Impact Assessment support study for the revision of Directive 2005/44/EC on harmonised river information services (RIS)

Final Report

Written by Ramboll Management Consulting, Panteia & Transport & Mobility Leuven
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Directorate-General for Mobility and Transport
Directorate D — Waterborne
Unit D.3 — Ports & Inland Navigation

Contact: MOVE D3 Secretariat

E-mail: MOVE-D3-SECRETARIAT@ec.europa.eu

European Commission
B-1049 Brussels

EUROPEAN COMMISSION

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Directorate-General for Mobility and Transport

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Table of Contents

Table of Contents ..... **v**

List of Boxes ..... **vii**

List of Tables ..... **vii**

List of Figures ..... **ix**

Glossary ..... **xii**

1. Introduction and context **1**

1.1. Objectives and scope of the study 1
1.2. Inland waterway transport 2
1.3. Historical developments in IWT 6
1.4. Structure of the IWT sector 9
1.5. River Information Services and the RIS Directive 11
1.6. Main findings of the Evaluation of the RIS Directive 21
1.7. Synergies with other EU policy instruments 22

2. Problem definition **23**

2.1. Identification of the problem – what is the problem and why is it problematic? 23
2.2. Identification, evolution and implications of the problem 23
2.3. Analysis of the problem drivers 28
2.4. Future development and possible impacts of the problem drivers 36
2.5. Overview of the impact to stakeholders in relation to the identified problem drivers 37
2.6. Problem tree 38

3. EU Intervention **39**

3.1. Rationale for EU action 39
3.2. Added value of EU action 40

4. Objectives **41**

5. Policy measures and comprehensive policy options **43**

5.1. Baseline scenario 43

5.2. Policy measures 68
5.3. Comprehensive policy options 72

6. Assessment of impacts 75

6.1. Impacts per policy measure 75
6.2. Social impacts 94
6.3. Environmental impacts 95
6.4. Impacts per policy option 96

7. Comparison of policy options 98

7.1. Effectiveness 98
7.2. Efficiency 99
7.3. SMEs 100
7.4. Competitiveness 100
7.5. Conclusion 100

8. The preferred option 102

9. Monitoring and evaluation 106

List of Boxes

Box 1: Description of the role of river commissions 17

Box 2: The main problem identified as part of this IA 23

Box 3: Rationale of the RIS Directive 39

Box 4: The need for up-to-date information for reliable voyage and route planning 48

List of Tables

Table 1: Inland waterways transport - annual data 2021 9

Table 2: Number and size of firms in Pan-European fleet 10

Table 3: Links between the conclusions of the ex-post evaluation and the IA 21

Table 4: List of discarded measures 70

Table 5: Policy options grouping policy measures 74

Table 6: Overview of costs and benefits of measure 1 ('Increase level of harmonisation of RIS by providing guidelines for competent authorities') in the period 2025-2050. 76

Table 7: Overview of costs and benefits of measure 2 ('Introduce complaint mechanism (in Member States) to ensure a higher degree of harmonisation for RIS') in the period 2025-2050. 76

Table 8: Estimated costs to run complaint mechanism (in Member States) x EUR 1,000), per country 77

Table 9: Estimated one-off investments costs related to the complaint mechanism (in Member States) x EUR 1,000), per country 77

Table 10: Overview of costs and benefits of measure 3 ('Introduce a new Performance Measurement Framework') in the period 2025-2050. 78

Table 11: Estimated one-off investments costs related to the complaint mechanism (in Member States) x EUR 1,000), per country 78

Table 12: Overview of costs and benefits of measure 4 ('Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency') in the period 2025-2050. 79

Table 13: Estimated one-off investments costs related to the measure 'Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency'(x EUR 1,000), per country 80

Table 14: Estimated recurrent adjustment costs related to the measure 'Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency'(x EUR 1,000), per country 80

Table 15: Estimated one-off investments costs related to the measure 'Require electronic voyage plan reporting' (x EUR 1,000), per country 81

Table 16: Overview of costs and benefits of measure 6 ('Introduce provisions for supplying data to the ERDMS and its operation') in the period 2025-2050. 82

Table 17: Estimated costs to introduce provisions for supplying data to the ERDMS x EUR 1,000, per country 83

Table 18: Overview of costs and benefits of measure 7 (Encourage cargo related information exchange through eFTI mechanisms') in the period 2025-2050 83

Table 19: Overview of costs and benefits of measure 8 ('Enforce cargo related information exchange through eFTI mechanisms') in the period 2025-2050. 84

Table 20: Overview of costs and benefits of measure 9 ('Enforce information exchange through the RIS COMEX platform') in the period 2025-2050. 85

Table 21: Overview of costs and benefits of measure 12 ('develop new standards and technical specifications for the exchange of information relating to IWT ports') in the period 2025-2050. 88

Table 22: Overview of costs and benefits of measure 13 ('mandate new standards and technical specifications for the exchange of information relating to IWT ports') in the period 2025-2050. 89

Table 23: Overview of costs and benefits of measure 14 ('improve harmonisation between RIS and information services for other modes of transport (e.g. maritime)') in the period 2025-2050. 90

Table 24: Overview of costs and benefits of measure 15 ('oblige Member States to share all necessary data cross-border that are required for traffic management and transport management') in the period 2025-2050 91

Table 25: Overview of costs and benefits of measure 16 ('specify more clearly the cases for exchange of personal data') in the period 2025-2050. 92

Table 26: Overview of costs and benefits of measure 17 ('mandate new standards and technical specifications for the exchange of information relating to IWT ports') in the period 2025-2050. 93

Table 27: Impact on external costs of CO2 emissions, air pollution emissions, noise and habitats relative to the baseline in 2030, 2040 and 2050 (in million EUR, 2022 prices) 96

Table 28: Expected overall impacts for each option, per stakeholder category 97

Table 29: Overview of costs and benefits in NPC (in millions) 99

Table 30: Overview of costs – preferred option 102

Table 31: Overview of benefits (total for all provisions) – preferred option 103

List of Figures

Figure 1: Overview of study logic 2

Figure 2: Modal split as a percentage of tonne kilometres (1995-2020) 3

Figure 3: Map of the main transport routes across Europe 5

Figure 4: Development of IWT in Europe (2015=100) 6

Figure 5: Development of transport performance of IWT (tonne*kilometre) 6

Figure 6: Objectives of the RIS Directive 12

Figure 7: Map of countries where RIS Directive directly applies in full 13

Figure 8: RIS services and key technologies 18

Figure 9: Mapping of digitalisation in IWT and RIS 19

Figure 10: RIS enabled corridor management 24

Figure 11: Stakeholder Survey 1: Considering the overall problem, if the current RIS Directive is not revised, how do you expect the problem to develop in the future? (n=59) ..27

Figure 12: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65) 29

Figure 13: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65) 31

Figure 14: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65) 32

Figure 15: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65) 34

Figure 16: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65) 35

Figure 17: Stakeholder Survey 1: If the current RIS Directive is not revised, how do you expect the following problem drivers to develop in the future? (n=59) 36

Figure 18: Problem tree (problem driver, main problem and implications) 38

Figure 19: Various levels of objectives 41

Figure 20: Objective tree 41

Figure 21: Overview of forecasted volume of the current network (left) with Canal du Nord (CEMT I) and future network with Canal Seine-Scheldt (right) (CEMT Vb) 44

Figure 22: Transport performance in IWT (in Giga tonne*kilometre) 49

Figure 23: Development of transport demand in passenger shipping towards 2050 (in Giga passenger kilometres) 49

Figure 24: Number of vessel journeys 51

Figure 25: Number of border crossings 52

Figure 26: Number vessel kilometres 53

Figure 27: Number of ships / barges in IWT 54

Figure 28: Index productivity per vessel (2003=100) 55

Figure 29: Historical development of the number of inland passenger ships in Europe 57

Figure 30: Development of number of self-propelled cargo vessels 57

Figure 31: Development of number of passenger vessels 57

Figure 32: Development of the number of ships in Europe, freight as well as passenger transport 58

Figure 33: Energy consumption in inland navigation 59

Figure 34: Development of energy consumption in inland navigation 59

Figure 35: Total energy use in passenger shipping 60

Figure 36: Emissions of CO_2 of inland vessels on Dutch territory plotted between 1990 and 2020 (kton) 61

Figure 37: CO_2 emissions from EU inland navigation 61

Figure 38: Emissions of NOx of inland vessels on Dutch territory plotted between 1990 and 2020 (kton) 62

Figure 39: NOx emissions from EU inland navigation (in ktons) 63

Figure 40: particulate matter emissions of inland vessels on Dutch territory plotted between 1990 and 2020 (ton) 64

Figure 41: particulate matter emissions from EU inland navigation (in ktons PM2.5) 64

Figure 42: Registered accidents in inland navigation in the EU (2009-2019) 65

Figure 43: Number of accidents in EU inland navigation (2015-2050) 66

Figure 44: Turnover and profit of the inland shipping sector in 2015 67

Figure 45: Transport costs in inland navigation 67

Glossary

Acronym/ Term	Definition
AIP	Application Programming Interfaces are sets of protocols and tools used to develop software applications that can interact with RIS data and services.
AIS	Automatic Identification System is an automated tracking system that displays other vessels in the vicinity.
BICS	The Dutch Inland Shipping Information and Communication System is an electronic reporting system for users RIS users and other parties that engage in the process of electronic reporting in inland shipping in the Netherlands.
BRG	The Better Regulation Guidelines are a set of guidelines developed by the European Commission to improve the quality of EU legislation and ensure that regulatory measures are efficient, effective, and transparent.
CCNR	The Central Commission for the Navigation of the Rhine is an international organization that is responsible for promoting the development and safety of inland navigation on the Rhine and its tributaries.
CEERIS	The Central & Eastern European Reporting Information System is a cross-border one-stop-shop platform with river information services covering 8 European countries.
CEF	The Connecting Europe Facility is a European Union funding instrument that supports the development of trans-European infrastructure networks in the fields of transport, energy, and telecommunications.
CEMT	The European Conference of Ministers of Transport is an intergovernmental organization promoting cooperation among European countries in the field of transport.
CEMT-class	An inland waterway classification according to CEMT (European Conference of Ministers of Transport) concerning allowed vessels dimensions on a fairway.
CESNI	The European Committee for Drawing Up Standards in the Field of Inland Navigation is an intergovernmental organization that develops technical and safety standards for inland navigation in Europe.
CESNI/TI	CESNI/TI refers to the CESNI Working group on information technologies.

Acronym/ Term	Definition
DAVID forms	The forms that unify the data fields of the three most commonly used border control forms (arrival and departure notification, crew list and passenger list).
DIWA	The Digital Inland Waterway Area refers to the implementation of digital technologies and data-driven solutions to improve the efficiency, safety, and sustainability of inland waterway transportation.
DIWA Masterplan	The Masterplan Digitalisation of Inland Waterways (DIWA) is a CEF funded multi-Beneficiary project aiming at developing a digitalisation strategy for IWT in the period 2022 until 2032.
DTLF	The Digital Transport and Logistics Forum is a multi-stakeholder platform established by the European Commission to promote the digitalization of transport and logistics services in Europe.
EBU	The European Barge Union is a trade association that represents the interests of the inland waterway transport sector in Europe.
EC	The European Commission is one of the seven main institutions of the European Union.
ECDIS	The Electronic Chart Display and Information System is a computer-based navigation system used on ships to display navigational information and provide real-time information about the ship's position, course, and speed.
EEA	The European Environmental Agency is an agency of the European Union (EU) established to provide reliable and independent information on the environment to policymakers and the public.
EFIP	The European Federation of Inland Ports is a non-profit organization that represents the interests of inland ports in Europe.
EFTI	Electronic Freight Transport Information is a digital system that enables the exchange of information related to freight transport between different actors in the supply chain.
EMSA	The European Maritime Safety Agency is an agency of the European Union established to improve the safety and security of maritime transport and to prevent marine pollution.
ERDMS	The Electronic Document and Records Management System is a software application that manages digital information with document management and records management functionalities.
eRIBA	eRIBA is a platform allowing to report digitally on all waterways in Flanders and on the Western Scheldt (including the Dutch side of the North Sea Port).

