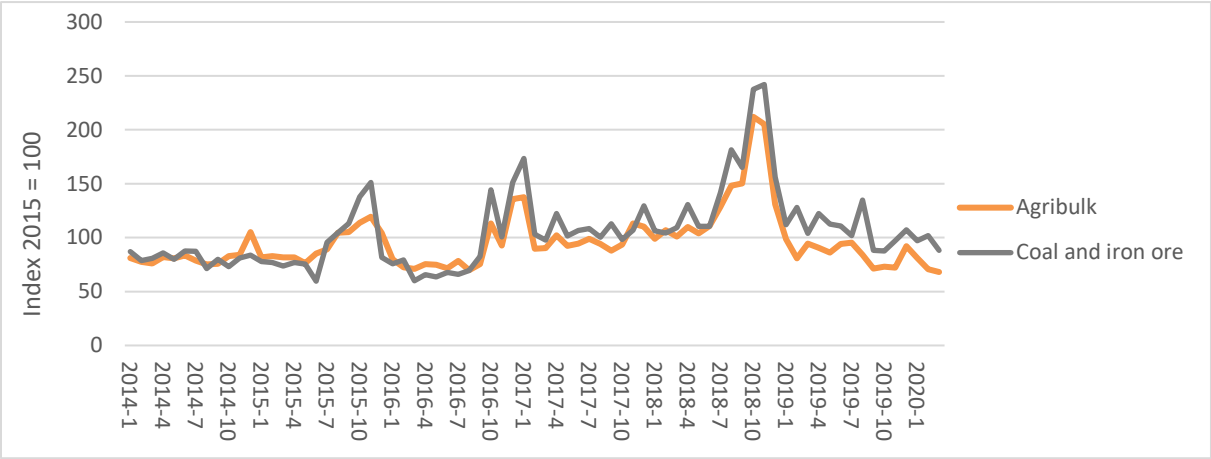
5.2 Evolution of freight rates and turnover

As in any other industry, turnover evolution in inland navigation depends upon two direct influencing variables: the evolution of the output (in IWT, the volume of transport) and the evolution of prices (freight rates in IWT). In inland navigation, prices can have a very clear impact on turnover, as their fluctuations are strongly influenced by the exogenous and volatile variable of water levels.

Freight rates in IWT are heavily influenced by water levels, in particular during times when water levels decrease strongly. Lower water levels reduce the available draught of vessels, and their effective loading capacity. For a given fleet capacity in a river basin, for example in the Rhine or Danube basin, low waters reduce the effectively available cargo carrying capacity.

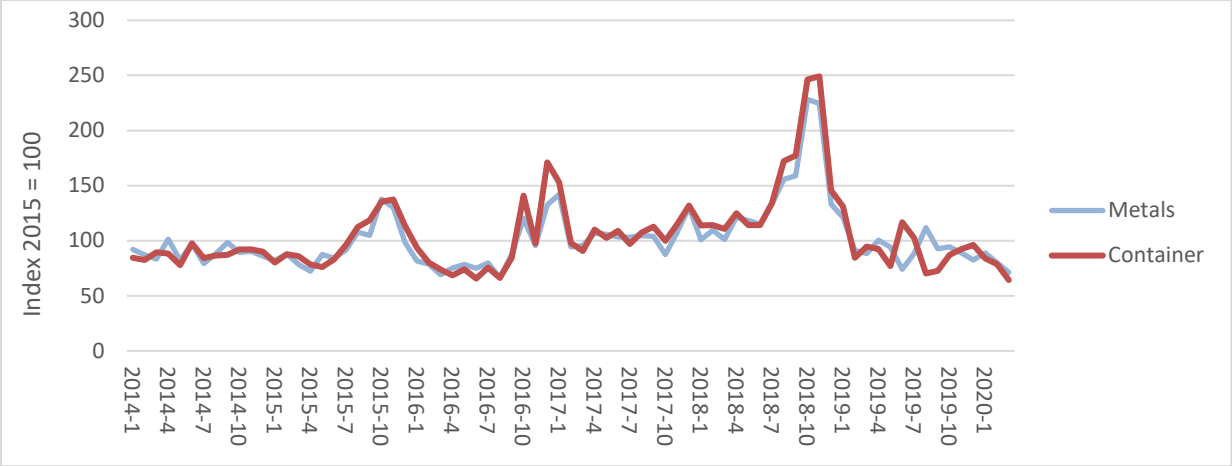
The following figures show the evolution of freight rates for agribulk, coal and iron ore, metals, containers and gasoil. The periods of strongly increasing freight rates were all low water periods. In November 2018, spot market rates for container transport were almost 2.5 times higher than average. For ARA-Rhine transport of gasoil, spot market freight rates were even 4.5 times higher than normal during this month.

Figure 8: Freight rate index for agribulk, coal and ores in the Rhine basin between January 2014 and March 2020



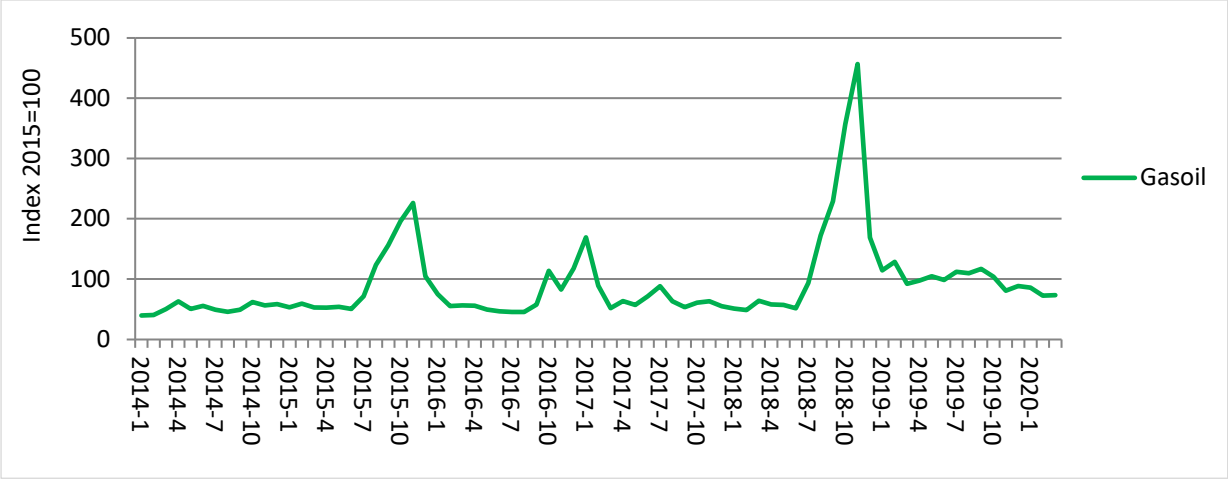
Source: Panteia

Figure 9: Freight rate index for metals and containers in the Rhine basin between January 2014 and March 2020



Source: Panteia

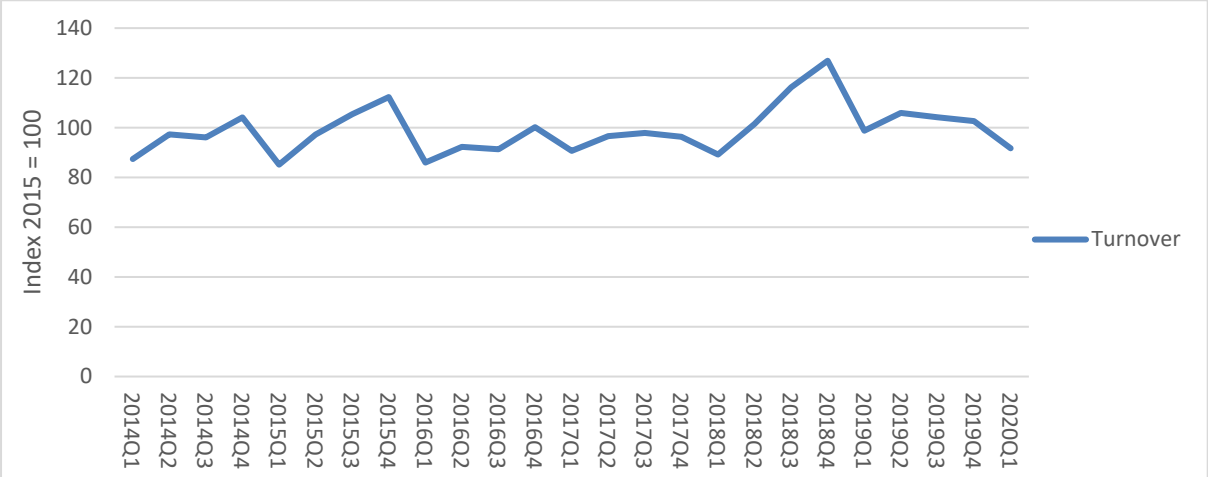
Figure 10: Freight rate index for liquid cargo (gasoil) on the Rhine between January 2014 and March 2020



Source: CCNR calculation based on PJK International. Index calculation based on €/metric tonne data.

Turnover evolution in goods transport is strongly influenced by freight rate variations. Even if the volume of goods transport dropped strongly in 2018, turnover rose, as the increase in freight rates overcompensated the decrease in volumes. This can be seen in the following graph, where the quarterly turnover for inland waterway transport companies in the Netherlands is shown (as an index).

Figure 11: Turnover index for IWT companies in the Netherlands (2014 Q1 – 2020 Q1)



Source: Centraal Bureau voor de Statistiek (CBS)

To summarise, it can be concluded that in inland navigation, the turnover is to a high extent determined by an exogenous factor of water levels, on which the company itself has no influence at all. The volume of transport can also be regarded as largely exogenous for the barge owner, as it represents a derived demand (derived from macroeconomic and industrial development, from harvest results, construction projects, etc.)

High freight rates, although beneficial for the company in the short term, could lead to a reduced turnover in the future, in the case where low waters could lead to a modal shift to other transport modes. A more stable and less volatile freight rate evolution could be regarded as beneficial for the inland navigation sector in the long run, in the sense of a more sustainable overall economic evolution.

It can be observed that the share of goods and passenger transport included in the turnover in the inland navigation sector differs considerably from one country to another. In Rhine countries, the share of

goods transport is highest in the Netherlands[39], while the share of passenger transport is highest in Switzerland. In Danube countries, goods transport has a higher average share in turnover than in Rhine countries. Romania is the country where goods transport represents more than 90% of total turnover.

Apart from differences between countries, the share of goods and passenger transport within turnover changes also over time. For France, Germany and Switzerland (Rhine countries for which detailed data are available) passenger transport has increased its share in turnover between 2014 and 2018, as the following table shows.

Table 2: Turnover in IWT by type of activity in 2018 compared to 2014

Country	Share in total turnover of…			
	goods transport		passenger transport	
	2014	2018	2014	2018
Romania	95.4%	94.6%	4.6%	5.4%
Slovakia	87.4%	87.6%	12.6%	12.4%
Croatia	91.7%	75.8%	8.3%	24.2%
Germany	82.2%	74.2%	17.8%	25.8%
France	53.9%	52.9%	46.1%	47.1%
Switzerland *	37.3%	16.1%	62.7%	83.9%
Italy	21.8%	10.5%	78.2%	89.5%

*Sources: CCNR analysis based on Eurostat [sbs_na_1a_se_r2], Swiss Tax Administration; * for Switzerland, values are for 2016, not for 2018, due to missing data for more recent years.*

There are several explanations for the decreasing share of goods transport and the rising share of passenger transport in turnover. Turnover in goods transport decreased in Germany between 2014 and 2018. In most other countries shown in the table it increased slightly.

However, turnover from passenger transport increased more significantly by various rates of growth. Growth of turnover from passenger transport was particularly strong in Switzerland and in Germany, but also in Italy and France. Passenger transport, particularly river cruises, boomed between 2014 and 2019 and was less affected by the afore-mentioned macroeconomic and industrial factors, as in general it is less dependent on such factors. Passenger demand is more dependent upon demographic factors, general political circumstances in a country, critical events (especially those events which prevent tourists from visiting certain countries, for example terror attacks, etc.), including pandemics. To conclude, the growth in passenger transport since 2014, notably driven by river cruising, was the major driving factor for the rise in its turnover share in western Europe.

The 2018 low waters had a negative effect on river cruises, but, as the 2019 figures for cruise traffic show (+24% cruise vessel traffic on the Rhine) passenger demand recovered immediately in 2019 and low waters did not have long-lasting effects, in contrast to freight transport, particularly for certain cargo segments such as iron ore and container transport.

[39] For the Netherlands, the CBS estimates that 92% of turnover in IWT is generated in goods transport and only 8% in passenger transport. However, there are no detailed data per year, over time, about this share.