Acronym/ Term	Definition
ERINOT	The ERI Notification Message is a standard used for the reporting of voyage related information and of information on dangerous and non-dangerous cargo carried on-board vessels sailing on inland waterways.
ERIRSP	The ERI Response Message is a standard used to respond to the ERI Notification Message.
ERIVOY	The ERI Voyage Plan Message is a standard used to report voyages which include multiple stops or changes of the convoy.
ESO	The European Skipper's Organisation is a non-profit association that represents the interests of professional skippers in Europe.
ESPO	The European Sea Ports Organisation is a non-profit organization that represents the interests of seaports in Europe.
ETN-SAS	The European Training Network for Safer Autonomous Systems
EU	The European Union is a political and economic union of 27 member States located in Europe.
EuRIS	EuRIS is a cross-border one-stop-shop platform with river information services covering 13 European countries.
FTE	Full-time Equivalent is a unit of measurement used to represent the workload of a full-time employee during a specified period of time.
GDPR	The General Data Protection Regulation is a regulation implemented by the EU to protect the privacy and personal data of EU citizens.
IA	An Impact Assessment is a process used to evaluate the potential economic, social, environmental, and other effects of a proposed policy, program or project.
IALA	The International Association of Marine Aids to Navigation and Lighthouse Authorities is an international non-governmental organization promoting the safe and efficient movement of vessels in international waters.
IENC	The Inland Electronic Navigational Chart is a digital chart that displays crucial information for navigation in inland waterways.
IMO	The International Maritime Organisation is a specialized agency of the United Nations (UN) established to promote safe, secure, and environmentally responsible shipping.
IPCC	The Intergovernmental Panel on Climate Change is a scientific intergovernmental body established by the UN to provide objective

Acronym/ Term	Definition
	and scientific information on climate change.
ITS	Intelligent Transport Systems are advanced technology systems used to improve transportation efficiency, safety, and sustainability
IWT	Inland Waterway Transport refers to the transportation of goods and passengers using rivers, canals, and other inland waterways.
MCA	A Multi-Criteria Analysis is a decision-making method that is used to evaluate alternatives based on multiple criteria.
MLH	A Marine Litter Hunter is a device or tool designed to collect and remove marine litter or debris from the ocean, rivers, or other water bodies.
NAIADES	NAIADES is the Action Programme in support of inland waterway transport, running from 2006 to 2013.
NaMIB	The German Electronic Reporting and Information System in Inland Navigation.
NPV	Net Present Value is a financial concept used to determine the current value of a stream of future cash flows.
NRMM	Non-road mobile machinery refers to any mobile machinery or equipment that is not designed for use on public roads or highways.
NRMM Stage V	Non-road mobile machinery standards that tighten restrictions on non-road engines and equipment and set stricter limits on emissions of particulate matter.
PIANC	The World Association for Waterborne Transport Infrastructure is an international organization that focuses on improving the planning, design, construction, maintenance, and operation of waterborne transportation infrastructure around the world.
RCC	A Remote Control Centre refers to a facility or control room from where remote monitoring and control of vessels or other maritime infrastructure is conducted.
RIS	River Information Services are a set of digital services and tools designed to enhance the safety, efficiency, and sustainability of inland waterway transport.
RIS COMEX	A multi-beneficiary project aiming at the definition, specification, implementation and sustainable operation of Corridor River Information Services.
SCBA	A Social Cost Benefit Analysis is an economic tool used to evaluate

Acronym/ Term	Definition
	the social benefits and costs of a particular project or policy.
SDG	The Sustainable Development Goals are a set of 17 goals established by the United Nations in 2015 as a blueprint for achieving a better and more sustainable future.
SME	Small and Medium-sized Enterprises refers to businesses with a limited number of employees and relatively low revenue compared to larger enterprises.
SWD	A Staff Working Document is a working document published by the Commission.
SWING	The Single Window for Inland Navigation is a platform allowing inland navigation operators and the waterway and port authorities to exchange navigation data, such as on the route, the type of cargo and on the ship.
TEU	A Twenty Foot Equivalent Unit is a unit of measurement used in the shipping industry to measure the carrying capacity of a container ship.
TIS	Traffic Information Services are services that provide real-time information on traffic conditions.
TMS	A Terminal Management System is a software application used to manage the operations of a transportation terminal.
TOS	A Terminal Operating System is a software application that is used to manage the operations of a container terminal.
TTIS	Traffic and Travel Information Services are services that provide real-time information to travellers about traffic conditions, transportation services, and other travel-related information.
UKC	Under Keel Clearance is the vertical distance between the lowest part of the ship's hull and the seabed.
UNECE	The United Nations Economic Commission for Europe is a regional commission of the UN.
VELI France	Online application that allows RS users to file travel declarations online for their voyages in France.
VHF	Very High Frequency Marine Radio allows instant communications between vessels and marinas, bridges and authorities.
VTMIS	The Vessel Traffic Management Information System is a nautical vessel movement observing system.

Source: elaboration of the contractor (2023)

Introduction and context

This document forms the Final Report of the Impact Assessment (IA) Support Study for the Revision of Directive 2005/44/EC on Harmonised River Information Services (RIS).[1] The study, which ran from February 2022 until February 2023, was awarded by the Directorate-General for Mobility and Transport (DG MOVE) of the European Commission to a Consortium led by Ramboll Management Consulting along with Panteia, Transport & Mobility Leuven and individual subcontracted experts.

Objectives and scope of the study

This study aimed to support the Commission in identifying and analysing policy options for possible revision of the RIS Directive. IAs aim to collect evidence (typically starting from the evaluation results, in this case especially the Commission Staff Working Document (SWD)[2], as well as older ones), to assess whether future legislative or non-legislative EU action is desired and justified to update an intervention and, if so, how it can best be designed to achieve the relevant policy objectives in the most effective and efficient way. In particular, IAs:

- Identify and describe the problem to be tackled
- Establish objectives for the EU action
- Formulate policy options, assess their potential impacts and, where appropriate, identify a preferred option
- Set out how the expected results will be monitored and evaluated

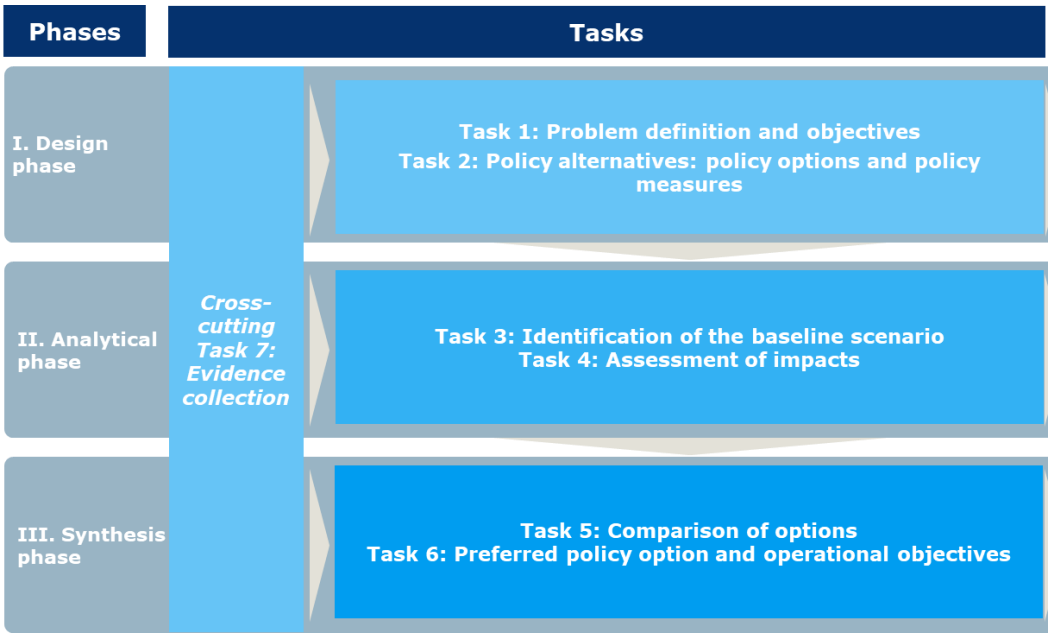
An IA is required for Commission initiatives that are likely to have significant economic, environmental, social and other relevant impacts or which entail significant spending, and where the Commission has a choice of policy options. IAs support the policy-making and decision-making process by feeding the evidence-based information needed to take an informed decision. IAs thus lead to more informed decision-making and in this way contribute to "better regulation" that delivers the full benefits of policies at minimum cost, while upholding the principles of subsidiarity and proportionality.

The study followed a series of tasks, as summarised in the figure below:

[1] Request for Service No. MOVE/D3/2021-692 in the Context of the Framework Contract With Re-Opening of Competition for Impact Assessment and Evaluation Support Studies in the Field of Transport MOVE/A3/2017 – 257.

[2] European Commission (2021). Commission Staff Working Document, Evaluation of the Directive 2005/44/EC on Harmonised River Information Services (RIS) {SWD(2021), EN, 51 final}. Henceforth referred to as "2021 Evaluation of the Directive"

Figure 1: Overview of study logic



Source: elaboration of the contractor (2022)

Inland waterway transport

The EU's inland waterway network stretches for around 37,000 kilometres and is a key means of connecting seaports, cities and industrial centres.[3] 13 Member States[4] are part of the interconnected waterway network. Dotted with over 250 inland ports, this network offers an alternative to transport via road or rail.[5] The European transport sector has been growing in a stable way, both in terms of passenger transport (1.2% growth rate annually of passengers per kilometre during the 1995-2019 period) and freight transport (1.4% growth rate annually of tons per kilometre during the 1995-2019 period).

In terms of modal split of freight transport in Europe in 2020, the road transport sector remains the most important with a market share of 53.3%, while sea transport accounted for 28.2% and IWT for 4%. This modal split remained virtually unchanged during the 1995-2020 period, as shown in the figure below.[6]

[3] European Commission (2018), Staff Working Document on digital inland navigation: https://transport.ec.europa.eu/document/download/666efbca-7e11-41e8-89a7-0352cbc37e04_en?filename=swd20180427-digital-inland-navigation.pdf

[4] Austria, Belgium, Bulgaria, Czechia, Germany, France, Croatia, Hungary, Luxembourg, the Netherlands, Poland, Romania and Slovakia.

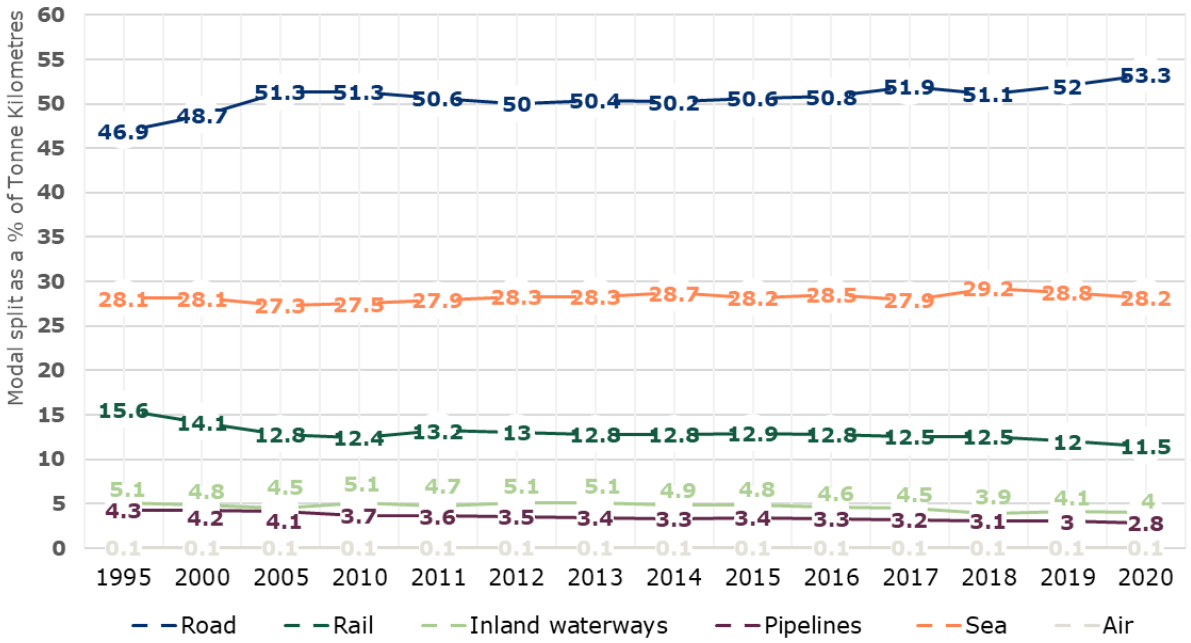
[5] European Commission (2016), Staff Working Document Refit Ex-Post Evaluation of Combined Transport Directive 92/106/EEC Final Report:

https://ec.europa.eu/transparency/documents-register/api/files/SWD(2016)140_0/de00000000292714?rendition=false

[6] European Commission (2021), Statistical pocketbook 2021:

https://op.europa.eu/en/publication-detail/-/publication/14d7e768-1b50-11ec-b4fe-01aa75ed71a1

Figure 2: Modal split as a percentage of tonne kilometres (1995-2020)



Source: European Commission (2022). Statistical Pocketbook – EU Transport in figures[7]

Some countries have tapped into IWT's potential more than others with high modal splits for the sector in terms of freight transport. Germany and the Netherlands are accounting for 70% of overall EU IWT transport[1]. In terms of modal split within each Member State, IWT has a significant role within the Netherlands (39.7%), Bulgaria and Romania (28% each) and much lower share for Belgium (10.9%), Luxemburg (8.2%), Germany (7.3%), Croatia (6.0%) and Hungary (4.7%). On the other hand, (freight) IWT tends to be rather marginal in Slovakia (2.9%), Austria and France (2.1% each)[8]

Despite operating with an average modal share of 4.6% over the period 2010-2020, IWT has provided, and continues to provide notable advantages as a mode of transport in comparison with other modes. One such advantage is the comparable environmental benefits of the transport of large bulk goods and over dimensional cargos. For instance, transporting goods via inland waterways uses only around 17% of the energy per km/ton of road transport and 50% of rail transport, and also creates significantly less noise emissions.[9] Moreover, there is little congestion on waterways compared to other modes of transport[10]. The modal shift strategy of the EU and its Member States, as expressed in:

[7] https://op.europa.eu/en/publication-detail/-/publication/f656ef8e-3e0e-11ed-92ed-01aa75ed71a1

[8] European Commission (2022), Statistical pocketbook, EU transport in Figures 2022: https://op.europa.eu/o/opportal-service/download-handler?identifier=f656ef8e-3e0e-11ed-92ed-01aa75ed71a1&format=pdf&language=en&productionSystem=cellar&part=

[9] European Parliament (2022): Briefing, Inland waterway transport in the EU:

https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698918

[10] CARIS, An; Limbourg, S.; Macharis, C.; van Lier, T. & COOLS, Mario (2014) Integration of Inland Waterway Transport in the Intermodal Supply Chain: a Taxonomy of Research Challenges. In: Journal of Transport Geography, 41, p. 126-136.