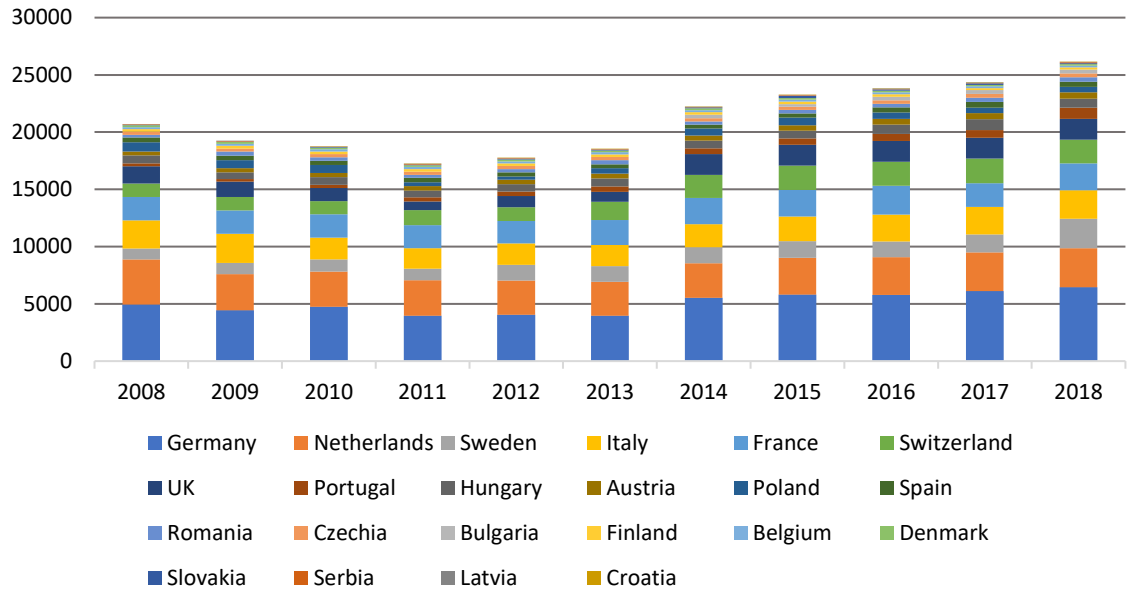
6. WORKFORCE AND LABOUR MARKET

6. Workforce and labour market

6.1 Quantitative evolution

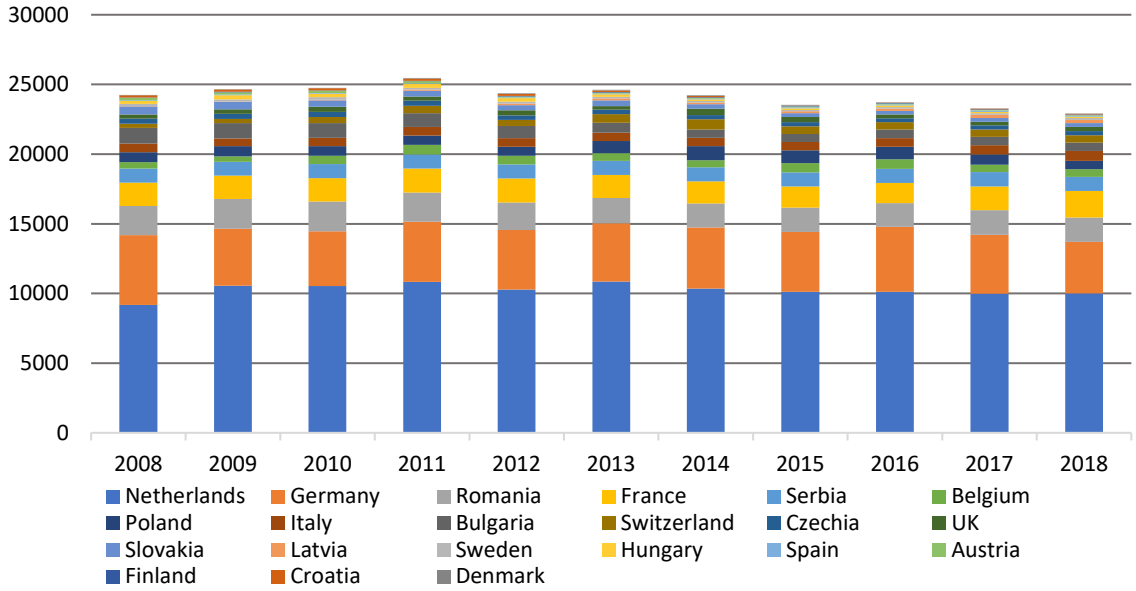
According to the Eurostat Structural Business Statistics, the total number of persons employed in the transport of goods and passengers on inland waterways in Europe amounted to approximately 48,266 in 2018, about 53% of them in passenger and the other 47% in goods transport. Since 2011, the number of persons employed in the passenger transport sector has increased continuously, leading to a jump in the passenger share of employment by nearly 5% from 2013 to 2014.

Figure 1: Number of persons employed in IWW passenger transport in Europe*



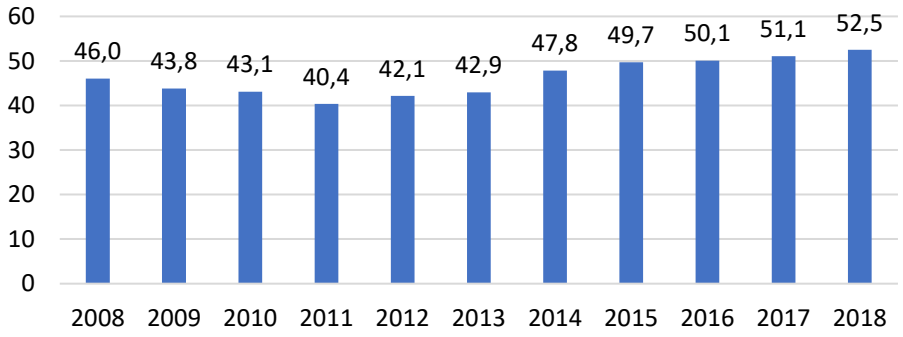
*Source: Eurostat (sbs_na_1a_se_r2) * Missing values are imputed by linear extrapolation.*

Figure 2: Number of persons employed in IWW goods transport in Europe*



*Source: Eurostat (sbs_na_1a_se_r2) * Missing values are imputed by linear extrapolation.*

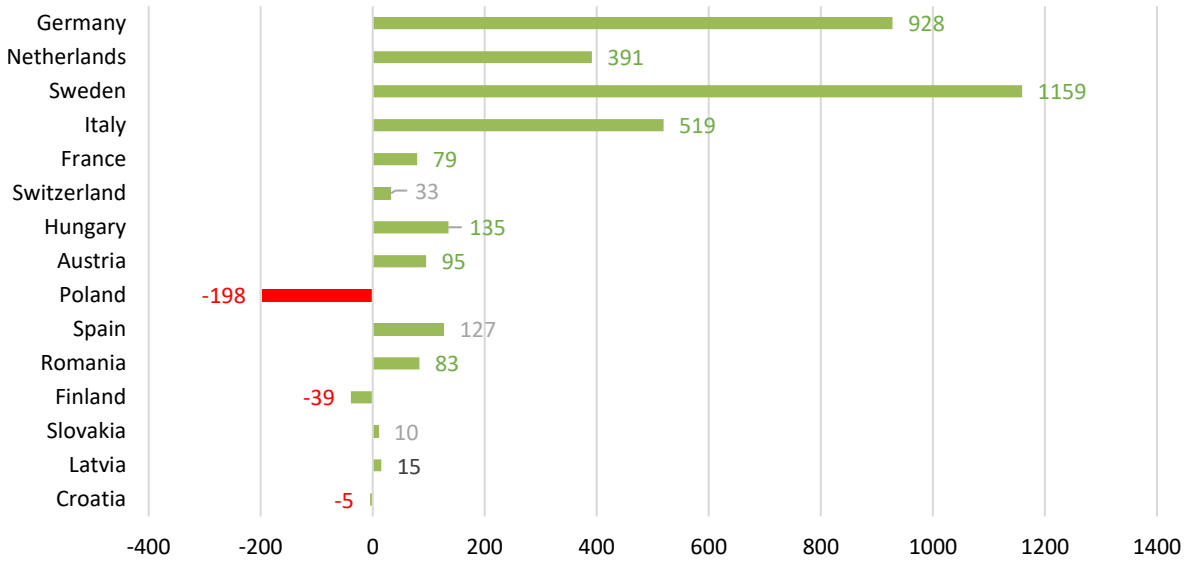
Figure 3: Share of passenger transport within IWW employment in Europe (%)*



*Source: Eurostat (sbs_na_1a_se_r2). * Missing values in country-level employment are imputed by linear extrapolation. * EU-27 plus the United Kingdom, Switzerland and Serbia.*

Between 2014 and 2018, the number of persons employed in IWW passenger transport in the European Union increased in nearly all EU countries. Decreases were only reported in Poland, Finland and Croatia.

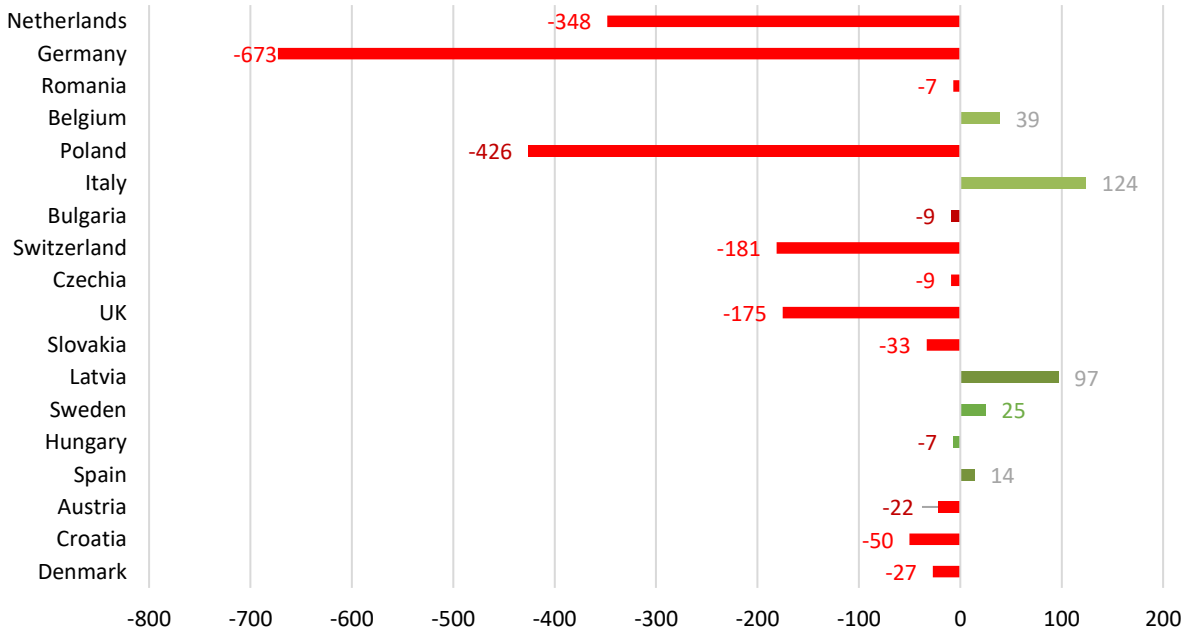
*Figure 4: Difference in the number of persons employed in IWW passenger transport in 2018 compared to 2014**



Source: Eurostat (sbs_na_1a_se_r2). The value for Finland is from 2013.

The situation is very different for employment in IWW goods transport as the overall number of persons employed in the European Union in this sector has decreased. While the strongest decrease between 2014 and 2018 was recorded in the Germany, employment increased most strongly in Italy.

Figure 5: Difference in the number of persons employed in IWW goods transport in 2018 compared to 2014

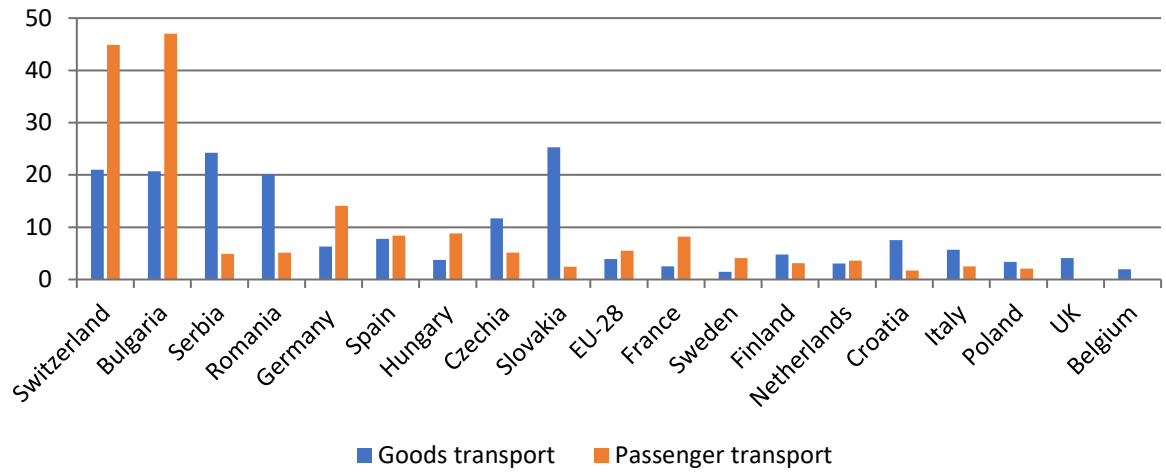


Source: Eurostat (sbs_na_1a_se_r2)

Switzerland has the largest average number of persons employed per company as its market is dominated by large river cruise companies (passenger sector) and tanker barging companies (freight sector). In tanker barging, the average company size is larger than in dry cargo transport. The Swiss structure contrasts sharply with the highly fragmented market structure prevailing in most other Rhine countries. This structure is made up of a large number of small family businesses owning or operating one or two dry cargo vessels in France, Belgium, and the Netherlands. Germany has an intermediary market structure, where the degree of fragmentation is not as high as in its western neighbour countries but higher than in its southern neighbour country, Switzerland.

In Danube countries, the market structure of freight transport is influenced by previously state-owned companies. As a result, the Danube company sector has a higher share of larger companies.

*Figure 6: Number of persons employed per company per country in 2017**



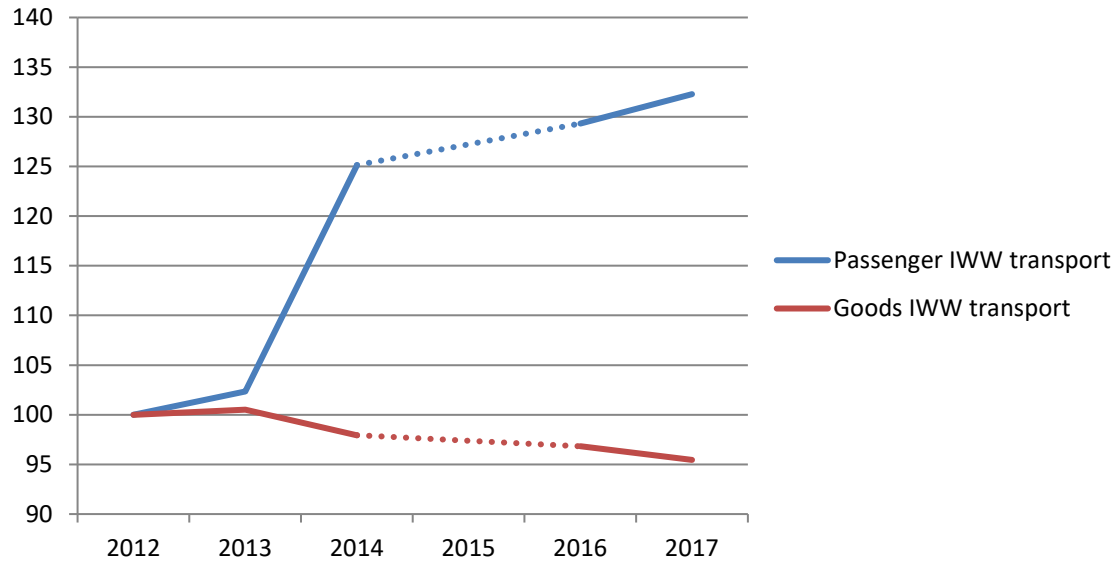
Source: Eurostat (sbs_na_1a_se_r2)
*Note: * Goods transport: 2016 for Bulgaria, 2015 for Hungary. * Persons employed are self-employed, helping family members and employees.*

On average in the European Union, about five persons are employed per inland waterway transport company (average of passenger and freight transport). Of course, this number is largely influenced by Germany and the Netherlands where, in 2017, respectively 82% and 97% of the companies had fewer than 10 persons employed.[40]

One should also highlight the difference between freight transport and passenger transport. Their weight in terms of the labour market is today about equivalent in Europe but the evolution over the past years has been different. While the size of the workforce is characterised by a decrease in freight transport employment between 2012 and 2018, the passenger transport sector successively registered a steady increase in employment between 2012 and 2018.

In addition to the substantial increase in the passenger transport workforce since 2013, it should also be noted that positions in inland navigation passenger transport are less and less impacted by seasonal breaks, leading to more stable career opportunities. Indeed, technological reasons, such as the use of modern cruise vessels or the use of single paddlewheel, and operational reasons, such as a wider offer of cruise types, have considerably extended the service period for passenger transport.

Figure 7: Evolution of employment in passenger and goods inland waterways transport in the EU-28 (Index 2012 = 100) *



Source: Eurostat (sbs_na_1a_se_r2)
** Dotted lines represent linear extrapolations due to missing data for 2015.*

6.2 IWT sector attractiveness

Inland navigation workers are a key driver for inland navigation dynamics, and it is very important for inland navigation to be sufficiently attractive, especially for young talents with entrepreneurial and innovation-oriented mindsets. Today, there is a shortage of qualified personnel at management level. In addition, the lack of qualified boatmasters can generally be observed, especially in tank vessel operation. Furthermore, a large number of highly qualified personnel is needed in the emerging passenger navigation market. Ensuring the attractiveness of the sector and a high-quality education is therefore paramount.

Figure 8 shows the evolution of the number of apprentices in Germany in the inland navigation sector. Following a strong decrease in the 1990s, the number of apprentices in the inland navigation sector increased in Germany between 2000 and 2009 in a catch-up effect. As in other sectors, the number of

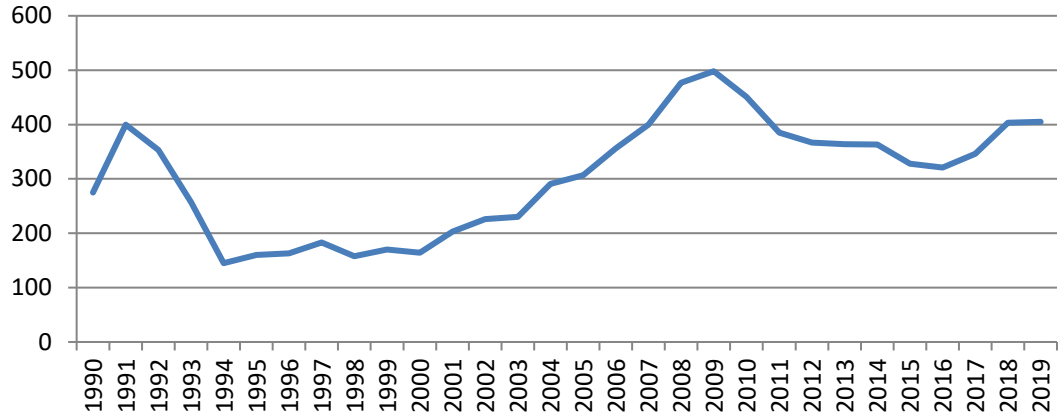
[40] Sources: destatis and CBS

apprentices decreased between 2009 and 2016 with the number of young people taking up university education augmenting, together with the economic crisis in the inland navigation industry.

However, for the first time in the last decade, a considerable increase followed in the years after 2016. Altogether, the evolution in the number of apprentices since the year 2000 could be explained by the economic boom (2000-2008) and recession (2009-2015) over this period of time, which impacted also strongly the IWT industry, and which could have influenced the tendency of young people to enter the industry. The period from 2016 to 2019 may not have been a boom, but it was at least a time when the inland navigation industry recovered from the financial crisis of 2009.

In 2019, 27 of the 405 apprentices were female. In the last years, no positive trend in the number of female apprentices is visible.

Figure 8: Number of apprentices in the inland navigation sector in Germany



Source: Association of German Chambers of Commerce and Industry (Deutscher Industrie- und Handelskammertag)

Despite the increase in the number of apprentices since 2016, the percentage of employees[41] under 25 years of age gradually decreased from 10.1% in 2013 to 7.6% in 2018, before slightly increasing to 7.9% in 2019, according to data from the German Federal Employment Agency.

Data from the German Federal Employment Agency and the Belgian National Social Security Office show that the age structure in European inland navigation has changed upwards during the last years. In Germany, the share of employees aged 55 and older continuously increased from 22.4% to 27.5% between 2013 and 2019. In the same period, the figures rose similarly in Belgium, from 18.7% to 23.6%.

As in the previous version of this report, the statement relating to the shortage of qualified personnel at management level remains true. The lack of qualified boatmasters can also be observed, especially in tank vessel operation. Furthermore, a large number of highly qualified personnel are needed in the emerging passenger navigation market.

6.3 New directive on professional qualifications and new CESNI standards

While the transposition of the working time directive 2014/112/EU introducing more predictable working patterns at the end of 2016 – with full application of the rules in some countries only in 2018 - has made IWT jobs more attractive, crew members on board of inland navigation vessels will now also enjoy more mobility of the work force and more attractive career opportunities as of 18 January 2022.

Directive (EU) 2017/2397 of the European Parliament and of the Council of 12 December 2017 on the recognition of professional qualifications in inland navigation and repealing Council Directives 91/672/EEC and 96/50/EC[42] simplifies access to professional qualifications and improves mobility for

[41] Employees being those workers who are subject to social security contributions.
[42] Official Journal of the EU L 345 of 27 December 2017

navigation personnel, from boatman to boatmaster. The adoption of the directive enables the legal frameworks that apply on the Rhine and in Europe to be harmonised, providing a high level of safety with a competence-based approach for all navigation personnel from now on. The dawning of this new era in inland navigation will not only increase labour force mobility but will also promote the attractiveness of jobs in this sector and have a positive effect on navigational safety. Basing itself on the text of the directive, the CESNI committee adopted several standards to which EU and Rhine law refer.

Commission delegated directive (EU) 2020/12 supplementing Directive (EU) 2017/2397 as regards standards for competences and corresponding knowledge and skills for practical examinations, for the approval of simulators and for medical fitness[43], incorporates several CESNI standards in EU law, e.g. standards of competence for the operational level, the management level, passenger navigation experts, sailing on inland waterways with a maritime character, sailing with the aid of radar and for liquefied natural gas (LNG) experts. Standards for the practical examination shall be applied for applicants wishing to obtain a specific authorisation for sailing with the aid of radar, a certificate of qualification as a passenger navigation expert, a certificate of qualification as a liquefied natural gas (LNG) expert and a certificate of qualification as a boatmaster. The CESNI standards contained in the directive also define technical and functional requirements applicable to vessel-handling simulators and radar simulators and standards for the administrative procedure for the approval of vessel-handling simulators and radar simulators.

Commission implementing regulation (EU) 2020/182 on models in the field of professional qualifications in inland navigation[44] contains standards adopted by CESNI for certificates of qualification as a boatmaster, and for certificates as a liquefied natural gas expert and as a passenger navigation expert, as well as standards for logbook, service record books and certificates for practical examination. For boatmasters and experts, the CESNI agreed on both an electronic and a physical format.

Delegated regulation 2020/473 on the standards for databases for certificates of qualification, SRB and logbooks[45] facilitates the electronic exchange of information regarding crew members by setting up rules on how national registers are connected to the database kept by the Commission. This system will contain data on crew members' certificates of qualification, service record books and vessel logbooks and shall be operational by mid-January 2022.

CESNI also began the analysis of the study on changes in workload over the last years (**T**owards **A** **S**ustainable **C**rewing **S**ystem, TASCS) which was submitted by Social Partners in January 2019. CESNI is reflecting on a European legal instrument on manning requirements which could apply to all qualifications defined in the directive on professional qualifications and which should be easy to enforce.

[43] Official Journal of the EU L 6 of 10 January 2020
[44] Official Journal of the EU L 38 of 11 February 2020
[45] Official Journal of the EU L 100 of 1 April 2020

7. EMISSIONS IN INLAND NAVIGATION

7. Emissions in inland navigation

7.1 European and international context

Addressing the issue of climate change is a political priority both nationally and internationally. The Paris Agreement, which aims to slow the pace of climate change (maximum 2° C increase) by reducing CO_2 emissions is one of its key components. In the Declaration signed in Mannheim on 17 October 2018, the inland navigation ministers of the Member States of the Central Commission for the Navigation of the Rhine (CCNR - Germany, Belgium, France, the Netherlands, Switzerland) reassert the objective of largely eliminating greenhouse gases and other pollutants by 2050.

In addition, to further improve the environmental sustainability of navigation on the Rhine and Inland waterways, the Mannheim Declaration tasked the CCNR to develop a roadmap in view of:

- reducing greenhouse gas emissions by 35% by 2035, compared with 2015,
- reducing pollutant emissions by at least 35% by 2035, compared with 2015,
- largely eliminating greenhouse gases and other pollutants by 2050.

On 28 November 2018, the European Commission presented its strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy by 2050, "A Clean Planet for All"[46], in which it asked for a European policy on the reduction of greenhouse gas emissions towards climate neutrality in 2050 for all transport modes, including the inland navigation sector. In addition, the May 2018 Communication "A Europe that protects: Clean air for all" from the European Commission provides the policy framework for reduction of air pollutant emissions such as NOx and Particulate Matter, covering, amongst other sectors, the transport sector[47].

Last but not least, on 11 December 2019, the European Commission presented its European Green Deal[48], laying out priority policy areas, one such area being sustainable mobility, and actions to be realised to achieve climate neutrality by 2050.

In this context, there is no doubt that all modes of transport shall make their transition towards zero-emission and the urgency is high for the IWT sector to develop measures to realise this transition This concerns both air pollutant emissions, which have attracted the most attention since 2014, but also greenhouse gases, which came into focus more recently.

Compared to the previous edition of this report, no new study regarding the intermodal comparison of emissions[49] or the possible scenarios for the energy transition[50] of the sector have been developed.