The European Green Deal[11], which says that a substantial part of the 75% of inland freight carried today by road should shift onto rail and inland waterways.

The Sustainable and Smart mobility strategy, in particular its point 45 "Transport by inland waterways and short sea shipping will increase by 25% by 2030 and by 50% by 2050" [12].

The Zero Pollution Action Plan[13] with its objectives towards zero pollution.

The aspect of safety within the IWT sector, compared with other modes, is also notable, particularly in the transportation of dangerous goods, when compared to other possible options.[14] The fact that 75% of EU waterway traffic crosses borders underlines the importance of measures to harmonise the exchange of information and support overall interoperability of systems along Europe's inland waterways.[15]

Despite these advantages, IWT also operates within a specific set of characteristics and challenges which can limit the interoperability[16] of the sector with other modes. For example, for IWT to be considered as part of the urban logistics/passenger transport chains, thus the location of the waterway is pivotal, with there a need for IWT ports to be close/flowing through urban centres[17] to be easily connected to other transport modes. This can be the case in some cities, but not in all. In Europe, for example, IWT is heavily concentrated in the Rhine corridor, with the Danube being a key pillar of the European inland waterway network, as shown in Figure 3 below.

In addition to the challenges related to the geographical location of inland waterway routes, meteorological and hydrological challenges persist. Significant fluctuations in the water level, for example, can cause fairway depth limitations, and unreliability of locks, which can also result in unreliable logistic operations and unpredictable prices lead to limited interest among shippers[18]. In particular, the last decade has been characterised by extreme draughts and low water levels have had a significant impact on the ability for inland vessels to transport goods, with the years 2018, 2019 and 2022 being notable for persistent

[11] European Commission (2019), Communication from the Commission, The European Green Deal:

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0640&from=EN

[12] European Commission (2020), Sustainable & Smart Mobility Strategy: putting European transport on track for the future: https://transport.ec.europa.eu/transport-themes/mobility-strategy_en

[13] European Commission (2021), Communication from the Commission :" Towards Zero Pollution for Air, Water and Soil", COM(2021)400 final: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0400&from=EN

[14] European Parliament (2022): Briefing, Inland waterway transport in the EU: https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698918

[15] https://www.ccr-zkr.org/files/documents/om/om17_II_en.pdf

[16] Interoperability is generally defined as the ability of two, or more, transport systems to operate effectively and efficiently together. See: Mulley, C., Nelson, J.D., 1999. Interoperability and transport policy: the impediments to interoperability in the organisation of trans-European transport systems. Journal of Transport Geography 7, 93–104. https://doi.org/10.1016/S0966-6923(98)00046-5

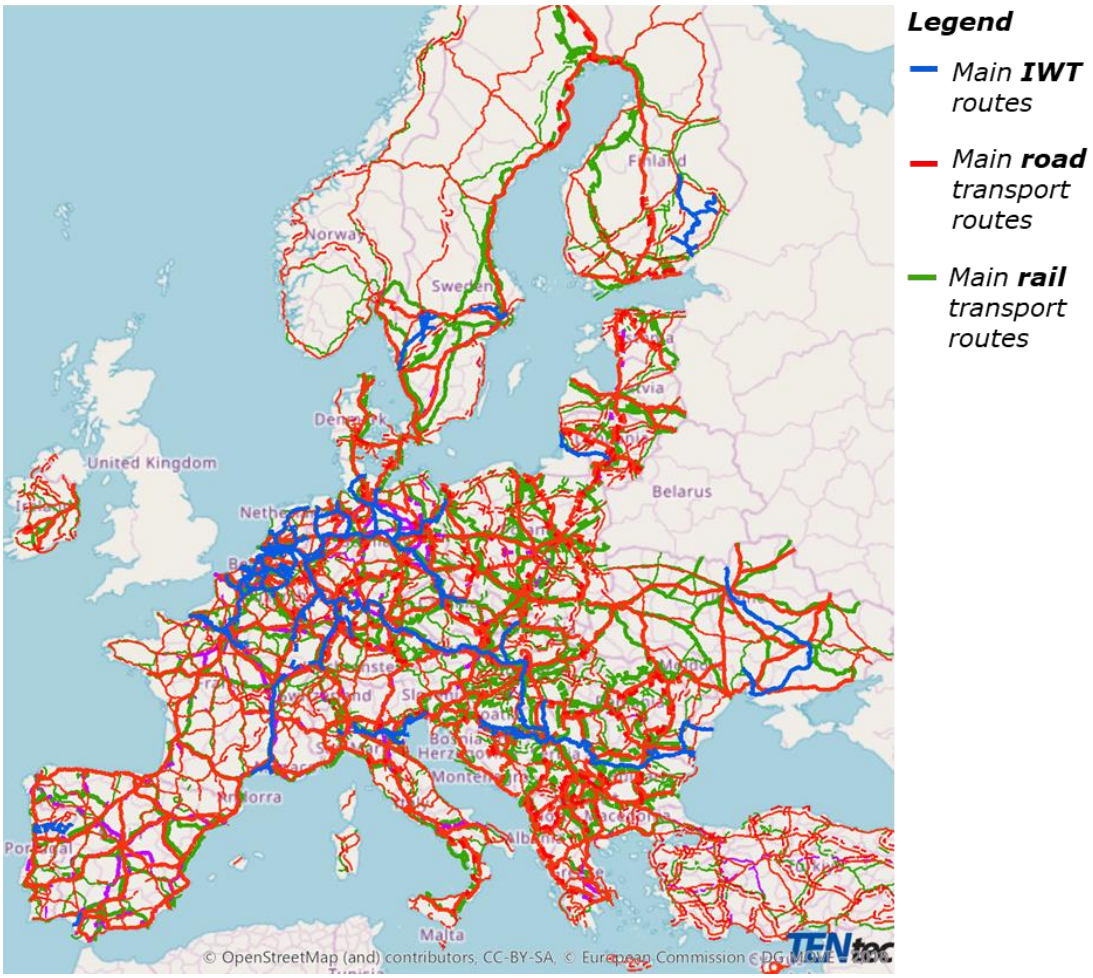
[17] CCNR (2022). Thematic report an assessment of new market opportunities for inland waterway transport, published in February 2022

[18] Wiegmans, B. and Konings, R. (2017). Inland Waterway Transport. New York: Routledge, ISBN 9781138826717.

droughts[19]. Climate change has become an undeniable driver in exacerbating this issue further, with climate modelling suggesting that these types of weather episodes are likely to become more frequent and intense[20]. Put together, these issues have had an impact on the number of business and long-term job losses within the IWT sector[21].

The economic downturns over the last decade, together with fierce price competition with other modes of transport have also hindered investments in new or innovative technologies and have resulted in majority of vessels being old and ill-equipped for the planned transition to zero-emission mobility[22].

Figure 3: Map of the main transport routes across Europe



Source: European Commission (2018). TENtec Interactive Map Viewer

[19] https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1059

[20] Toreti, A., Belward, A., Perez-Dominguez, I., Naumann, G., Luterbacher, J., Cronie, O., Seguini, L., Manfron, G., Lopez-Lozano, R., Baruth, B. and van Den Berg, M., (2019). The exceptional 2018 European water seesaw calls for action on adaptation. Earth's Future, 7(6), pp.652-663. And https://joint-research-centre.ec.europa.eu/jrc-news/european-droughts-2018-warning-things-come-2019-06-17_en

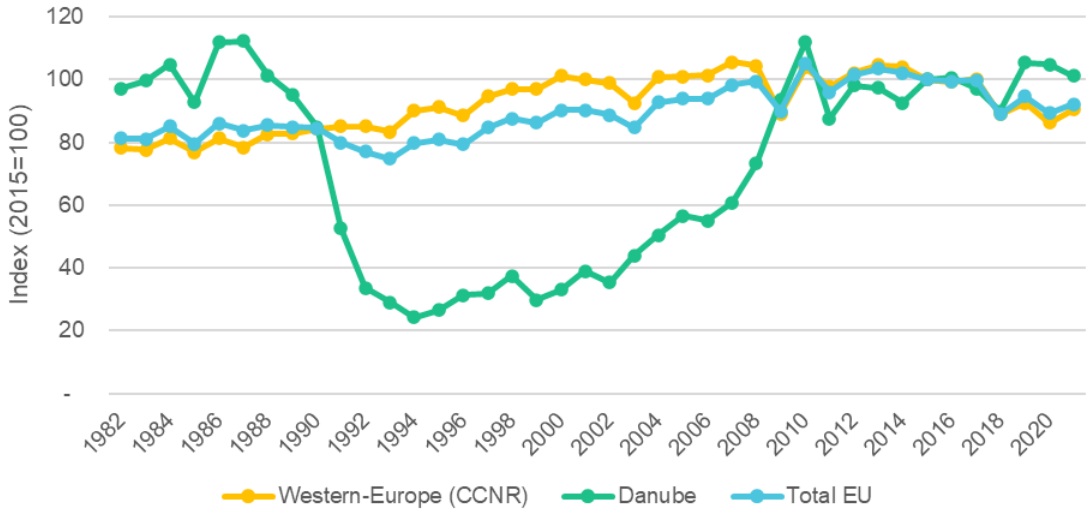
[21] Streng, M., Saase, N., and Kuipers, B. (2020). Economische impact laagwater Een analyse van de effecten van laagwater op de binnenvaartsector en de Nederlandse en Duitse economie. https://www.eur.nl/upt/media/2020-04-erasmusupt-eindrapporteconomischeimpactlaagwater0

[22] https://inland-navigation-market.org/?lang=en

Historical developments in IWT

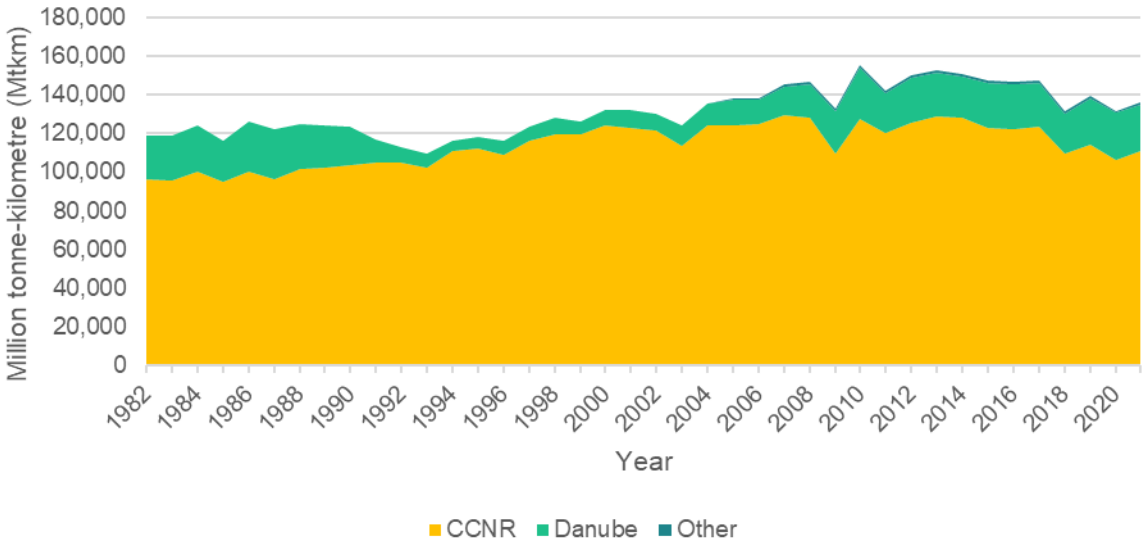
The following graph shows the development of the transport volumes in inland navigation from a historical perspective. For freight transport, transport performance is measured in tonnes transported times the distance travelled. For passenger transport, performance is measured in persons transported times the distance travelled.

Figure 4: Development of IWT in Europe (2015=100)



Source: Eurostat, table IWW_GO_QNAVE (full availability for CCNR countries since 1982, full availability for Danube countries since 2005 – earlier years based on statistics of the Danube Commission).

Figure 5: Development of transport performance of IWT (tonne*kilometre)



Source: Eurostat, table IWW_GO_QNAVE (full availability for CCNR countries since 1982, full availability for Danube countries since 2005 – earlier years based on statistics of the Danube Commission).

In the period under analysis (i.e. the modelling years for the baseline will be 2025, and in 5 years steps until 2045), **there have been several important developments in the sector**. Firstly, Figure 5 shows that **European inland navigation volumes have hardly increased since 1982**; in particular in the 1980s, inland navigation hardly experienced any growth. This applies, as illustrated above, to volumes but also to the size of the fleet (for the development from 2003 onwards, see paragraph 6.4). In particular, the then ongoing oil crisis limited economic growth. Although the first container liner services were set up on the Rhine in the

1970s, it was not yet possible to exploit this concept. It was not until 1987 that the first inland container terminal was set up in the Netherlands. In 1985, the volume of containers on the Rhine was only 200,000 Twenty Foot Equivalent Unit (TEU). Today, about 5 million TEU are transported annually on the inland waterways. In the mid-1980s, European inland navigation found itself in a major crisis. The fleet was old, the expectations for the future were not good and there was a large overcapacity, especially in the smaller tonnages.

The 1990s were marked by further **liberalisation of the inland navigation markets**. Inland water transport domestic markets were protected on a national scale and did not have free access. Cargo was distributed by rotation with exchange systems, at set rates, to registered shipping companies. During the 1990s, boatmen's exchanges were abolished and free competition in inland navigation became a reality. The result of this was significantly lower freight rates, but due to the higher volume, and the higher turnover rate, the annual revenue remained at the same level. The cabotage regime also contributed to a better use of inland vessels. The volumes in the 1990s developed positively for inland navigation. This was due to economic growth, but also due to strong liberalisation. Volumes on the Rhine increased by 10%, but there was particularly rapid growth in transport on the north-south axis, as well as inland transport in the Netherlands (+35%) and Belgium (+20%), all of which was achieved in the last two years after the abolition of compulsory rotation.

In contrast, Danube transport collapsed completely in the 1990s. This was due to the lifting of the Iron Curtain which resulted in state shipping companies suddenly having to operate in a free market and compete with other modes. With outdated equipment and poor navigability of the Danube, this was not easy and many of these companies went out of business. In addition, the war in the former Yugoslavia caused an economic downturn and many infrastructure damages. As a result, transport performance on the Danube collapsed.

The first decade of the 21st century was the first under a completely free market regime for inland navigation. All restrictions, for example, regarding cabotage or free negotiations between skippers and shippers, were off the table. A substantial proportion of cargo was traded on the spot market[23]. Chartering offices or shipping companies are clients of private individual-owned SMEs, who still form the majority of the market and in most cases, and in most cases, only operate a single ship. Also, as a result of the free market, empty sailing has been reduced, as ships do not have to return to the boatmen's' exchange. It is worthy to highlight that 2003 saw extremely low water conditions. In the first decade of the 21st century, inland container shipping in particular experienced a strong advance. The number of container terminals along the Rhine increased sharply and also in the domestic markets (e.g. the Netherlands and Belgium)[24]. Inland navigation has become a serious player in this market segment, which also requires a specific type of vessel optimised for container ships. Earnings increased and at the end of the period described, many companies decided to renew their fleets.

While inland navigation did well in the period 2000-2007, it did poorly in the period 2008-2013. The year 2008 could be described as good, with sufficient demand for freight. However, the first effects of a cooling economy and upcoming recession were felt in the last six months of the year. In 2009, the credit crisis hit Europe hard and volumes in the inland shipping sector fell drastically. Afterwards, however, inland shipping quickly recovered, as far as volumes were concerned. Rates and therefore earnings lagged behind[25], mainly due to a large fleet expansion that took place in this period. Also noteworthy is the nuclear disaster that took place in Fukushima (Japan) in 2011. As a result, the demand for large shipping

[23] The spot market involves variable contracts with shipping companies.

[24] Source: Rijkswaterstaat weekmonitor. This data source contains all journeys through the Netherlands.

[25] Vrachtprijsmonitoring, Panteia data

units to transport coal increased. This further supported the market recovery. In 2014, we can thus say that the crisis in inland shipping was over.

From 2014 onwards, the inland shipping market recovered well. Coal transport provided a much-needed boost to the dry cargo market, especially for the larger vessels. These were also able to benefit from an increase in container volumes and, subsequently, a rebound in the volume transported on the national markets. In addition, a large number of obsolete vessels were taken out of service due to technical requirements. This resulted in a better balance between demand for shipping space and supply of capacity. In the tanker shipping sector, in particular, the steep drop in the price of oil after 2015 led to a strong rebound in the volume of transport. In addition, the obligation to transport all mineral oil products in double-hulled tankers (by 2019 at the latest) resulted in a considerable reduction in fleet capacity. Tourism was booming and a record number of passenger ships sailed Europe's international rivers. In 2018, inland navigation experienced historic low water levels on all major free-flowing rivers in Europe. As a result, the volume on the Rhine and Danube fell sharply. Container ships and double-hulled tankers could not navigate the shallow depths of the Rhine at Sankt Goar for about one month. Industrial companies in the Upper Rhine area were particularly affected. One year later, there was a limited recovery in volumes, but the economy was cooling down due to global trade tensions and, as a result of the energy transition, less demand for coal.

In 2020, inland navigation was hit by a new crisis. The outlook was already poor due to the aforementioned trade tensions. This already led to lower demand for ores and metal products in German industry. In addition, increasingly coal-fired power stations are being closed in Germany, which means that demand is also falling in that market segment. On top of this, in March 2020 a Europe-wide lockdown occurred as a result of the COVID-19 crisis, which reduced the demand for raw materials in certain industries and resulted in the non-production of finished products. Moreover, waterway operators greatly reduced the operation of bridges and locks to limit the transmission of virus particles among operating personnel. This led to restrictions on the Upper Rhine, the Moselle, the Rhine-Main-Danube connection and various inland waterways. The number of containers transported fell for the first time in years, although there was a strong recovery in the autumn. The tanker market was still able to benefit during the first few months from major storage obligations but has also experienced a major dip since June. Storage tanks in seaports are full and refineries in the hinterland have reduced production.

In 2021 and 2022, there was a strong recovery in the inland shipping sector. This was mainly driven by German energy policy and the war in Ukraine and the resulting energy effect. In 2021, Germany shut down some of the last nuclear power plants and additional energy had to be generated, some of it using coal. The inland navigation sector benefitted from this. In 2022, the importance of coal-based energy generation became even greater due to the interruption of gas supplies from Russia.

Structure of the IWT sector

The inland navigation fleet comprises passenger and freight vessels of numerous types. The diversity of vessels in IWT is quite large, as shown in the table below.

Table 1: Inland waterways transport - annual data 2021

Countries	No. Inland freight water transport enterprises	No. Inland freight water transport persons employed	No. Inland passenger water transport enterprises	No. Inland passenger water transport persons employed	Total transported goods (In thousand tonnes)
Belgium	288	615	58	128	166,160
Bulgaria	24	546	3	:	18,093
Czechia	23	289	69	:	344
Denmark	5	33	14	168	:
Germany	533	4,920	350	4,793	195,093
Estonia	0	0	6	:	:
Ireland	0	0	38	104	:
Greece	12	76	26	156	:
Spain	9	64	101	405	:
France	651	1,974	256	2,021	56,647
Croatia	5	49	26	39	6,548
Italy	107	665	1,000	2,259	980
Cyprus	0	0	0	0	:
Latvia	5	136	14	16	:
Lithuania	0	0	42	:	6,221
Hungary	22	98	:	:	8,022
Malta	0	0	4	:	:
Netherlands	3,279	9,868	1,085	2,991	369,141
Austria	11	:	81	:	8,271
Poland	263	581	147	:	2,075
Portugal	1	:	57	:	:
Romania	74	1,541	129	516	32,120
Slovenia	1	:	53	:	:
Slovakia	15	287	43	74	6,013
Finland	10	56	58	182	579
Sweden	69	274	335	835	2,033
Iceland	1	0	5	27	:
Norway	:	:	18	43	:
Switzerland	29	524	:	:	:
Serbia	50	944	12	64	:
Bosnia and Herzegovina	11	12	:	:	:

Source: Eurostat (2022). IWW_GO_ANAVE, IWW_GO_ATYGO, SBS_NA_1A_SE_R2. N.B. The colours show how large the value is within each category (per column); the darker the colour, the higher the value. (:) indicates no data available.

The table below provides a detailed overview of the number and size of firms in the Pan-European fleet. The table shows the crucial importance of small firms (i.e. usually SMEs) within the European inland waterway sector.

Table 2: Number and size of firms in Pan-European fleet

Structure	Number of firms	Number of vessels	Percentage of firms	Percentage of owned vessels
General cargo ship				
>2 vessels firms	125	559	2,62%	9,98%
2 vessel firms	395	790	8,28%	14,10%
1 vessel firms	4,253	4,253	89,11%	75,92%
total	4,773	5,602	100,00%	100,00%
unknown		333		
Freight push barges				
>2 vessels firms	239	2787	30,29%	80,53%
2 vessel firms	124	248	15,72%	7,17%
1 vessel firms	426	426	53,99%	12,31%
total	789	3461	100,00%	100,00%
unknown		134		
Tanker vessels				
>2 vessels firms	132	784	12,09%	42,33%
2 vessel firms	108	216	9,89%	11,66%
1 vessel firms	852	852	78,02%	46,00%
total	1,092	1,852	100,00%	100,00%
unknown		88		
Cruise ships				
>2 vessels firms	92	484	11,63%	37,64%
2 vessel firms	103	206	13,02%	16,02%
1 vessel firms	596	596	75,35%	46,35%
total	791	1,286	100,00%	100,00%
unknown		44		

Source: IVR, CCNR (2017)

As set out in 2022 CCNR thematic report[26], **the structure of IWT across Europe is reliant upon traditional market segments, including dry cargo, liquid cargo as well as container transport**. In 2021, the number of inland vessels in Europe comprised more than 10,000 vessels registered in Rhine countries, 3,500 in Danube countries and 2,300 in other European countries[27]. The newbuilding rate for dry cargo vessels decreased by eight units, from 26 in 2020 to 18 in 2021. Regarding tanker vessels, the number of newly builds increased by 4 units, from 40 units in 2019 to 54 in 2020 and 58 in 2021.

Trends in the IWT sector point towards passenger transport (e.g. ferry transport, other public waterway transport, day trips, river cruises) as an important component which, although it suffered greatly from the Covid-19 pandemic, has seen positive demand trends over the past decades (see Figure 31 below). Indeed, the consequences of the pandemic were noted to have been particularly severe for passenger transport with reports for this category showing an increasing trend from 17,895 employees in 2010 to 23,100 in 2019, whilst in 2020 the employment levels decreased to 21,023 employed persons. To compare, the number of employed persons in the transport of goods sector counted 23,170 persons in 2020, mildly above the employment in passenger transport.

[26] CCNR (2022). Thematic report an assessment of new market opportunities for inland waterway transport. Available at: https://inland-navigation-market.org/wp-content/uploads/2022/03/Thematic-report_20212022_EN_BD.pdf

[27] CCNR (2022). Annual Report. Inland navigation in Europe market observation. Available at: https://inland-navigation-market.org/wp-content/uploads/2022/10/CCNR_annual_report_EN_2022_BD.pdf

Future outlooks from the CCNR also note the role of the energy transition within Europe as having an important effect on freight volumes in the IWT, primarily on the transportation of coal. Liquid mineral oil products will however continue to be a key component of the energy sector and of inland navigation for the next decade, but it is anticipated that this will decline slowly overtime.

Addressing climate change has moved to the forefront of EU policy in recent years. The European Green Deal[28] and the Sustainable and Smart Mobility Strategy[29] demonstrate this. Particularly relevant for this study is that shifting a considerable part of the share of inland freight done by road transport (currently 75%) to inland waterways and rail is among its targets. In line with this, the second policy priority of the RIS Directive is fostering the green transition, as many of the RIS technologies aim to also improve the sustainability of the IWT sector.

River Information Services and the RIS Directive

Directive 2005/44/EC, (henceforth referred to as the "RIS Directive"), establishes a framework for the deployment and use of harmonised, interoperable and open river information services. It applies to the Member States which have inland waterways falling within the scope of the Directive[30]. RIS is defined in the RIS Directive as:

> "*River Information Services (RIS)' means the harmonised information services to support traffic and transport management in inland navigation, including, wherever technically feasible, interfaces with other transport modes. RIS do not deal with internal commercial activities between one or more of the involved companies but are open for interfacing with commercial activities. RIS comprise services such as fairway information, traffic information, traffic management, calamity abatement support, information for transport management, statistics and customs services and waterway charges and port dues*."
>
> Directive 2005/44/EC, Article 3

The RIS Directive operates according to four general objectives and two specific objectives and operational objectives, respectively. The objectives of RIS are outlined in the figure below.

[28] Communication from the Commission 'The European Green Deal.'