However, important studies are currently being undertaken. One such study that is currently being realised, under the impulse of the Central Commission for the Navigation of the Rhine, aims at advising on suitable funding and financial schemes to support the energy transition of the IWT sector[51]. For this purpose, a series of topics are being addressed: which scenario for the energy transition of the sector, at which cost and by when? Which barriers and levers currently exist to trigger a positive investment decision in greening measures? Which funding and financing mechanisms could contribute to realising this energy transition? Would the setting up of a dedicated fund for the greening of the IWT sector bring some added value, which form could it take? Intermediary results are expected in October 2020.

All such questions are essential in order to agree on a realistic scenario for the energy transition of the inland waterway sector towards zero-emission. Today, several options are under study as there is no "one-size-fits-all" solution for realising the energy transition. It is foreseen that different (modular) options

[46] https://ec.europa.eu/clima/policies/strategies/2050
[47] http://ec.europa.eu/environment/air/index_en.htm
[48] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#policy-areas
[49] CE Delft (2016), STREAM Freight transport 2016. Chapter 7.1 of market report 2014-2017 "main features and trends of the European Inland Waterway Transport sector":
[50] IFEU institute scenarios and CCNR calculation. Chapter 7.4 of market report 2014-2017 "main features and trends of the European Inland Waterway Transport sector"
[51] Intermediate results from such studies are available here: https://ccr-zkr.org/12080000-en.html

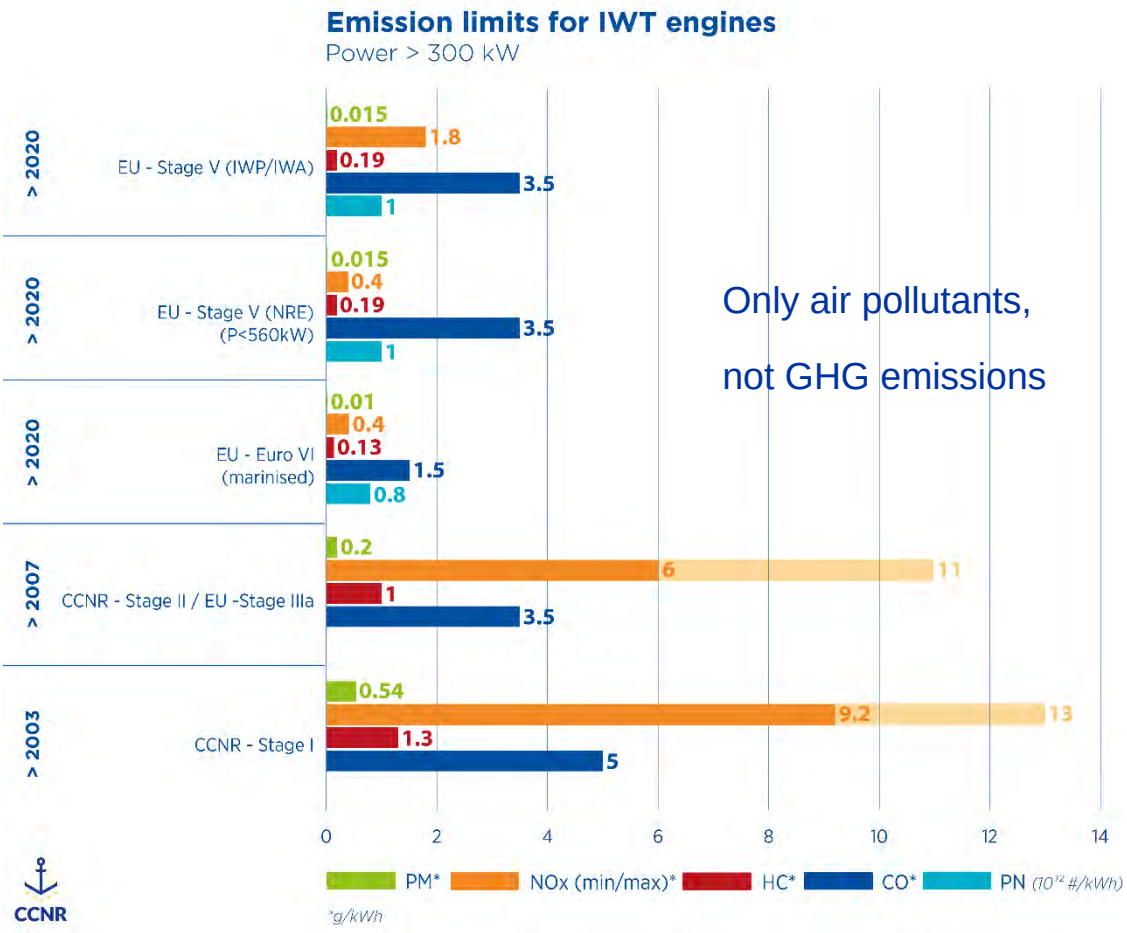
for zero-emission powertrains, using a mix of energy sources/fuels, will play a role to achieve this ambition objective.

7.2 Intermodal comparison of emissions

Although inland waterway transport has the advantage of economies of scale due to the large capacities of ships compared to trains and trucks, the emissions of inland vessels are attracting more and more concern and attention. Pollutant emissions have been the main focus in recent years, as the new non-road mobile machinery (NRMM) regulation shows.[52] It has been in operation since 1 January 2017 and introduces more stringent compulsory rules and emission limits for new engines in the inland navigation sector - engines up to 300 KW as of 1 January 2019 and above 300 KW as of 1 January 2020 ("stage V engines").

After this date, all new engines for inland waterway vessels will need to comply with the Stage V emission requirements which limit the emission of Carbon Monoxide (CO), Hydrocarbons (HC), Nitrogen Oxides (NOx), Particulate Matter (PM and Particle Number (PN). The existing engines are not affected and are allowed to continue operating until the end of their economic lifetime. Also, there are no obligations for retrofitting existing engines.

Figure 1: Emission limits for IWT engines (g/kWh)



Source: CCNR

However, given the current European and political context, the reduction of greenhouse gas emissions towards zero emission is also attracting more attention and becoming a priority.

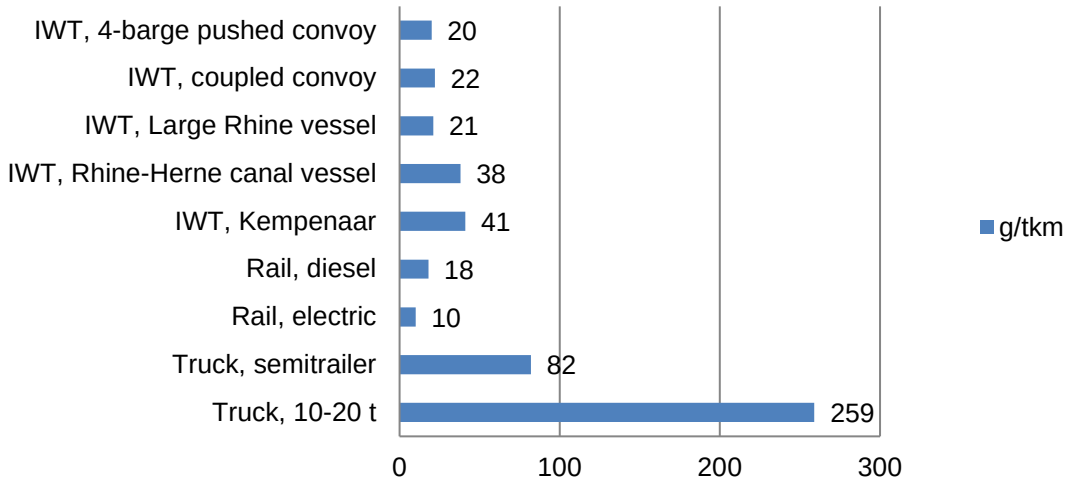
[52] Regulation (EU) 2016/1628 of the European Parliament and of the Council of 14 September 2016 on requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery, amending Regulations (EU) No 1024/2012 and (EU) No 167/2013, and amending and repealing Directive 97/68/EC https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1523895850443&uri=CELEX:32016R1628

For comparing emissions between IWT, road and rail, a study published by the research institute CE Delft is used as a reference (same study as the one used in the previous edition of this report).[53] The study contains values for CO_2 emissions and main pollutant emissions per tonne-kilometre, for different vessel and vehicle types.

For PM[54], the emissions due to wear-and-tear were also taken into account. These emissions are caused by abrasion from tyres, brake linings and road surface. They are relevant for trucks, where they can be of the same magnitude as the PM emissions from engines.

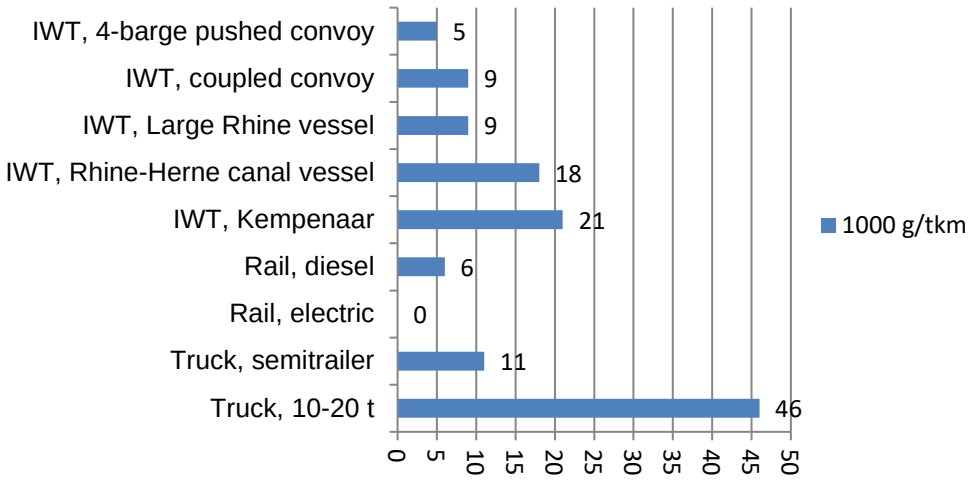
The following figures show the emission factors according to CE Delft for the different vessel, train and truck types. Within IWT, it is straightforward to see the influence of the vessel size: larger vessels have lower fuel consumption values per tonne-kilometre and therefore lower emissions per tonne-kilometre than smaller ones. Four-barge pushed convoys have the lowest values of the vessel types presented here.

Figure 2: Representative emission factors for CO_2, bulk transport



Sources: CE Delft (2016), STREAM Freight transport 2016. Well-to-wheel emissions approach.

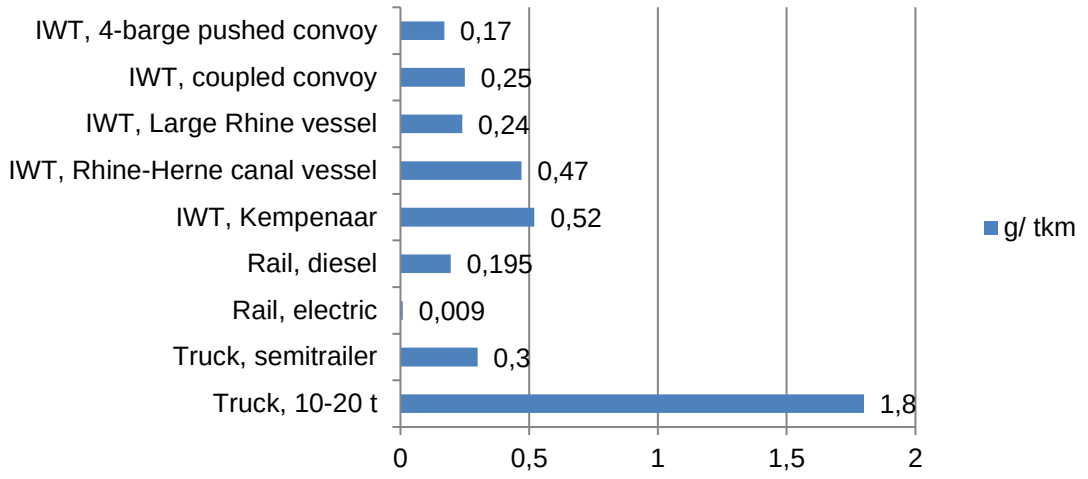
Figure 3: Representative emissions factors for Particulate Matter (PM), bulk transport



[53] CE Delft (2016), STREAM Freight Transport 2016 – Emissions of Freight Transport modes
[54] Particular Matter Emissions due to combustion or wear and tear

Sources: CE Delft (2016), STREAM Freight transport 2016. Well-to-wheel emissions approach.

Figure 4: Representative emissions factors for nitrogen oxides (NOx), bulk transport



Sources: CE Delft (2016), STREAM Freight transport 2016. Well-to-wheel emissions approach.

It can be concluded that, overall, IWT has higher CO_2 and pollutant emissions than railways given that today 80% of railway goods traffic is based on electric traction.

The comparison between IWT and road traffic delivers different results, dependent upon the vessel or vehicle type. However, the most representative vessel types in terms of their share of transport performance (Large Rhine vessel and Rhine-Herne canal vessel) have clearly lower CO_2 emissions than trucks, and about the same level of pollutant emissions.