See:https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF.

[29] Communication from the Commission 'Sustainable and Smart Mobility Strategy – putting European transport on track for the future.' See: https://eur-lex.europa.eu/resource.html?uri=cellar:5e601657-3b06-11eb-b27b-01aa75ed71a1.0001.02/DOC_1&format=PDF

[30] There are currently 13 Member States that are part of the European network of waterways of class IV 11 or above.

Figure 6: Objectives of the RIS Directive

Source: Elaboration by the Contractor based on the 2021 Commission Staff Working Document SWD(2021) 50 final

The legislative process to regulate RIS started in May 2004 with a Commission Proposal for a Directive of the European Parliament and of the Council on Harmonised River Traffic Information Services on Inland Waterways in the Community. Ultimately, the RIS Directive 2005/44/EC was adopted after the Council agreed on the European Parliament amendment after the first reading and published on September 30, 2005.

The RIS Directive establishes a framework for the deployment and use of harmonised, interoperable and open RIS aiming to enhance safety, efficiency and environmental friendliness of inland waterway transport in the EU. At the same time, it intends to facilitate interfaces with other transport modes (i.e. multimodal transport). It foresees that while Member States are responsible for the development and implementation of RIS in an efficient, expandable and interoperable way (e.g. establishing RIS centres and designating authorities to oversee its application and the exchange of international data), the European Commission is responsible for setting out technical guidelines and technical specifications for RIS planning, implementation and operations.

The RIS Directive de facto applies to 13 EU Member States: Austria, Belgium, Bulgaria, Croatia, Czechia, France, Germany, Hungary, Luxembourg, the Netherlands, Poland, Romania and Slovakia, because these are the countries that contain inland waterways of CEMT class IV and above which correspond to waterways of international importance (see the map below).[31]

[31] The Directive applies to "all inland waterways of the Member States of class IV and above which are linked by a waterway of class IV or above to a waterway of class IV or above of another Member State, including the ports on such waterways as referred to in Decision No 1346/2001/EC of the European Parliament and of the Council of 22 May 2001 amending Decision No 1692/96/EC as regards seaports, inland ports and intermodal terminals as well as project No 8 in Annex III (3)."

Figure 7: Map of countries where RIS Directive directly applies in full

Source: elaboration of the contractor (2022)

The formal transposition deadline of the RIS Directive was 20/10/2007. An overview of the transposition Member States is provided on EUR-Lex.[32] In sum, 21 Member States have communicated measures implementing, and thus transposed, the RIS Directive.[33]

The main countries of relevance to the RIS Directive can also be grouped along four main corridors:[34]

Rhine corridor: Rhine stream area, Neckar, Mosel and waterways in Northern Netherlands.

Danube corridor: Danube including Main-Danube canal and parts of tributaries like Sava, Drava (higher or equal than CEMT class IV) until the Black-sea and White Gate-Midia canal.

[32] National transposition measures communicated by the Member States concerning: Directive 2005/44/EC of the European Parliament and of the Council of 7 September 2005 on harmonised river information services (RIS) on inland waterways in the Community: https://eur-lex.europa.eu/legal-content/en/NIM/?uri=CELEX:32005L0044

[33] Belgium, Bulgaria, Czechia, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Sweden

[34] It should be noted that definitions differ between different sources and approaches. According to the TEN-T approach, for instance, the main corridors are the Rhine-Danube and the Alpine-Rhine corridors. For the purpose of the present study, the RIS COMEX approach is followed. In RIS COMEX, the corridors are defined as "Information services among fairway authorities mutually and with waterway users and related logistic partners in order to optimize use of inland navigation corridors within the network of European waterways." This definition comprises the next important step in the development of RIS where a corridor approach is being developed instead of focusing on regions or Member States.

North-South corridor: Southern Netherlands (Scheldt and Maas), Belgium and France (until the Mediterranean but excluding Mosel and Upper Rhine).

East-West Corridor: Oder- Wisla, Elbe, Weser and Mittellandkanal.[35]

In addition, there are several countries (i.e. Spain, Italy, Portugal, Switzerland, Serbia, Moldova and Ukraine) which are implementing the RIS Directive voluntarily. For instance, RIS actions of a smaller geographical scale can be observed in Portugal (Douro),[36] Italy (Po)[37] and Spain (Guadalquivir)[38] within the Orient-East-Med and the Mediterranean corridor which are also implemented on a voluntary basis.

The RIS Directive has been one of the main drivers of digitalisation in the IWT sector through the introduction of information and communication technologies (ICT).[39] The goal of harmonising river traffic information services on inland waterways is part of a broader European Commission aim to make IWT a more viable alternative to road or rail transport as mentioned above. The introduction of the RIS Directive intended to secure interoperability between existing information services in Europe as well as with those that will be developed in the future.[40] In a nutshell, RIS support navigation on the inland waterway network, more broadly looking to enhance safety in inland ports and rivers, as well as the efficiency of navigation and calamity abatement processes, the better utilisation of existing infrastructure and the increased integration of inland waterway transport into multimodal supply chains via the timely provision of relevant information.[41]

Over the years, several concrete legislative measures have been adopted to support the development and maintenance of IWT in Europe. These serve to help specify and implement crucial parts of the RIS Directive (especially, its technical specifications) and are listed below:

Commission Regulation (EC) No 414/2007 of 13 March 2007 concerning the technical guidelines for the planning, implementation and operational use of river information services (RIS) referred to in Article 5 of Directive 2005/44/EC of the European Parliament and of the Council on harmonised river information services (RIS) on inland waterways in the Community

Commission Implementing Regulation (EU) 2019/838 of 20 February 2019 on technical specifications for vessel tracking and tracing systems and repealing Regulation (EC) No 415/2007

[35] This can also be linked to the pan-European Transport Corridors (http://aei.pitt.edu/39350/1/A4030.pdf), Trans-European Transport Networks, TEN-T (https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/index_en.htm) and the CORISMA (https://www.riscomex.eu/how-it-began/) corridors.

[36] See: https://ec.europa.eu/inea/sites/default/files/fiche_2015-pt-tm-0205-w_final.pdf

[37] See: https://ec.europa.eu/inea/en/printpdf/14197

[38] See: https://ec.europa.eu/inea/sites/default/files/fiche_2015-es-tm-0260-w_final.pdf

[39] Commission Staff Working Document (2021), Evaluation of the Directive 2005/44/EC on harmonised RIS:

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0050&from=EN

[40] Panteia (2014), Evaluation of RIS Implementation for the period 2006-2011, see https://ec.europa.eu/transport/sites/transport/files/modes/inland/studies/doc/2014-07-evaluation-of-ris-implementation-main-report.pdf

[41] See: https://ris.cesni.eu/

Commission Implementing Regulation (EU) 2018/2032 of 20 November 2018 amending Commission Regulation (EC) No 416/2007 concerning the technical specifications for Notices to Skippers

Commission Implementing Regulation (EU) 2019/1744 of 17 September 2019 on technical specifications for electronic ship reporting in inland navigation and repealing Regulation (EU) No 164/2010

Commission Implementing Regulation (EU) 2018/1973 of 7 December 2018 amending Implementing Regulation (EU) No 909/2013 on the technical specifications for the electronic chart display and information system for inland navigation (Inland ECDIS) referred to in Directive 2005/44/EC of the European Parliament and of the Council

Development and implementation of RIS standards and guidelines

The RIS Expert Groups[42] produced the standards including updates, but also technical clarification documents and other relevant documentation. The developed standards are then delivered to the European Commission, CCNR or other international bodies in order to make the standards legally binding. Participants of the RIS Expert Groups are representatives of Governmental bodies, branch organisations, research institutes, consultants and the industry. All expert groups operated as independent bodies without a formal legal status.

Since 2019, the work of the RIS Expert Groups has been gradually integrated into the work programme of the recently established CESNI working group on information technology (CESNI/TI)[43]. Besides the public institutions, there are also expert groups within branch organisations working on RIS such as the IWT platform, with member organisations such as the European Skippers Organisation (ESO) and European Barge Union (EBU). Since 2018, the ESO and EBU have been cooperating in a more structured way within the Inland Waterway Transport Platform.

The institutional framework has changed since the publication of the RIS Directive, as Member States seek more cooperation with neighbouring countries to comply with the RIS standards and to allow for cross-border data exchange. Also, between the supranational and intergovernmental institutions such as the River Commissions, a stronger collaboration with the European Commission is realised through the CESNI.

[42] It should be noted that the expert groups were affiliated with the CCNR, Danube Commission and the European Commission.

[43] CESNI/TI was established in June 2019 and its activities thus fall outside of the scope of the present evaluation.

Services used within inland waterways

As the definition above sets out, RIS may include a wide range of services used on inland waterways, for example:

Fairway information services – a universal dashboard on which all nautical details are displayed and from which they can be transmitted through personal profiles. An example of this is the provision of real-time information on water levels, weather conditions, and navigation warnings to help ships navigate safely and efficiently along the waterways.

Traffic information services – The comprises of information on vessel positions to allow for tactical or strategic planning. An example of this is vessel tracking systems. These systems use GPS or other tracking technologies to provide real-time information on the location, speed, and movement of ships along the waterways. This information can be used by river authorities, shipping companies, and other stakeholders to monitor and manage the flow of traffic along the waterways, reducing congestion and optimising the use of limited resources such as locks and ports.

Traffic management services – Traffic management aims at optimising the use of the infrastructure as well as facilitating safe navigation especially at RIS Centres as well as at locks and bridges. An example of this is dynamic scheduling systems. These systems use real-time information on vessel movements, water levels, weather conditions, and other factors to optimize the allocation of resources such as locks, bridges, and ports. The systems aim to balance the conflicting demands of safety, efficiency, and sustainability, while considering factors such as shipping schedules, cargo volumes, and vessel characteristics.

Calamity abatement support services – These services are responsible for registering vessels and their transport data at the beginning of a trip and updating the data during the voyage with the help of a ship reporting system. An example of this is the use of emergency response systems. These systems are designed to provide rapid and coordinated support in the event of a disaster or other emergency situation along the waterways, such as a collision, grounding, or oil spill.

Information for transport management services – this includes estimated times of arrival (ETAs) provided by boat masters and fleet managers based on fairway information making it possible to plan resources for port and terminal processes. An example of this is the use of cargo management systems. These systems provide real-time information on the availability, location, and movement of cargo along the waterways, allowing shipping companies, terminal operators, and other stakeholders to optimise the use of limited resources, such as ships, docks, and storage facilities.

Statistical and customs services – these services facilitate the collection of inland waterway statistical data in EU Member States. An example of this is the collection and analysis of shipping data. This data can include information on vessel movements, cargo volumes, transit times, and other relevant parameters. The data is used to support a variety of stakeholders, including governments, shipping companies, and other industry organisations, in their efforts to monitor, regulate, and improve the performance of the IWT system.

Waterway charges and port dues information services – the travel data of the ship can be used to automatically calculate the charge and initiate the invoicing procedure. An example of this is the provision of information and billing systems for the use of waterways and port facilities. These systems typically provide shipping companies and other users with information on the fees and charges associated with using the waterways and ports, including tolls, taxes, and other costs.

Stakeholders affected by the RIS Directive

The RIS Directive mainly affects the following stakeholder groups:

IWT operators (including international associations representing IWT operators) – Inland waterway operators are required to equip their vessels with compatible navigation equipment and to participate in the RIS systems in order to support safe, efficient, and environmentally responsible navigation on the inland waterways.

Port operators (including international associations representing port operators) - Port operators are required to participate in the RIS systems and to make their facilities and services available to vessels equipped with compatible navigation equipment.

Manufacturers of RIS applications (including representatives of manufacturers) - The RIS Directive is centred on the deployment of systems and services to support safe, efficient, and environmentally responsible navigation on the inland waterways. This creates a market for manufacturers of RIS applications, who develop and provide equipment and systems that are compatible with RIS and meet the technical requirements of the RIS Directive. Manufacturers are required to ensure that their systems are evaluated and certified to meet the technical standards set out in the RIS Directive.

Other private sector actors of IWT supply chain operations, for example freight forwarders, logistics services providers and shippers, river cruise operators and terminal operators

Citizens - By promoting the growth and competitiveness of the IWT sector, the RIS Directive also helps to create new jobs and economic opportunities in the IWT supply chain and supports the development of new and improved technologies and services that can benefit citizens. As the RIS Directive aims to a more integrated, sustainable, and efficient IWT system in Europe, it can benefit citizens by supporting the development of a modern, accessible, and affordable transport system.

Governmental/ public authorities, in particular fairway authorities, port authorities, RIS authorities, waterway management bodies (including their representation through INE, Inland Navigation Europe), and enforcement bodies - Government and public authorities are responsible for implementing the RIS Directive in their jurisdiction, which may involve the deployment of new systems and services, the establishment of regulations and policies to support RIS, and the development of new partnerships with private sector actors. The RIS Directive also requires government and public authorities to ensure that the RIS systems and services are accessible, reliable, and secure, and to take measures to promote their widespread use.

International organisations, such as the River Commissions, CESNI, UNECE and PIANC - International organisations and River Commissions play a critical role in promoting the development and implementation of the RIS Directive across Europe, by providing guidance and support to national and regional authorities and by promoting cooperation and coordination between different countries and regions.

Box 1: Description of the role of river commissions

As national and international boundaries are often intersected by numerous different bodies of water and river courses, different national interests in the use and protection of these water courses need to be delicately balanced according to river management principles across the entire watershed. Besides the EU, a range of other institutional actors play a role in the development and implementation of RIS in Europe, at international level (UNECE, PIANC), regional level (River Commissions - CCNR, Danube Commission, Sava Commission, and Mosel Commission), and local level (national competent authorities and RIS providers).

Source: European Commission (2021). SWD (2021) EN 51 final

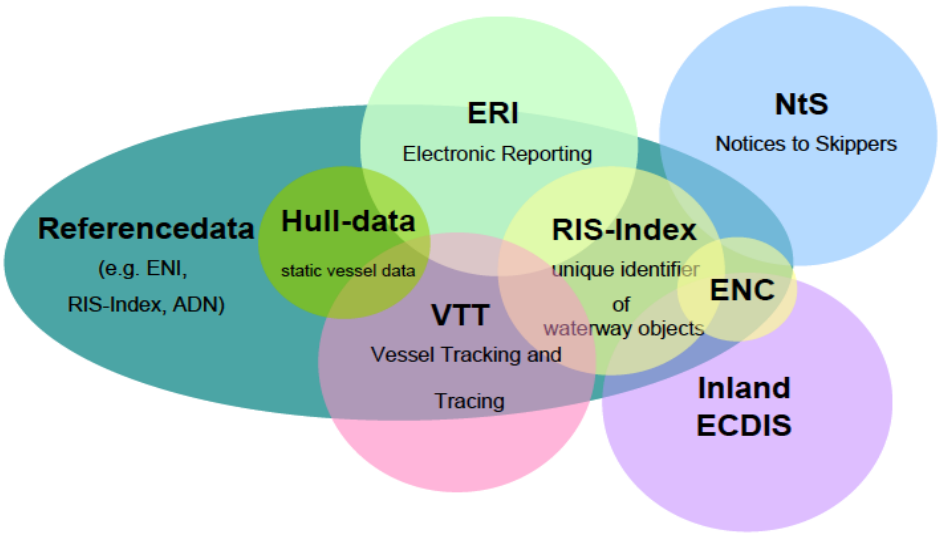
Digitalisation and automation in IWT

Digitalisation is of particular importance to inland waterway transport and by extension to RIS for four main reasons:

- To improve navigation and traffic management
- To better integrate IWT with other modes of transport (i.e. to create multimodal supply chains)
- To improve safety
- To reduce the administrative burden (e.g. by making law enforcement more efficient and effective)

The figure below outlines the main RIS services and key technologies.

Figure 8: RIS services and key technologies



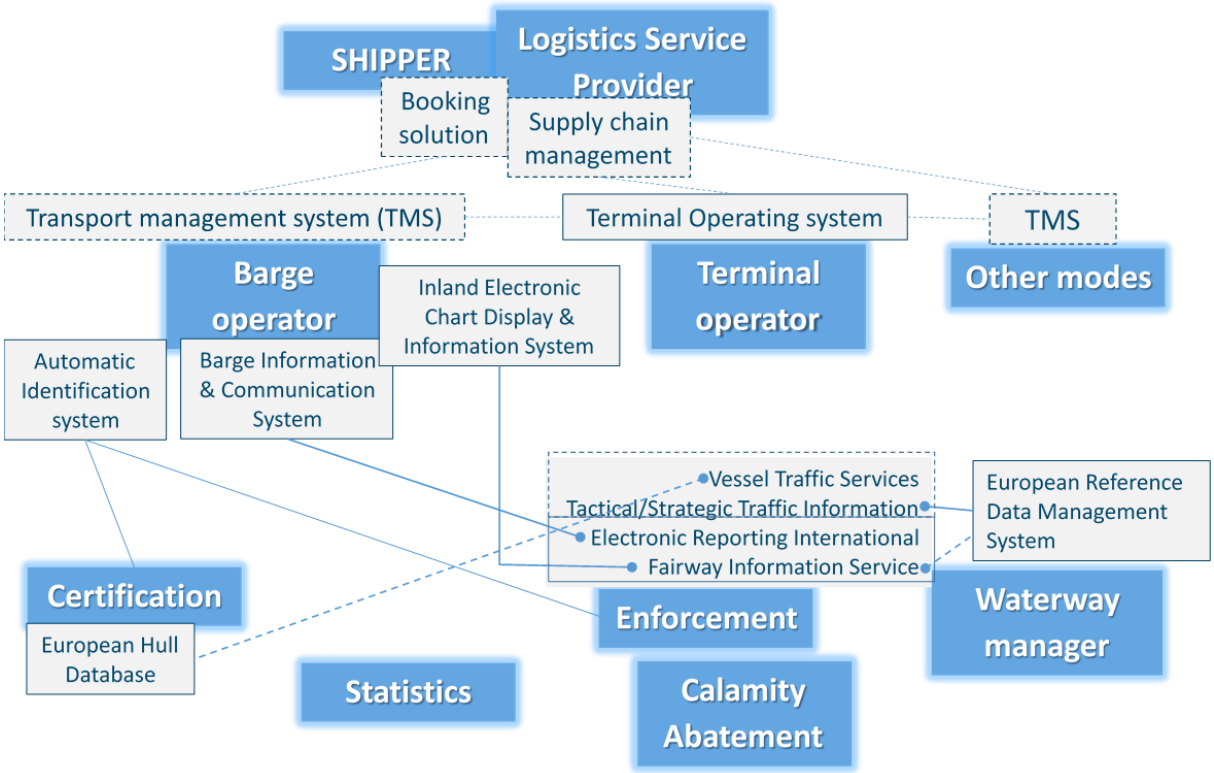
Source: Pianc RIS guidelines 2011

An additional area of application not included in the figure, but which is another key component of RIS, is the compatibility of the equipment necessary for RIS. The different RIS technologies are integrated with one another. There are **four key types of integrations**, as presented in the DINA (2017) report:

- **Vertical integration** between customers and operators within the supply chain by using barge booking systems and transparent exchange of data concerning cargo status, track and trace and estimate time of arrival calculations.
- **Horizontal integration** between barge operators and ports and terminal operators to reduce waiting times for berthing and commence (un-)loading procedures.
- **Operational integration** where barge operators exchange information concerning the fairway and infrastructure with the fairway managers and vice versa.
- **Administrative integration** concerning e-IWT, law enforcement, calamity abatement, statistics, etc.).

In all types of integration, **real-time data** concerning cargo, crew and vessel, in addition to governance to address the privacy and cybersecurity challenges, **and centralised database sharing is needed across Member States**.

Figure 9: Mapping of digitalisation in IWT and RIS



Source: based upon EC, 2017, Dina, p.32, full lines = mandatory systems/technology/data exchange
Dotted lines = not mandatory; white boxes digital services; blue boxes = actors

As shown in the figure above, shippers use supply chain management solutions to optimise their production activities by predicting their stock size of production materials. These solutions should include easier access to operators, improvements on the overall efficiency of the supply chain and bundling of multiple shipments. The logistics service provider plays a vital role in organising the reliable flow of goods to or from its clients, but when choosing for IWT, the provider deals with a black box (i.e. no tracking of cargo status, no accurate information, still phone calls and emails with the operator). There is thus **a need for easier booking facilities (e.g. Bargelink, 4Shipping), more visibility and a synchronisation of flows**.

Moreover, between logistics service providers and their customers, there are often no real-time links between systems. The procurement of e-documents and improved track and trace systems that also provide data concerning cargo and transhipment procedures, next to linking with compatible terminal and transport systems (Terminal Operating System and Terminal Management Systems), could stimulate IWT to be better integrated within the supply chain. These e-documents could also lower the transaction costs of operators who are currently still obliged to fill in, often paper, reports for authorities and other mandatory declarations (e.g. vessel clearing at border crossings). One element that could still be added to the figure is that of corridor management which is a more recent development in terms of the digitalisation of RIS.

Considering the developments in digitalisation in the IWT, the RIS Directive is credited as being one of the main drivers in the sector of the introduction of information and communication technologies (ICT). In the upcoming years, the digitalisation and increased automation of transport in general, and Intelligent Transport Systems (ITS) in particular, are expected to take a big leap forward. The Commission aims to achieve more efficient management of transport networks as part of the Digital Single Market strategy.[44] Digital

[44] http://ec.europa.eu/priorities/digital-single-market/

technologies and the further digitalisation of logistic processes are fuelling the transformation of the European IWT sector (e.g. in the area of ports), as is the case with other industrial processes all over the world. Technology enabled by the Internet of Things (IoT) is currently helping many inland ports transition towards greener and more efficient practices.[45]

Moreover, smart shipping developments[46] increase the use of digital technologies as well as the autonomous (i.e. fully automated) navigation of ships, with no crew on board. This corresponds to CCNR level of automation 5[47], where the ship's navigation automation system of all dynamic navigation, is responsible for making all decisions related to navigation and its interaction with infrastructure and other vessels. Market developments on barges and autonomous shipping are widespread and diffused. Therefore, the possible impact of wider smart shipping on, for example, safety, sustainability and competitiveness of the sector are still under discussion. To deal with these developments, elaborate discussions on the potential of the automation of vessels have intensified in recent years. For instance, under the Horizon 2020 programme, the Autonomous Shipping Initiative for European waters (AUTOSHIP) is aiming to speed up the transition towards a next generation of autonomous ships in the EU.[48]

With the upcoming development of more automated vessels, the further development of RIS and further digitalisation (e.g. e-documents) could prove to be essential success factors in modernising the fleet within the supply chain and ultimately even incentivise a modal shift. By reducing waiting times at terminals with the support of advanced digital systems, the existing capacity can be used more optimally and with more capacity on the supplied IWT service side, which could lower the costs of the operator and lower the freight rate. An IWT terminal operating system (TOS) could provide that extra capacity, but in most cases, this does not exist. In most major European ports, the problem of waiting time at terminals for barges is caused by the priority handling of seagoing vessels. Barges can only commence operations if the quay is free. Other modes do not have that specific problem.

[45] PIANC (2022). Smart shipping on inland waterways. PIANC report n° 210 inland navigation commission.

[46] As defined in the PIANC (2022) report on smart shipping**; Smart shipping** is defined, from the perspective of infrastructure providers and traffic managers, as being broader than just an autonomous vessel. Smart shipping is understood as consisting of the following four components: [1] **Smart vessels** (vessels that are highly automated and are therefore equipped with automated systems using (external) data to optimise the key functions of the vessel), [2] **Smart Traffic Management and Infrastructure** (the management of the inland waterways takes into account real-time (external) data coming from ships, infrastructure and third parties), [3] **Smart Travel and Transport** (the interaction between ships and third logistic parties are evolved into a smart, smooth and flexible process), and [3] **Smart Regulation and Facilitation** (this is regulation that supports innovation and future-oriented initiatives, and this always with an eye for safety).

[47] As stated in CCNR (2022). Automated navigation: International definition of levels of automation in inland navigation (edition 2022). Automation level 5 is defined as: autonomous = *full automation 5 the sustained and unconditional performance and fallback performance by a navigation automation system of all dynamic navigation tasks, without expecting a boat master responding to a request to intervene*

[48] https://www.autoship-project.eu/

Main findings of the Evaluation of the RIS Directive

Fifteen years after the adoption of the Directive 2005/44/EC on harmonised RIS on inland waterways in the Union, the Commission conducted its ex-post evaluation Staff Working Document (SWD), the purpose of which was to support any further decisions related to the development of the legislative framework in this policy area, including a possible revision of the current Directive.[49] The results of the evaluation, are presented in the table below.

Table 3: Links between the conclusions of the ex-post evaluation and the IA

Main ex-post evaluation conclusions	How it is covered in this IA
Conclusions on effectiveness	
The degree of harmonisation differs between RIS technologies. RIS technologies are not used to the same extent in all countries and river corridors. Monitoring of the implementation of the Directive is weak. There is no indication of a modal shift towards inland navigation occurring as a result of the RIS Directive.	Policy measures are defined: to strengthen the degree of harmonisation, to further align Member States' implementation of RIS, to strengthen the monitoring of the implementation, and to improve the role of RIS in supporting the integration of IWT in the multimodal chain.
Conclusions on efficiency	
The findings show that there is potential for simplification, to address the slow update and adoption process of technical standards.	Policy measures are defined to simplify the update and adoption of technical specifications.
Conclusions on relevance	
The RIS Directive and its implementing acts are still relevant; however, its primary focus on the safety of navigation is no longer sufficiently aligned with the sector's needs. More specifically, it does not support the need for improving the efficiency of inland waterway transport and its integration into the multimodal supply chains. In addition, it does not sufficiently address new technological challenges, such as automation of vessels, and the further digitalisation of the sector.	Policy measures are defined to increase the IWT multimodal potential, its efficiency and technological challenges.
Conclusions on coherence	
The Directive and its implementing acts form a consistent legal framework. Both internal coherence and coherence with other EU legislation is ensured.	The proposed measures are coherent with the RIS Directive and with other EU legislation.
Conclusions on EU added value	
The rationale for public intervention at EU level through the RIS Directive is rooted in the cross-border, international character of the inland waterway transport sector and contributes to avoiding fragmentation between different national or regional (e.g. between the River Commissions) RIS implementation approaches. Stakeholders considered that the same benefits could not have been achieved by comparable interventions at the international, regional or national level. However, higher benefits of digitalisation and data exchange are hindered by the lack of full harmonisation of data provided across the Member States.	Several policy measures are defined to further align Member States' implementation of RIS, which would result in even further integration of RIS.