Such conclusions confirm that reducing both greenhouse gases and air pollutant emissions is no longer an option, but a necessity as well as a true obligation, if inland navigation wants to preserve and strengthen its position as a sustainable and environmentally friendly mode of transport.

As in the IWT sector, efforts are also being deployed in other transport modes to become more sustainable. In addition, the shorter lifetime of truck engines compared to inland vessels is an advantage, which facilitates the progressive transition of this sector towards zero-emission. If inland navigation lags behind in the energy transition process, it faces the risk that transport demand might shift to other modes such as rail or road.

7.3 Emission reduction measures in IWT

Emission reduction measures in inland shipping can be categorised into three main groups:

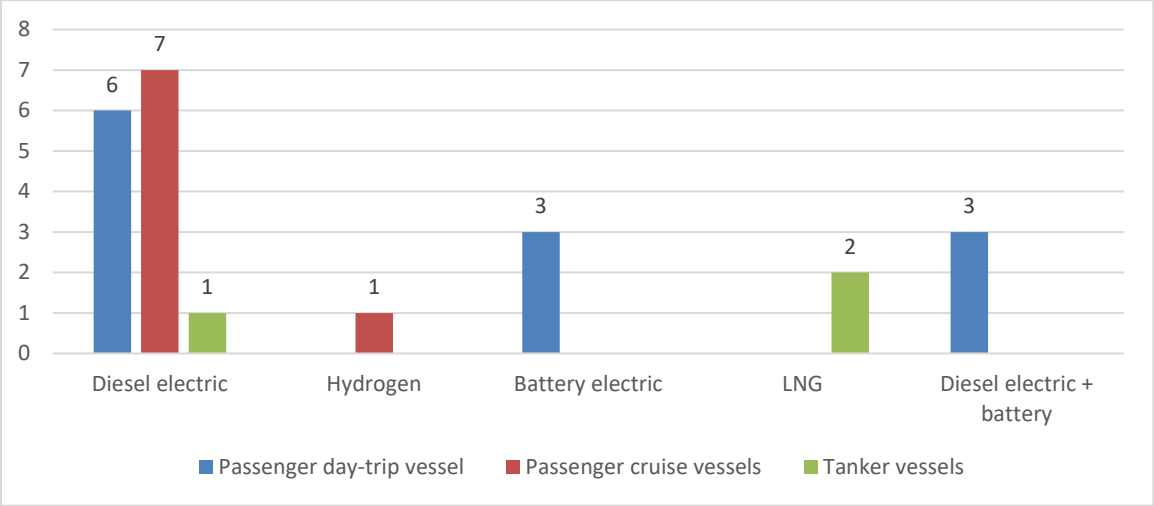
- technical measures: relating to the vessel's propulsion, the architecture of vessels, the installation of post treatment systems such as a particular matter filter, or selective catalytic reduction
- operational measures: speed reduction/smart steaming, optimal maintenance
- measures related to traffic and transport management.

There is currently no comprehensive database listing emission reduction measures available on board of existing vessels or new vessels. However, based on current knowledge, innovations to reduce emissions from existing and new vessels have increased since 2014, although these remain rather limited.

As shown in the figure below, out of the 202 new vessels certified by the classification society Bureau Veritas over the period 2014-2020, 23 were equipped with emission reduction measures, the majority of which (14) consisted in the installation of diesel electric engines in the passenger transport sector.

More innovative types of propulsion such as battery electric propulsion or hydrogen propulsion, are only installed occasionally and mainly for the purpose of pilot projects. Naval architectural measures aiming at fostering the energy efficiency of vessels were installed on five vessels within this period. Two such measures consisted in optimised hull form and three of weight reduction by composite materials, all on day-trip vessels. From this sample, it can be seen that most innovative solutions are more likely to be installed on passenger vessels (cruise and day-trip vessels).

Figure 5: Amount and type of emission reduction technologies on inland vessels out of the vessels certified by Bureau Véritas over the period January 2014-April 2020



Source: Bureau Véritas

It is worth noting that this figure consists of only a sample of the newbuilt construction and may not be fully representative. Indeed, 80-85% of newly built vessels are certified by the classification society, Lloyds' Register. However, Lloyd's Register also confirmed that the number of ships equipped with innovative emission reduction measures is very limited. A few are equipped with hybrid propulsion and the use of GTL (gas-to-liquid) is only available on some passenger vessels. After-treatment systems are more common, but not on all vessels. Architectural measures such as flexible propeller tunnels are installed on only a very few vessels.

7.4 Limited emission reduction measures on inland vessels: what are the reasons?[55]

Important efforts are being deployed by the IWT sector to reduce both its pollutant and greenhouse gases, as well as to realise its energy transition. Many innovative zero-emission solutions are currently being tested in this sector.

However, as mentioned earlier in this report, innovations to reduce emissions from existing and new vessels remain rather limited. This can be explained by various economic, technical and regulatory reasons.

There are **economic reasons** that explain the lack of positive investment decisions by shipowners/operators to invest in technologies contributing to zero-emission. One main bottleneck is the lack of business cases and convincing shipowners/operators into investing in technologies that contribute to zero-emission. This can be explained in part by missing or inadequate financial/funding solutions as well as by commercial incentives for ship-owner/operators.

[55] Sources: PROMINENT project: Deliverable 6.3 and 6.4 http://www.prominent-iwt.eu/wp6-roll-out/, Pre-study "financing the energy transition towards a zero-emission European IWT sector" undertaken by EICB and financed by the Dutch Ministry of Infrastructure and Water Management, Edition 1 of the study "Assessment of technologies in view of zero-emission IWT" undertaken by DST and financed by the Swiss Federal Office of Transport.

Given the long lifetime of vessels and their engines, as well as the ability for the shipowners/operators to further extend their lifetime by means of overhauling the traditional engine, the demand for new engines is very low. In addition, compared with other modes, the IWT market is small with specific technical requirements. Consequently, there is little interest from engine and technology suppliers in developing and offering new engines and energy solutions specifically for IWT vessels, resulting in relatively higher costs for such solutions. Given the size of the IWT market, standardisation at global level could lead to positive economies of scale and provide incentives for the development of new technologies in the IWT sector.

Higher total cost of ownership (investment and operational costs combined) for greening technologies, as well as the uncertainties in the business case development (e.g. a persistent low oil price), consist in risk parameters for shipowners. Indeed, investment costs are generally significant for zero-emission technologies. Zero-emission technologies also come with higher operational costs compared to the current state-of-the-art, due, for instance, to additional maintenance costs, loss of space on the vessels and/or to more frequent bunkering.

Moreover, the shipowners' investment capacity, depending on the sector concerned (liquid/dry/container/passenger), can be quite limited. The market structure of the IWT sector, consisting in a high share of family businesses, can be an explanation. Public funding (in the form of grants) to make such a business case a reality and thereby attracting private investors, is essential. However, such public funding should become more adequate. For instance, at EU level mostly pilot vessels to demonstrate innovative techniques benefit from grants. EU funding therefore does not result in a large-scale uptake of greening techniques. In addition, mobile equipment is currently not in the scope of existing funding schemes at EU level. Investments into alternative fuels infrastructure, for which funding opportunities are currently available at EU level, must continue to be available and should go hand-in-hand with investments into mobile equipment.

Greater accessibility to funding and financing solutions, as well as a minimal administrative burden, are also essential for the IWT sector.

Last but not least, the fragmented supply side of the sector, combined with dominance of short-term or even single trip contracts in the spot-market, are additional barriers to acquire loans for investments. The fragmented nature of the sector also becomes a barrier when means of strengthening the investment capacity of shipowners, such as joint financing of greening technologies, is considered.

Indeed, the large number of vessel types and engines used within the IWT sector prevents sufficient standardisation, however necessary, to attain economies of scale. In addition, there is in general a lack of willingness of shipowners to cooperate and bring their investment capacity together, as it requires giving up some of their autonomy, deeply rooted in the sector.

There are also **technical reasons** which could explain this limited number of vessels that are equipped with innovative solutions. Such technical reasons are not the focus of this report but are important to mention.

Regarding the stage V requirements described earlier in this chapter, one major concern was that there would be no engines meeting those standards on the market by the time the NRMM regulation would enter into force. Today, this concern still exists, as there are still no so-called Stage-V engines on the market. However, alternative engine solutions with stage V certification and thereby meeting the NRMM regulation requirements are now becoming available (such as Stage V-IWP or IWA, marinised NRE or Euro VI engines). They are launched on the market by manufacturers such as Beta Marine, DAF / PACCAR (Vink-Diesel) or Deutz AG. Other manufacturers such as Caterpillar or Scania have also announced the availability of such stave-V compliant engines in 2020/2021.

Regarding zero-emission technologies, most are still experimental and not yet developed to a mature level. In addition, it is difficult to predict the possible technological leap that may take place in the coming years, such as possible breakthroughs in carbon capture or CO2 storage technologies. However, pilot applications of zero-emission technology and further research and development in that regard, are essential first steps to identify and address the technical barriers to the deployment of new zero-emission technologies. Supporting such pilot projects remains essential to take up the energy transition challenge.

In order to highlight the essential role of such pilot projects but also the innovative potential of the IWT sector in terms of zero-emission technology, some pilot project examples are shown below. More than 70 pilot projects are currently being undertaken or will be in the near future[56].

- **Pilot project in Germany: Elektra – inland push boat powered by hydrogen fuel cell (newbuild)**[57]

The Elektra project consists in the design and realisation of a hybrid inland freight push boat powered by hydrogen fuel cells and Li-ion batteries. The project aims to test such a vessel not only from a technical but also from an economic efficiency point of view: "*ELEKTRA is not only investigating hydrogen's feasibility as an energy store given its specific properties, but also exploring ways of creating an infrastructure for charging accumulators with onshore electricity as well as supplying fuel cells with hydrogen. Furthermore, the project is developing an extensive energy management system for all producers and consumers to ensure the limited energy available onboard is harnessed optimally. This will foster economic efficiency while also securing a competitive edge over conventionally powered ships*."

- **Pilot project in Germany: Innogy – inland passenger vessel powered by methanol fuel cell (retrofit)**[58]

The MS Innogy is a passenger vessel operating on Lake Baldeney in Germany, powered by methanol fuel cell. The project is led by Innogy, a leading distributor of green energy in Germany and the City of Essen. The methanol fuel cell system powering the vessel is developed and manufactured by the Danish fuel cell manufacture SerEnergy. This solution is modular, making it possible to adjust according to the individual energy requirements of the customer. This is a unique feature within the fuel cell industry where other systems would require more development work and adjustments to each project. This also

[56] Annex 1 of the report published on the hydrogen propulsion in inland navigation and short-sea shipping performed by EICB "*Waterstof in binnenvaart en short sea een inventarisatie van innovatieprojecten*": https://www.eicb.nl/wp-content/uploads/2020/07/2020-07-EICB-Rapport-Waterstof-in-de-binnenvaart-en-short-sea.pdf
[57] Source: https://www.e4ships.de/english/inland-shipping/elektra/
[58] Source : https://serenergy.com/the-first-methanol-fuel-cell-powered-vessel-in-germany-is-now-sailing-the-waters-of-lake-baldeneysee/

makes it possible for the customers to increase their system by expanding the rack with one module or more. The MS innogy fuel cell system is a 35-kW system consisting of seven 5 kW modules integrated in one rack. The energy system is a hybrid constellation consisting of a fuel cell system and a battery pack, where the fuel cells work as a range extender allowing the vessel to sail for an entire day without fuelling. Using waste heat from the fuel cell to drive the methanol reformation process leads to a high electrical efficiency. It is CO2-neutral, has zero harmful emission, is low on noise and vibrations. According to the evaluation report carried out in 2017/2018, after only 1.5 years, the project is a success. In addition to the technical enhancements and optimisations to increase fuel cell service life and a significant reduction in system failures, it was possible to gain valuable experience of operating a fuel cell vessel. It is important to note that a high-quality and regular training concept plays an important role and that close collaboration and communication between the operators and the manufacturer is very important. The response from the public and from MS innogy passengers travelling quietly on Lake Baldeney and with low emissions was entirely positive.

- **Pilot project in the Netherlands: Sendoliner - diesel electric inland container vessel supplemented by a battery pack (retrofit)**[59]

The Sendo Liner is an inland container ship, mainly transporting foodstuffs from the Groningen province to the Port of Rotterdam. It was designed by Concordia Damen in close collaboration with its client and owner of the vessel, Sendo Shipping. During the design of the ship, Concordia Damen and Sendo Shipping paid extensive attention to making the ship as efficient, economical and clean as possible in its task of container transport on inland waterways. Indeed, a step-by-step and modular approach was chosen to design this inland vessel in order to make the ship as profitable as possible and to make it future-proof for an easy transition to emission-free sailing. It is powered by a diesel-electric engine and supplemented by a battery pack allowing the vessels to sail emission-free for two to three hours or to cover an entire day at standstill without any generator running. Compared to what is traditionally understood as being hybrid propulsion, i.e. the propellers can be driven both in diesel-direct and diesel-electric mode, propulsion of the Sendo Liner is always through the electric motors. The battery component is made of batteries that can be charged by shore power and not only by the onboard power units. The ratio between energy stored in batteries and energy stored in diesel fuel is something which may change in the future, depending on how the technologies and their price differential evolves. The

[59] Sources:https://products.damen.com/en/ranges/sendo-liner/sendo-liner ; https://www.maritimeholland.com/maritime-holland-issue1/sendo-liner/

ship is ready to go either way. While being the main source of power today, the gensets and diesel fuel may become merely a “range extender” in the future.

In order to optimise the container carrying capacity and therefore reduce the energy consumption per cargo unit, a first step was to optimise the hull shape. The length of the accommodation was reduced to increase the length of the cargo-hold, which made it possible to store an additional row of containers at the bow. The second step was achieved by increasing the ballast capacity.

- **Pilot project in France: Ducasse sur Seine – full electric floating restaurant**[60]

In September 2018, a new 38-metre-long inland vessel was launched, equipped with 100% electric propulsion (no noise, no vibrations) and hosting a Michelin star restaurant, the “Ducasse sur Seine”. It navigated on the Seine during a two-hour cruise. No used water is discharged into the Seine and an energy-saving system controls the air conditioning and kitchen functions. This innovative propulsion system allows for low emission of CO2 per passenger (12g/km versus 146g/km on a traditional boat).

Many other pilot projects are ongoing, such as the Dutch projects “Future proof shipping”[61] aiming at retrofitting existing inland vessels with fuel cells by 2021 or “Zero emission services (ZES)”[62] supplying interchangeable energy containers for new and existing inland vessels. ZES containers are charged using renewable power. Skippers can quickly exchange a depleted container for a full one at exchange and loading stations. These stations are equipped with an ‘open access’ network and can also be used to stabilise the electricity grid or meet temporary local demand for electricity. ZES offers users a future-proof solution. In the future, such containers could also be able to work with hydrogen for example.

Beyond the economic and technical reasons mentioned above, there are currently shortcomings in the current **IWT policies and legislation**, which do not allow to provide sufficient incentives to stimulate energy transition. These are in particular:

- current legislation (NRMM Regulation) addresses only the emission reduction of air pollutants (but not greenhouse gases) and does not address the existing fleet and engines, only new ones;
- without effective internalisation of external cost mechanisms in the inland waterway transport sector, shipowners/operators are not “rewarded” for investing in cleaner vessels, nor are they deterred from investing in more polluting vessels.

[60] Source : https://www.ducasse-seine.com/en/ship
[61] Source: https://www.futureproofshipping.com/
[62] Source: https://zeroemissionservices.nl/en/home-english/

In addition, in order to guarantee a high level of safety in inland navigation, protect the environment and people on board, it is essential that innovative solutions for inland vessels' propulsion remain regulated by stringent technical requirements. CESNI recently published a guide to explain the procedure to obtain derogations to technical requirements for pilot vessels[63]. This procedure is sometimes criticised for creating administrative burden and lacking flexibility. However, authorisation of pilot projects is absolutely necessary to prepare regulatory changes and support the development of innovative solutions.

[63] http://cesni.eu/prescriptions-techniques/#09

8. PASSENGER TRANSPORT

8. Passenger transport

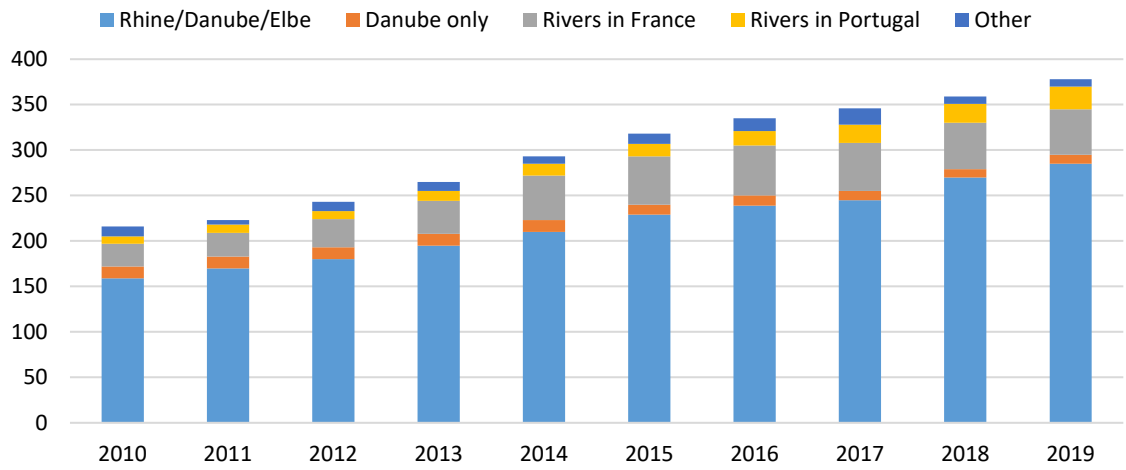
An important segment of passenger transport on European inland waterways are river cruises, for which a great deal of information is available. However, there are also other forms of passenger transport on rivers such as ferry traffic and day trips. A common feature of the whole European river passenger transport sector is that it has been highly adversely affected by measures taken in order to contain the COVID-19 pandemic.

8.1 Passenger transport fleet

In the river cruise segment, the EU has increased its fleet capacities substantively over the last decade. In 2019, 378 active cruise vessels, about 46% of which were registered in Switzerland, with at least 40 beds, were operating in the EU, which represented more than 40% of the worldwide active river cruise fleet. This compares to 359 river cruise vessels in 2018, 293 in 2014 and 216 in 2010.

Vessels active on the Rhine (including tributaries), Danube and Elbe represent 75% of active vessels in the EU, up from 72% in 2014. Vessels active on rivers in France account for 13%, with a falling trend since 2014. The number of vessels on Portuguese rivers (Douro and one vessel on the Guadiana) nearly doubled between 2014 and 2019 and Portugal now has a share of 6.6%. From a technical point of view, these vessels are foreseen for operation only in these regions.

Figure 1: Number of river cruise vessels in the European Union by region of operation (2010 – 2019)

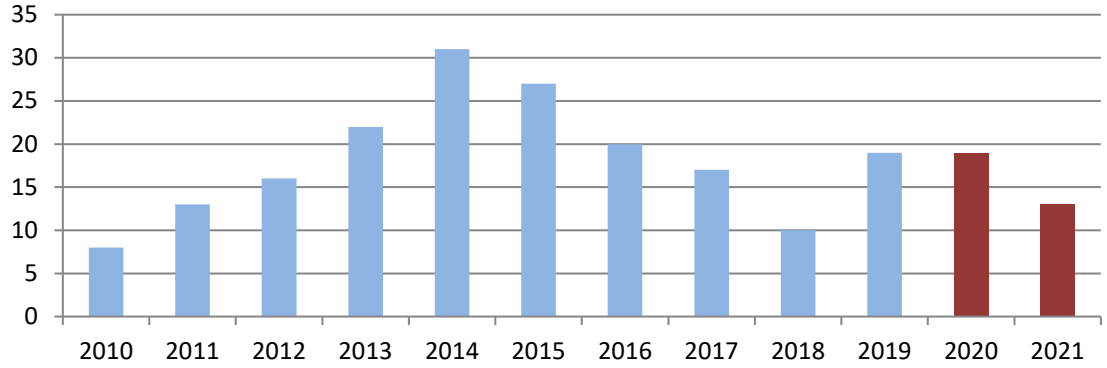


Source: Hader, A. (2019), The River Cruise Fleet.

The construction rate is more important in passenger transport than in goods transport. In Europe, 19 new river cruise vessels were put into service in 2019, which is nine more than one year before. This brought a negative trend in newbuilding activity to a halt. This negative trend was the result of strongly rising newbuilding rates until 2014, and the willingness of large cruise companies to limit the new capacity added to the market, so as to avoid overcapacity.

For the years 2020 and 2021, the number of new vessels entering the European market is expected to remain approximately at the level of the preceding years: 19 new vessels are foreseen for 2020, and 13 for 2021. However, it should be noted that the order book for new river cruise vessels accounted for in this chapter pre-dates the COVID-19 crisis. Its impact on the newbuilding activity is expected to be felt in 2021 and 2022 as the construction of vessels for 2020 already started before the pandemic.

*Figure 2: New river cruise vessels for the European market (2010 - 2021) **



Source: Hader, A. (2019), The River Cruise Fleet
** 2020: forecast based on order books, 2021: on order in May 2020.*

Remarkably, four of the new vessels in 2020 are planned to operate on the Seine, 13 will operate on central European waterways, and two on the Douro.

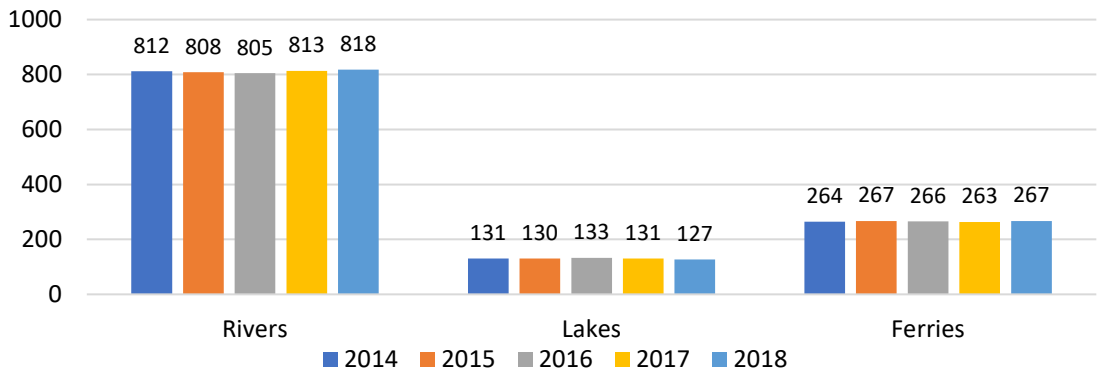
Apart from those river cruise vessels with 40 beds and more, there is also a noteworthy number of small river cruise vessels with 10 to 39 beds each. In 2018, 67 of these small river cruise vessels operated on European rivers, 35 of them in the Netherlands and surrounding regions, and 19 in France.

The fleet of small river cruise vessels is distinctly older than the fleet of vessels with 40 beds and more. Out of the 67 active small cruise vessels, 38 were built before 1940, and only 11 were built after 1980. Many small river cruise vessels are former cargo vessels that were converted into cruise vessels.

Day trips constitute a further segment of touristic passenger transport on European inland waterways, including both rivers and lakes. However, an assessment of the day-trip segment's size is complicated by the fact that to date there are no Eurostat data on the number of passenger vessels, far less on the number of day-trip vessels, or on the number of passengers on inland waterways. This problem has been identified and pilot studies on this issue have been initiated. However, a current analysis must make use of national databases by taking into account the number of river cruise vessels and subtracting this from the number of total passenger vessels. By this indirect calculation, the number of non-cruise passenger vessels can be determined.

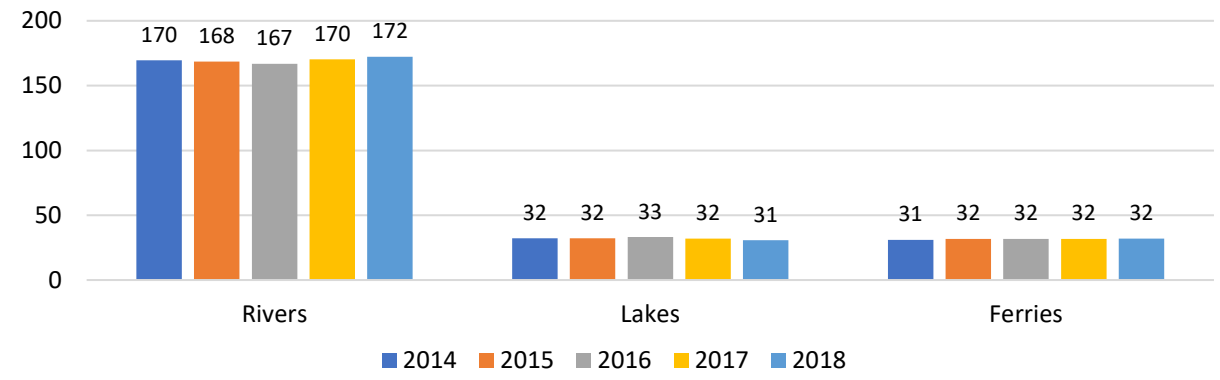
The five countries with the largest day trip fleets in Europe are Germany, the Netherlands, France, Italy and Switzerland. The number of active day trip vessels in Germany did not change very much between 2014 and 2018, increasing by five in total from 1,207 to 1,212. Their total capacity rose slightly from 232,933 to 234,719 passenger places. Most German day trip vessels operate on rivers, and only a relatively small number operate on lakes. Day trip vessels on rivers have an average capacity of 210 passenger places, vessels on lakes have 241 places, and ferries have 120 places. The average capacities also did not change substantively. Overall, the most important development was that the capacity of vessels on lakes decreased by about 5% between 2014 and 2018.

Figure 3: Number of day trip vessels in Germany by segment



Source: Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) – Zentrale Binnenschiffsbestandsdatei (ZBBD) (Federal Waterways and Shipping Administration – Central Register of Inland Waterway Vessels).