Source: elaboration of the contractor (2022)

[49] European Commission (2021). Commission Staff Working Document, Evaluation of the Directive 2005/44/EC on Harmonised River Information Services (RIS) {SWD(2021), EN, 51 final}. Henceforth referred to as "2021 Evaluation of the Directive"

Synergies with other EU policy instruments

The rationale to revise the RIS Directive is interlinked with key objectives of current European Union policy. As set out in the **European Green Deal**[50], a substantial part of the 75% of inland freight currently carried by road should shift onto rail and inland waterways. Similarly, the **Sustainable and Smart Mobility Strategy**[51] underlined the need to increase the use of more sustainable transport modes and indicated that inland waterway transport and short-sea shipping should increase by 25% by 2030 and by 50% by 2050. The thematic areas of **digital technologies** and **digitalisation** are seen as critical enablers for achieving the sustainability goals of the European Green Deal across sectors, including inland waterway transport.

The 2018 Commission Staff Working Document on **digital inland navigation**[52] further identified three key challenges to the competitiveness of the inland waterway transport sector that could be improved by further digitalisation: (I) inefficient navigation and traffic management, (II) inefficient integration of inland waterway transport in logistics processes and (III) administrative burden and costs involved in complying with and enforcing legislation. The revision of the RIS Directive is also aimed to be conducted through an integrated approach with the recently adopted NAIADES III Communication[53] on inland waterways policy.

The revision of the RIS Directive is finally also connected to the achievement of the **Sustainable Development Goals** (SDG)[54]. In particular, the role of RIS is underpinned through SDG 13 on taking urgent action to combat climate change and its impacts and SDG 9 on industry, innovation and infrastructure.

[50] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX%3A52019DC0640

[51] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:789:FIN

[52] https://ec.europa.eu/transport/sites/default/files/legislation/swd20180427-digital-inland-navigation.pdf

[53] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0324

[54] https://sdgs.un.org/goals#goals

Problem definition

This chapter aims to verify the existence of the needs (in the form of an identified problem and related problem drivers) related to the revision of the RIS Directive . This problem definition has been elaborated by the contractor based on their own understanding, discussions with DG MOVE and members of the Steering Group and has been validated by stakeholder input from the stakeholder survey 1. In accordance with the Better Regulation Guidelines (BRG) toolbox (specifically Tool #13), this chapter will be structured across four main sections: identification of the problem, analysis of the causes and drivers and identification of which stakeholders are affected and involved and presentation of the problem tree.

Identification of the problem – what is the problem and why is it problematic?

This section presents the identification of the problem including an assessment of how the problem is expected to evolve and the likelihood that the problem will persist.

Identification, evolution and implications of the problem

In the light of the developments of the IWT sector and RIS more broadly (see sections 0 to 0) since the introduction of the RIS Directive, there is a possible need for an update of the RIS Directive. To summarise all these developments, one key problem has been identified in this study, as detailed in the box below.

Box 2: The main problem identified as part of this IA

Slow and fragmented deployment of River Information Services that hamper the competitiveness and safety of the sector, and its contribution towards the European Green Deal objectives

Source: elaboration of the contractor based on discussions with DG MOVE

The following sections provide a break-down the main identified problem, as well as discuss its implications and likely evolution in the future.

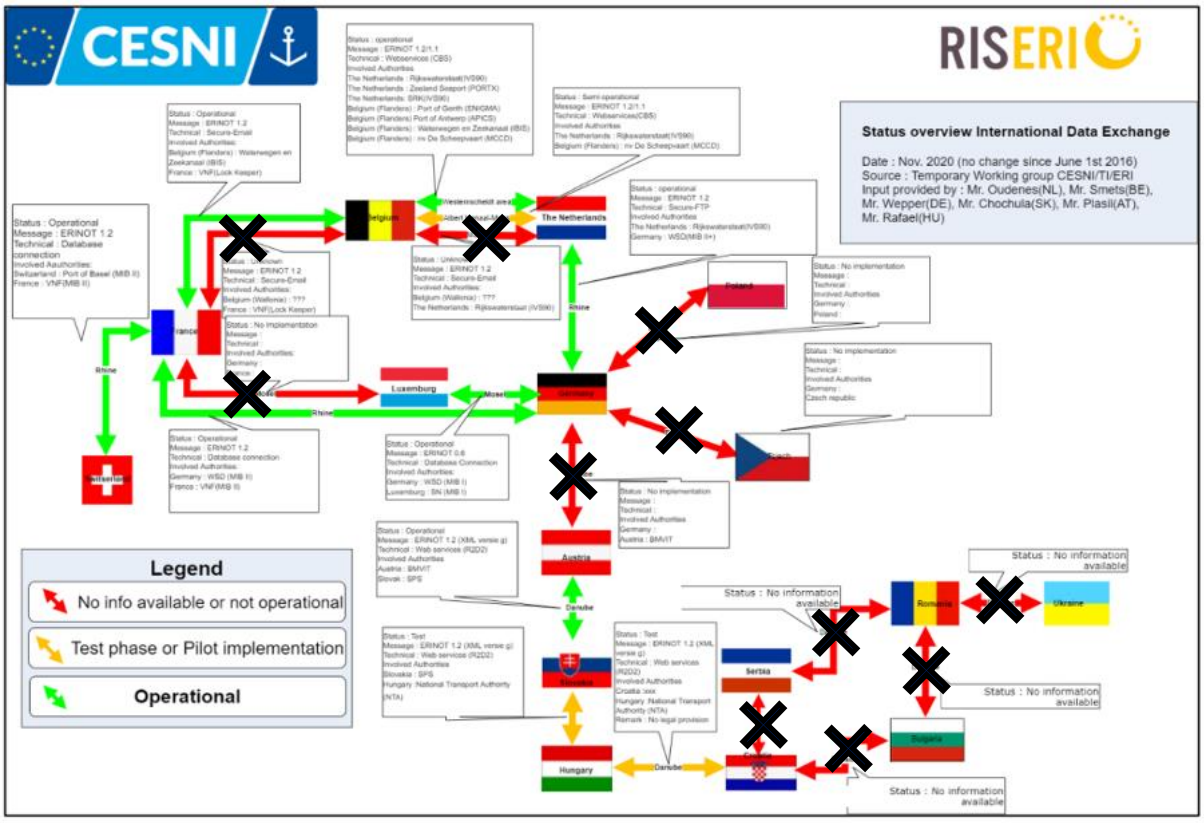
How has the deployment of RIS been slow and fragmented?

Based on the findings from the Commission SWD[55], the degree of harmonisation was found to differ between RIS technologies (see section 0 for definitions). In particular, technologies which were most harmonised was in type-approval of RIS equipment and electronic navigational charts, while this was slightly less in data for navigation and planning and notices to skippers. A highly positive harmonisation effect of the RIS Directive was achieved through the implementation of tracking and tracing systems, even though this is not mandated by the RIS Directive. By contrast. The lowest harmonisation was found in electronic ship reporting, especially due to different reporting requirements in the Member States resulting in resubmissions of electronic reports. To provide a visualisation of these variations, the diagram below presents the DIWA Masterplan (SuAc 2.4: RIS enabled corridor management) and describes the interactions between the various electronic reporting systems in Europe. It can be seen that in the Rhine catchment for example, the electronic transmission of reports is generally positive, while in Eastern Europe (i.e. borders

[55] European Commission. (2021). Commission Staff Working Document evaluation of the Directive 2005/44/EC on Harmonised River Information Services (RIS). {SWD(2021).

between Germany and Poland as well as Germany-Czech Republic) and on the Danube, it is comparatively less harmonised. This was supported by evidence from the Commission SWD, where interviewees from different stakeholder groups and different countries outlined agreement with this assessment, and by the examples provided in support of their claims.

Figure 10: RIS enabled corridor management



Source: DIWA Masterplan[56]

The 2021 Commission SWD also found evidence that RIS technologies are not fully used to the same extent in all countries and river corridors. Despite the lack of full harmonisation and differences in use of RIS in countries, consulted stakeholders as part of the 2021 evaluation agreed, that standardisation of RIS has been the strongest benefit brought about by the RIS Directive. Conversely, not a single respondent from the 2021 public consultation on the evaluation of the RIS Directive believed that the EU properly implemented the monitoring of the setting up of RIS, thus the application of the RIS Directive. Indeed, this sentiment was carried in the 2022 public consultation on the revision of the RIS Directive, where all of the 13 participants noted that missing and non-harmonised RIS information continues to hamper efficient and safe navigation. This was echoed in stakeholder survey 1 under this study, with 42 out of 65 stakeholders noting this this was a current problem the IWT/ RIS sector face (See accompanying technical appendices, Appendix 1).

In what ways has the slow and fragmented deployment of RIS hampered competitiveness and safety in the sector?

With regards to the competitiveness of the sector, evidence from the Commission SWD noted that there was **no statistically significant evidence that the RIS Directive had an impact on the performance or growth of the inland navigation sector**. Furthermore,

[56] https://www.masterplandiwa.eu/

there is limited data available to assess whether existing infrastructure has been used more optimally as a result of the RIS Directive. This is paired with the fact that that the logistics sector is not competitive enough without sufficient levels of digitalisation and it has been found that this is the case for the inland waterways sector in particular. For instance, this was suggested by the European Federation of Inland Ports (EFIP) in response to the evaluation of the RIS Directive and recognised more widely in the findings of the Commission SWD.

Recognising the challenges in drawing direct causal links between the RIS Directive and overall competitiveness of the IWT sector, the Commission SWD noted the **indirect** impact of the RIS Directive on the efficiency of the IWT sector as a whole. As trade and cargo volumes are expected to grow further, the need arises for more sustainable and cost-effective solutions. Moreover, the DINA report (2017) found IWT to be falling behind other modes of transport in terms of digitalisation and development of intelligent systems (see Section 0).[57] Thus, there is a need for a greater role of the effectiveness of the RIS Directive going forward, putting an emphasis on fostering technological developments/Smart Shipping.

With regards to **safety**, inland navigation is generally regarded as a safe mode of transport. Nevertheless, accidents do occur regularly and sometimes even with grave consequences. The most common accidents in inland navigation are minor. For example, a ship goes off course and hits, the bank, the quay, a breakwater or a bollard. Other accidents in the sector with usually limited damage are groundings. Accidents with greater damage are often collisions between ships, or collisions with infrastructure. One could think of collisions with bridges, where ships often completely destroy their wheelhouses and in some more rare cases, there are (serious) injuries or even fatalities.

The Commission SWD noted that analysis of available accident data does not provide evidence of a reduction in the rate of accidents having taken place, but skippers believe that RIS technologies have reduced the number of accidents and improved safety on the waterways. However, it should be noted that this was based on a widely held opinion of stakeholders, while concrete data cannot “prove” that the RIS Directive has made a positive contribution in terms of increasing safety. Despite this, accident data is not reliably collected and reported on, so it is possible the Directive did indeed have an impact. Indeed, it is evident that accurate data on the fairway infrastructure and traffic image can contribute to safer navigation.

At the same time, much remains to be gained. For example, the Commission SWD noted that ‘*an upcoming shift towards (semi)-autonomous sailing might positively impact the degree of safety in inland navigation*.’ It further indicates that ‘water level messages concerning bridge passages can avoid collision with infrastructure, and messages related to traffic can help avoid collisions between ships.’ Given that current and accurate under keel clearance heights are only made available for a limited number of bridges, there is much to be gained here.

How does the problem affect the contribution of the IWT sector toward the European Green Deal objectives?

In terms of increased environmental protection, there is limited evidence to suggest that the use of RIS has led to a reduction in fuel consumption, although the attributability to the Directive is unclear. A reduction in fuel consumption indirectly decreases emissions, greenhouse gases and emissions from fuel transport and production (well-to-tank) which implies social benefits.

[57] Towards Digital Inland Waterway Area and Digital Multimodal Nodes: waterborne digital services between maritime and inland ports, DG MOVE, 2015-2017.

While the IWT sector has long been recognised as one of the most CO_2-efficient modes of transport (per tonnes of goods carried)[58], the overall modal share of the EU inland waterway transport sector has not seen significant growth levels in recent years, remaining stable at around 4%[59]. Thus, while the European Green Deal has called for decisive action to shift a substantial part of the freight transported by road (currently accounting for 75% of inland freight) to inland navigation and rail, the current modal share of the inland waterway transport suggests that the sector is not fully adapted to contribute to the targets set with the Green Deal. For instance, climate change (e.g. leading to extreme weather conditions) is causing more frequent changes in water levels on European rivers. As river discharges are expected to change, for the Rhine that will lead to longer periods of low water levels, leading to reduced navigability. RIS-tools could help to mitigate the reduced navigability challenge, for instance, by providing more detailed information on the actual depth of the river (e.g. through technology such as up-to-date depth charts of inland waterways), and more reliable and longer-term forecasts for water levels.