Figure 4: Capacity of day trip vessels in Germany by segment (in 1,000 passenger places)



Source: Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) – Zentrale Binnenschiffsbestandsdatei (ZBBD) (Federal Waterways and Shipping Administration – Central Register of Inland Waterway Vessels).

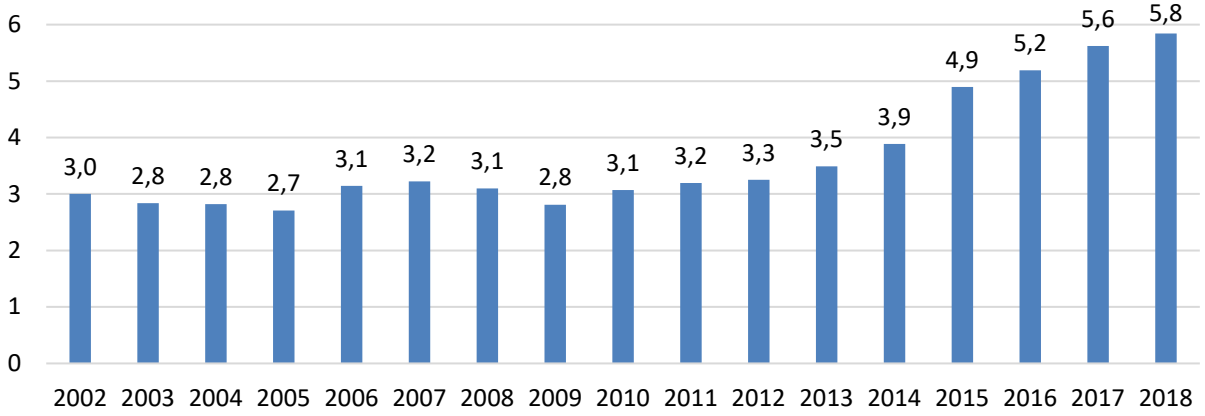
In 2017, France had in total 365 day-trip vessels on rivers and canals with a capacity of 47,580 places, which transported nearly 10.6 million passengers, 52% of them foreigners. There is a strong focus on the capital region Île-de-France, where 34% of these vessels with 70% of the passengers operated.

8.2 Passenger transport demand

In the Île-de-France region, demand on day-trip vessels was 8.0 million passengers both in 2014 and 2015, and 6.1 million passengers in 2016. The reason for this drop was less tourists visiting Paris due to the terror attacks in 2015. The demand then recovered, and rose to 7.3 million passengers in 2017, 7.5 million passengers in 2018 and 7.9 million in 2019.

According to the IVR database, 511 day-trip vessels (day cruise vessels, passenger vessels Amsterdam type, passenger ferries and passenger vessels shorter than 45 metres) took place in the Netherlands in 2020. Among these 511 day-trip vessels, 149 (29% of all Dutch day trip vessels according to IVR) operate in Amsterdam. Day trips on the city's 165 canals are a popular tourist attraction. The number of passengers on day-trip vessels in Amsterdam has increased continuously since 2009 and by about 50% between 2014 and 2018.

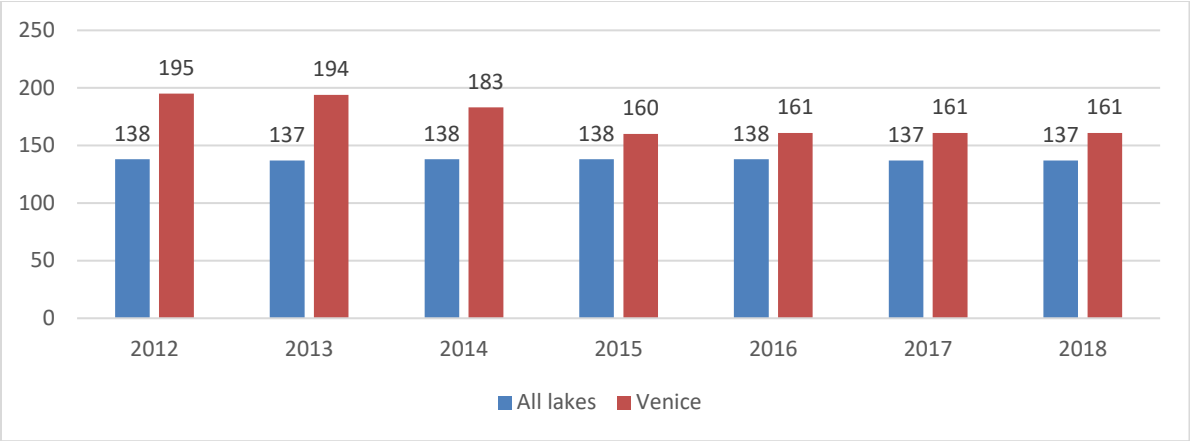
Figure 5: Number of passengers on day trip vessels in Amsterdam (in million persons)



Source: City of Amsterdam – Amsterdam in cijfers.

Italy's day trip vessels are concentrated on its lakes, particularly on the large lakes south of the Alps in northern Italy, and on the lagoon and canals of Venice where motorised waterbuses are used for public transport. According to the Italian Ministry of Infrastructure and Transport, the number of vessels following a scheduled public service operating on lakes, of which 21 are ferries, has barely seen any change over the last years. However, the number of day-trip vessels in Venice, which excludes gondolas and other solely touristic means of transport, decreased substantially between 2013 and 2015 before stabilising afterwards.

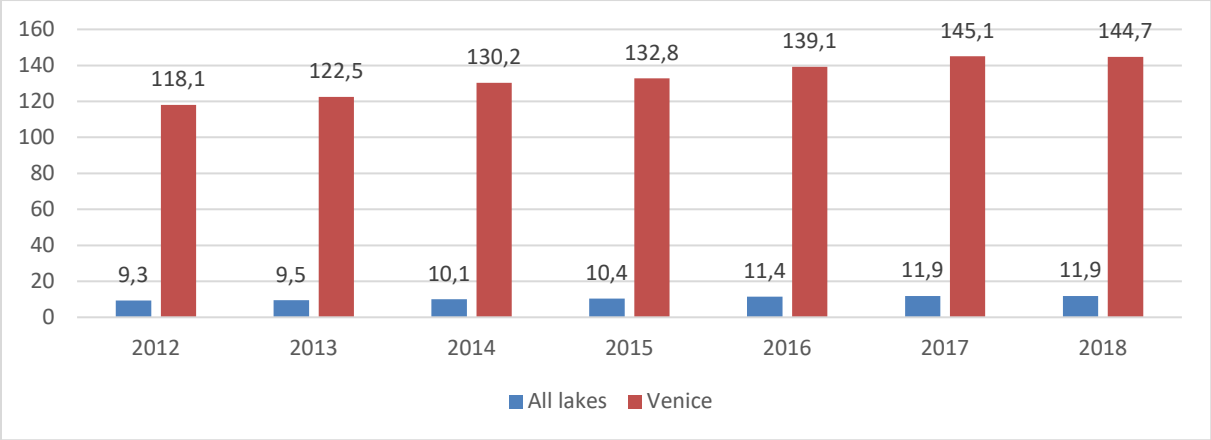
Figure 6: Number of day trip vessels following a scheduled public service in Italy by area of operation



Source: Ministero delle Infrastrutture e dei Trasporti - Conto Nazionale delle Infrastrutture e dei Trasporti (Italian Ministry of Infrastructure and Transport – National Account of Infrastructure and Transport).

When looking at the number of passengers who use these day trip vessels, the dominance of Venice in this segment is much stronger, indicating a much higher number of passengers per vessel over a whole year. A partial explanation for this phenomenon could be that vessels in Venice are used relatively constantly throughout the whole year by locals and tourists, whereas seasonality is more pronounced for the lakes. A continuously positive trend is visible for both the lakes and Venice over the past years. Day trip vessels on Italian lakes transported about 28% more passengers in 2018 than in 2012. For Venice, this increase amounted to about 23%.

Figure 7: Number of passengers on day trip vessels in Italy following a scheduled public service by area of operation (in million persons)



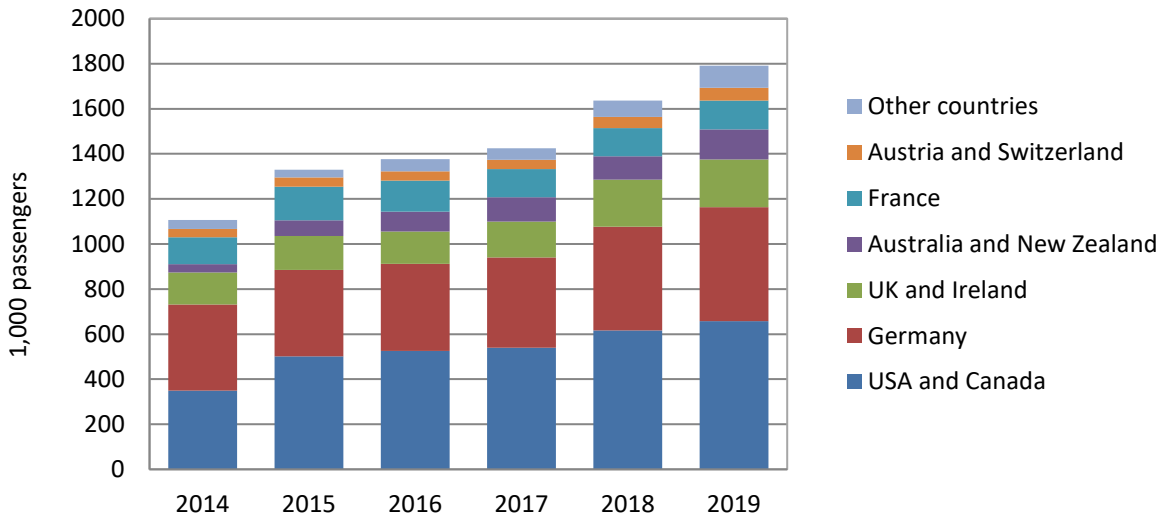
Source: Ministero delle Infrastrutture e dei Trasporti - Conto Nazionale delle Infrastrutture e dei Trasporti (Italian Ministry of Infrastructure and Transport – National Account of Infrastructure and Transport). Note: Without data for the Lago di Bolsena, on which between 2 and 4 vessels operated each year.

Due to the country's topography, lakes also play an important role for the segment of day trip vessels in Switzerland. According to the Swiss Federal Statistical Office, 247 day-trip vessels operated on the lakes between Lake Geneva and Lake Constance in 2018. Out of these, 105 did not follow scheduled services and were used entirely for tourism purposes. The remaining 142 vessels followed a scheduled service and thus formed part of the country's public transport system. In 2016, this category of vessels transported 11.3 million passengers. Moreover, eight day-trip vessels following scheduled services were active on rivers in 2018, of which six operated on the Swiss part of the Rhine and two on the Rhône.

Compared to the size of their overall inland waterway fleet, central and eastern European countries also have substantial numbers of day-trip vessels that mostly show a positive trend for the last years. From 2014 to 2018, the number of active day trip vessels increased from 80 to 88 in the Czech Republic but decreased from 20 to 14 in Slovakia. In Hungary, the number of active ferries increased from 55 to 62 between 2014 and 2017, whereas the number of other day trip vessels on rivers and lakes rose from 126 to 132. The increase in that period was even more pronounced in Poland, where the fleet of day-trip vessels expanded from 98 to 116. The number of active day-trip vessels in Romania increased from 65 to 78 between 2015 and 2018, accompanied by an increase in available passenger seats from 6,330 to 7,140.

In 2019, a total of 1.79 million river cruise trips were made on inland waterways in the EU, which corresponds to an increase of 9.5% compared to the previous year and of 61.8% compared to 2014.

Figure 8: Number of passengers on European River Cruise vessels per country of origin (1,000 passengers)



Sources: SeaConsult, IG River Cruise (2019), Der Fluss-Kreuzfahrtmarkt 2019.

With a share of 37% of all river cruise tourists in Europe, US-Americans and Canadians were again the most important source market in 2019, as was the case in 2018 (38%). German tourists were again in second place in 2019, with a share of 28%, as they were in 2015. Since 2014, Australia and New Zealand had the biggest relative increase among the most important passenger destinations with their number more than tripling. They now have a share of 7.5% compared to 3.4% in 2014.

Considering global demand evolution, the market for river cruises is independent of other shipping markets, as it is less exposed to fluctuations in industrial production. However, travel intensity is strongly influenced by the effects of temporary and regional influences such as weather conditions (i.e. ice in the winter season). Nevertheless, thanks to the use of modern cruise vessels and new technologies, for example propulsion with a single paddlewheel, it is possible to extend the service period considerably, so that the season break lasts only from January to March/April.

There is only a very general connection between the demand for river cruising and global economic development. In principle, dependencies linked to the purchasing power are usually influenced or even replaced by regional political events, intra-industry trends such as an expansion or constriction of the supply chain (i.e. cancellation of cruises due to closures) and marketing measures.

Furthermore, and thanks to its navigable tributaries, the Rhine offers several different travel itineraries, which makes it attractive for repeaters, that is to say tourists who travel repeatedly to the same destination.

Another positive aspect of the Rhine is its geographical proximity to important global airports such as Amsterdam, Basel, Frankfurt and Cologne. This geographical situation offers a considerable advantage to foreign passengers (especially from overseas) arriving by air. Thus, distant source markets can also easily be operated.

From the point of view of navigation, the Rhine offers the best conditions for three-floor passenger vessels up to a length of 135 m, not least because the water level for cruise ships is rarely too low and locks can only be found on the Upper Rhine.

Another aspect to be taken into consideration, not only with regard to the construction of new vessels, is the number and size of locks. On the rivers Elbe and Moldau in particular, newly constructed vessels can gain in length but cannot exceed a width of more than 10.0 metres in order to respect the constraints of navigation.

The Danube, together with the Rhine, is the most important European river for the cruise sector. On the Danube, there is a cluster of ports that play a significant role in river cruising. These main ports are Passau (Germany), Vienna (Austria), Bratislava (Slovakia), Budapest (Hungary) and Belgrade (Serbia). River cruises on the Danube can be split into two major types of journeys:

- **Short distance cruises** from Passau to Vienna, Bratislava and Budapest, with a duration of 5 to 8 days. They represent the most common type of Danube river cruise in terms of number of passengers transported (720,800 passengers in 2019, 565,000 passengers in 2016 and 534,000 in 2015).
- **Long distance cruises** from Passau to the Danube delta region with a duration of 14 to 16 days. For these cruises, there were 135,040 passengers in 2019, compared to 87,000 passengers in 2016, and 83,000 in 2015.

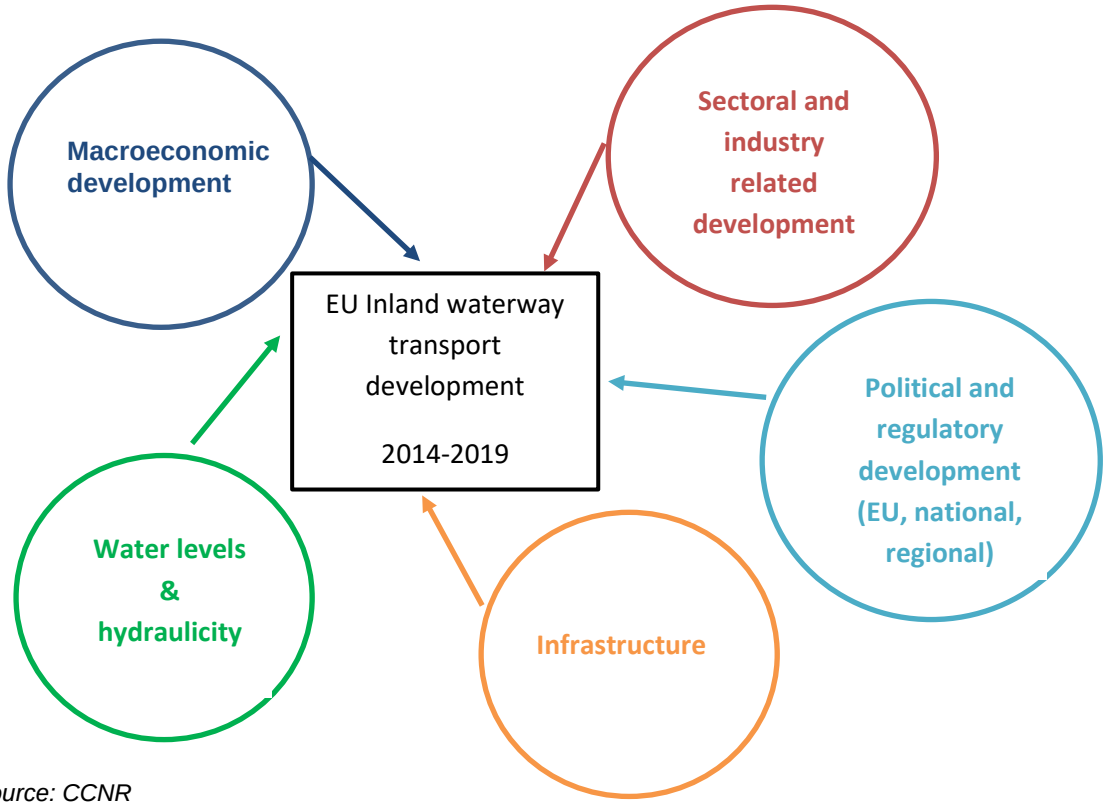
Concerning the nationality of the vessels, Switzerland has by far the highest share of all states, with 172 cruise vessels flying the Swiss flag, out of 378 cruise vessels in Europe in total (data for 2019). Germany (53 vessels), Malta (43 vessels), the Netherlands (41 vessels) and France (41 vessels) follow behind. In Portugal, 19 vessels are registered, sailing mainly on the Douro.

9. SUMMARY AND CONCLUSIONS

9. Summary and conclusions

In the previous chapters, the development of inland waterway transport in Rhine and Danube countries were analysed between 2014 and 2019 for the total transport demand, and also for certain cargo segments (liquid cargo, dry cargo, containers, metal & metal products, agribulk, chemicals, construction materials). In order to explain the evolution, and to reveal influencing factors, hydraulicity development was also examined, as well as aspects relating to macroeconomic, industry and sectoral evolution and infrastructure. When analysing these aspects, in combination with the development of the inland waterway transport demand, it can be concluded that the development of the inland waterway transport between 2014 and 2019 is influenced by several factors, and is therefore not a mono-causal process, but should be understood and regarded as the outcome of several different influencing factors.

Figure 1: Influencing factors for the development of inland waterway transport



Source: CCNR

The macroeconomic development in 2014-2019 was characterised by an ascending evolution between 2014 and 2017 and a slowdown of growth in 2018 and 2019. [64] At the same time, economic growth was more dynamic in eastern Europe (including Danube countries) than in western Europe (including Rhine countries).

The slowdown in macroeconomic growth that took place in 2018 and 2019 was one major reason for the rather weak results of container transport on the Rhine (and in Rhine countries) in 2018 and 2019, alongside hydraulicity issues. As well as containers, chemicals, iron ore, metals, and other goods also suffered on the Rhine and in western Europe under the less dynamic macroeconomic and industrial growth (the two being related) in 2018 and 2019.

In Danube countries, not only better macroeconomic fundamentals, but also an expansion in key industries such as steel production (in Hungary, Romania and Serbia) triggered an increase in metals and iron ore transport, which are key goods segments on the Danube. All steel industry related materials account for 45-55% of transport demand on the Middle Danube. Even if low water levels affected

[64] See figure 2, in chapter 1.2 (Economic context). For further reading, see the annual market observation report 2020, chapter 1.

Danube transport in 2014-2019, the better economic fundamentals led to a more positive evolution of cargo volumes and a stronger recovery in 2019. This can be seen not only on a country level but also on the level of inland ports traffic in Danube countries. While waterside traffic in major Rhine ports was 6.7% lower in 2019 than in 2014, waterside traffic in major Danube ports was 25% higher in 2019 than in 2014. Finally, major French and Belgian inland ports' waterside traffic was 8.7% higher in 2019 compared to 2014. [65]

The positive results in French and Belgian inland ports reflects an expansion in the key cargo segments in France and Belgium, sands, stones, gravel and building materials on the one hand, and agricultural products on the other hand. This expansion is driven by the strong commitment of stakeholders in the ports sector to shift cargo volumes from road transport to IWT, in combination with large regional construction and infrastructure projects. It therefore shows that growth for IWT can be triggered by a strong commitment from stakeholders in the ports and regional political sector. The positive trend in France and Belgium reflects also the fact that for these parts of Europe, demographic projections are positive, which is an important basis for growing transport demand in the construction sector.[66]

Hydraulicity was a major influencing factor for European inland navigation. However, the influence of the extreme drought on transport activity is more pronounced on the Rhine and the Danube compared to other European regions (for example France, Belgium, the Netherlands). Fluctuations in water levels are not a new phenomenon. But their economic impact is stronger today than in the 20th century, due to larger vessels with a higher draught, and due to more sophisticated logistical and production chains. Adaptation is needed in order to cope with low water periods due to the intensification of climate change in the future, mainly in three areas: 1) vessel design and vessel architecture, 2) river infrastructure, and 3) logistics and storage. While concepts for the first and third aspects already exist and can be applied, it should be noted that necessary infrastructure upgrading takes a long time to be realised. The optimisation of the fairway depth on the Middle Rhine, to name one of the most important projects, is not expected to be finalised before 2030.

Another important phenomenon for the development of IWW volumes in western Europe in 2014-2019 (and in the years to come), is the structural decline of carbon-related cargo such as coal and mineral oil products. It should be understood as a sectoral and industry related factor, which is independent from hydraulicity, infrastructure and even macroeconomic factors. The energy transition has already led and will lead to a further decline in volumes for those goods segments, especially for IWT on the Rhine, in Germany and in the Netherlands. The reduction in volumes (especially of coal) weighs heavily on total IWW volumes, and this reduction is currently barely compensated by other (existing or new) cargo segments. The decline of IWT's modal split share, which was observed at the national level (Germany and the Netherlands) as well as at EU level between 2014 and 2019 (see figure 12 in chapter 1.4 and figure 16 in chapter 2.5), can partly be attributed to the energy transition and lost coal volumes.

It is therefore necessary to think about the development of new markets for IWT. One example, which was described in the report, and relating to the Ports of Paris, is the urban transport of building materials. This is one example where the existing pattern (delivery of building materials by trucks) has many disadvantages in terms of urban pollution, traffic jams, accidents, logistical problems. In such situations, IWT can help to reduce these negative external effects, as well as concurrently increase its transported volumes (win-win situation). Along with the example of Paris, another recent project is the "Amsterdam Vaart!", by the city and the port of Amsterdam, the public company Waternet (water company for Amsterdam and surrounding area) and the research company TNO, which, together, managed and analysed nine construction projects in Amsterdam, where inland vessels were used instead of trucks for the delivery of construction materials and transport of excavation material. [67]

In addition to transport demand, the report also analysed the company sector, including employment and turnover. The following conclusions can be made: an increasing number of IWW transport workers are employed in passenger transport, which augmented its share in employment in the EU from 47.8%

[65] See chapter 3.2, Tables 2, 3 and 4.
[66] See also chapter 8 of the annual market observation report 2020 of the CCNR/European Commission, in particular the section on sands, stones, gravel and building materials.
[67] See the description of the project and the results on the website of the port of Amsterdam: https://www.portofamsterdam.com/en/business/cargo-flows/local-construction-logistics-water

in 2014 up to 51.9% in 2017. With regard to companies, a decrease in the number of goods transport companies can be seen during the same period of time. This decrease took place particularly in large western European IWT countries (the Netherlands and France), where the company sector in freight transport is very fragmented (many small family businesses). Despite the reduction in the number of companies), both in the Netherlands and in France, the structure of the market has not changed since 2014. In the Netherlands and in France, 96-97% of all companies in IWW freight transport had at maximum nine employed persons in 2014, and this was still the case in 2017. More recent data for the Netherlands (for 2019) show that even in this most recent year, still 97% of all Dutch IWT companies (both in freight and in passenger transport) had at maximum nine employed persons.

Regarding emissions in inland navigation, and given the current political and climate context, there is high urgency for all modes of transport to make their transition towards zero-emission. This is true for the IWT sector as well, both for air pollutant emissions, which have attracted the most attention since 2014, but also greenhouse gases, which have also been under the radars more recently. Despite the absence of comprehensive databases listing greening measures available on board of existing vessels or new vessels, expert interviews show that the number of vessels equipped with greening measures is rather limited. This can be explained by economic, technical and regulatory reasons. However, important efforts are being deployed by the IWT sector and many innovative solutions are currently being tested. Today, several scenarios are under study as there is no “one-size-fits-all” solution for realising the energy transition. It is foreseen that different (modular) options for zero-emission powertrains, using a mix of energy sources/fuels, will play a role to achieve this ambition objective.

While the number of goods transport companies and volumes of goods transported decreased between 2014 and 2019 in western Europe, passenger transport figures were far more positive. River cruises experienced a boom period between 2014 and 2019, a period during which the number of passengers on cruise vessels increased from 1.10 million in 2014 to 1.79 million in 2019 (+61.8%). Vessels active on the Rhine (including tributaries), Danube and Elbe represented 75% of all active vessels in the EU, compared to 72% in 2014. The number of foreign tourists from overseas augmented their share in demand figures, with US Americans and Canadians ranked first with a share of 37% of all cruise passengers in 2019, compared to 32% in 2014.

The activity of day trip vessels was also overall positive, although slightly less dynamic than river cruises. Day trip vessels in Amsterdam can be regarded as one important regional example for the activity of this sector in Europe. Passenger numbers increased from 3.9 million passengers in 2014 to 5.8 million in 2018 (+50.3%). The day trip sector is also very important in France, Germany, Switzerland and Italy. For Italy, the number of passengers on publicly available excursion vessels on Italian lakes increased from 10.1 million persons in 2014 to 11.9 million in 2019. The number of passengers on boats in Venice is even more significant and increased from 130.2 million in 2014 up to 144.7 million in 2018.

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