The energy consumption of a barge is variable and is dependant, among other things, on the vessel's cruising speed, the resistance the vessel encounters from the water and the depth of the water. Several studies, including Hekkenberg (2017)[60], have outlined a third-power relationship between the amount of propulsion energy required and speed. That is, when a vessel doubles its speed, its energy consumption increases eightfold (2^3). The question this raises is why barges do not always cruise as gently as possible. The reason for this is that, in addition to fuel costs, fixed capital costs and personnel costs that weigh heavily on operations. By keeping the turnaround rate high, these charges can be spread over more units of cargo, which actually lowers the unit transport costs. As a result, barges usually operate at economic speed: the speed at which the **interplay of variable and fixed costs** produces the most favourable outcome.

Along with the EU Green Deal, EU transport policies more generally intend to reduce road transport towards less polluting and more energy efficient alternatives, including IWT. For instance, the Combined Transport (CT) Directive[61] aims to promote combined transport operations by reducing restrictions to these operations and therefore, increasing their competitiveness[62]. Indeed, it should be noted that the energy consumption of IWT per ton-km of transported goods is approximately 17% of that of road transport and 50% of rail transport[63]. According to the OECD, significant changes are expected in the dynamics of competition in land transport.[64] In road transport, increasing automation, vehicle-sharing, and electrification are expected. In rail, an increase in efficiency and reduction in costs is expected with the adoption of digital technologies, particularly when coupled with location data. In addition to the opportunities of IWT in decreasing the energy consumption of the EU

[58] European Commission (2021). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: NAIADES III: Boosting futureproof European inland waterway transport. COM(2021) 324

[59] Modal split of freight transport - Inland Waterways 2019, Eurostat - Data Explorer (europa.eu)

[60] Hekkenberg, R. G., Van Dorsser, C., & Schweighofer, J. (2017). Modelling sailing time and cost for inland waterway transport. European Journal of Transport and Infrastructure Research, 17(4), 508-529.

[61] Council Directive 92/106/EEC of 7 December 1992 on the establishment of common rules for certain types of combined transport of goods between Member States

[62] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A31992L0106

[63] European Commission (2023). European Alternative Fuels Observatory. https://alternative-fuels-observatory.ec.europa.eu/transport-mode/inland-waterways

[64] https://www.oecd.org/fr/innovation/competition-and-innovation-in-land-transport.htm

transport system more generally, inland waterway transport also ensures a high degree of safety, in particular when it comes to the transportation of dangerous goods.

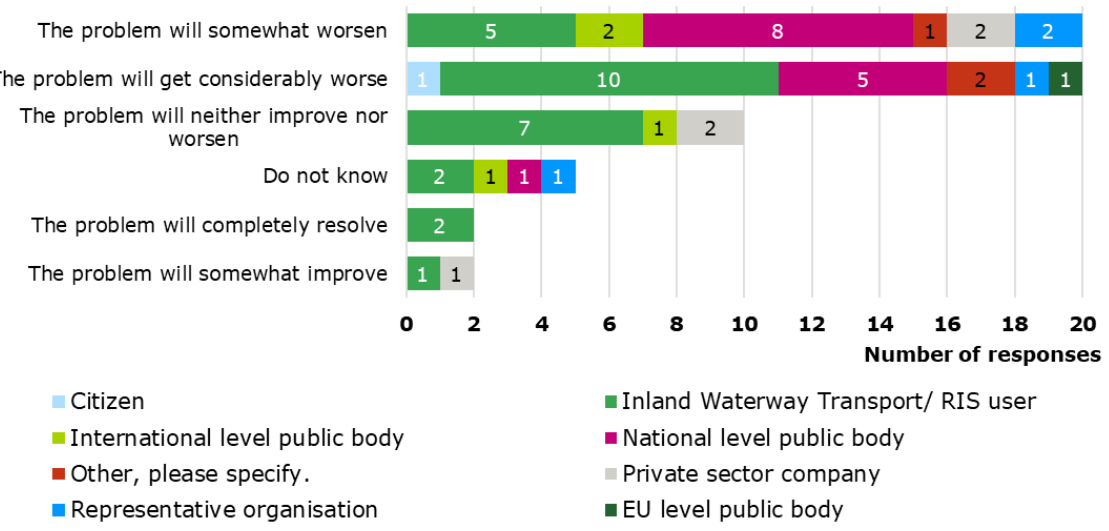
How is the problem expected to evolve?

Despite the environmental and safety benefits of the IWT compared to other transport modes, the current state of play of the IWT sector and its interconnection within the transport system has been running as efficiently as it could be. For example, the scarcity of transhipment infrastructure, and of inland multimodal terminals in particular, is pronounced in certain parts of Europe. Similarly, the IWT system is not currently fully adjusted to operate within cross-border multimodal logistics chains, with there being a greater need for the optimisation of navigation conditions, greater use of smart traffic management systems, and the multimodal exchange of data[65].

To deal with above-mentioned challenges, the sector will need to adapt to improve the currently slow and fragmented deployment of RIS stemming from the five identified problem drivers presented in the following section. If these problem drivers are not addressed, the problem is likely to persist as the IWT falls behind on these developments.

To understand the perspective of stakeholder with respect to the **evolution of the problem**, the online survey of stakeholders on the identified problems and drivers, and potential policy measures (henceforth referred to as "Stakeholder Survey 1") asked respondents about the expected development of the main problem should no changes be made to the RIS Directive. The figure below presents the answers to this question. It is important to highlight that the majority of stakeholders, across a diversity of stakeholder types, were of the opinion that the problem will get either considerably or somewhat worse. Only four out of 59 stakeholders[66] stated that the problem will somewhat improve or completely resolve.

Figure 11: Stakeholder Survey 1: Considering the overall problem, if the current RIS Directive is not revised, how do you expect the problem to develop in the future? (n=59)



Source: Survey 1 to stakeholders on the identified problems and drivers, and potential policy measures organised by the contractor (2022)

[65] European Commission (2021). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: NAIADES III: Boosting futureproof European inland waterway transport. COM(2021) 324

[66] Representing three Inland Waterway Transport/ RIS users and one private sector organisation.

However, the findings from the NAIADES/DINA Expert Group organised in July 2022 as part of this study were more neutral, where the following question was asked through a Mentimeter[67] poll: *If no revisions were made to the RIS Directive (i.e. the baseline scenario), how do you expect the problem to develop (rate from 1 to 5[68])*. This resulted in an average score of 2.7 with an even distribution across the different experts who responded during the workshop, indicating that expert group members expected the situation to either remain the same, or worsen slightly in case of no changes to the RIS Directive. However, the experts believed that the aim of the revision of the RIS Directive is still necessary in order to improve the situation.

Thus in summary, the problem of "*Slow and fragmented deployment of River Information Services that hampers the competitiveness and safety of the sector, and its contribution towards the European Green Deal objectives*" **is expected to get either considerably or somewhat worse according to the majority of stakeholders groups**. Indeed, stakeholders believe that changes to the RIS Directive should be made to improve the situation. Possible ways in which the problem could evolve were uncovered through desk research and stakeholder consultations, including developments in changes/updates of legislation, specifications, and standards relevant to the RIS Directive, increasing need for revisions to the RIS technical specifications, the increasing degree of extreme weather conditions affecting operation, and the rise in digital test fields/beds for waterways. Overall, improvements to the current RIS Directive were deemed necessary to address the challenges faced by the IWT sector and to prevent the problem from persisting or worsening.

Analysis of the problem drivers

The previous section introduced the identified main problem that the RIS Directive and the IWT sector in general face, and how this is expected to evolve. This problem is caused by a variety of underlying developments in the form of problem drivers (five in total). The following section presents an analysis of each of the five problem drivers. This analysis is based on desk research and stakeholder consultations, including stakeholder survey 1, workshops with the DINA/ NAIADES expert groups and stakeholder workshops with skippers.

Problem driver 1: Missing and non-harmonised RIS information hampers efficient and safe navigation

The Commission SWD found that although the RIS Directive has led to progress in the harmonisation of RIS, it has not yet reached its full potential in this regard[69]. One of the challenges is that IWT users still receive, in part, fragmented or low-quality information from Member States via RIS. As missing and non-harmonised RIS information mainly impacts voyage planning, it is no surprise that in Survey 1 most of the stakeholders that identified problem driver one as indeed reflecting a current problem driver (23% of total respondents), or as somewhat reflecting a current problem driver (more than 41% of total respondents) are Inland Waterway Transport/RIS users. Out of 15 respondents[70] who answered that problem

[67] https://www.mentimeter.com/

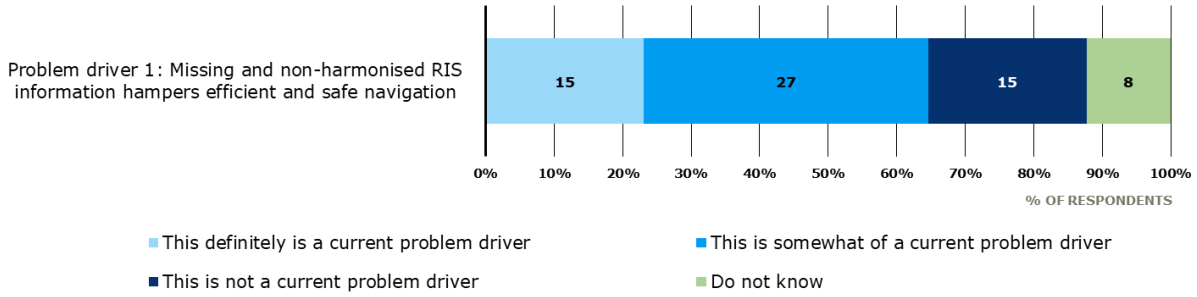
[68] Score of 1 being the situation would get much worse, and a score of 5 being that the situation would get much better.

[69] p. 47, Vanessa Ludden, Dr. Karolina Wrona, Lara Jansen, Elisa Colaiacomo (Ramboll) Dr. Edwin Verberght, Prof. Thierry Vanelslander, Prof. Edwin van Hassel (University of Antwerp) Linus Hoet (DLA Piper) (2020), Study supporting the evaluation of Directive 2005/44/EC on Harmonised River Information Services (RIS)

[70] Eight of the respondents were Inland Waterway Transport/RIS users, (in particular, four of them are ship masters (skippers), and four of them are ship owners/operators), two national level public bodies, (one

driver one *definitely* reflects a current problem, eight of them represented the views of IWT/ RIS users. Similarly, among the 27 respondents[71] who found problem driver one to be *somewhat* of a current problem, nine were IWT/ RIS users, while nine were also National RIS Authorities.

Figure 12: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65)



This problem mainly relates to the **absence of certain technical specifications**, for example, technical specifications for data for navigation and voyage planning, as stipulated in Annex I of the RIS Directive. Another issue is formed by differences in terms of data quality and monitoring standards across the Member States and the lack of EU guidelines on this aspect. The difference in data formats across countries, together with the unreliability of the RIS Index, were specifically mentioned by some stakeholders in Survey 1 as a current problem in the RIS sector.

To give just one example, blockages of objects are indicated with Notices to Skippers (NtS); in instances where one lock chamber is blocked, in one country this is reported as a complete blockage of the lock chamber, while in other countries this is reported as a partial blockage of the lock. Such problems lead to inefficient navigation across the European waterways as it takes ship operators time to interpret the data and it may even lead to surprises when arriving at the location of the blockage. As emerged during Stakeholder Workshop 2 with skippers, information on water levels is also crucial for skippers to plan a voyage, and the way these data are communicated and predicted could similarly be improved. Skippers also flagged that missing and non-harmonised RIS information is one of the main drivers hampering efficient voyage planning, with direct repercussion on the possibility to use RIS[72].

National administration one Shipping Regulation/Technical Certification Authority), and by two representative organisations, (of which one was a European level professional association and the other was international).

[71] Nine of them are Inland Waterway Transport/RIS users, (in particular, five ship owners/operators, one cargo owner/shipper, one fleet manager/operator and one ship master (skipper)), and nine are national level public bodies (five National administrations, three National RIS authorities and one Port Authority), followed by three River Commissions at an international level and three private sector companies (two marine/RIS equipment manufacturers and one logistics service provider).

[72] For example, discussions with training institutes and validated by the sector (in the context of the stakeholders' consultation for the impact assessment) indicate that of an average 15 minutes spent to prepare a cross border journey, 2.5 minutes are used for addressing such discrepancies. Considering the 355,406 border crossings in 2020, around 14,800 hours were estimated to be "wasted" due to these discrepancies, or around EUR 395,000. The weighted average of the tariff per hour for non-manual workers (ISCO 8 - Plant and machine operators and assemblers) in the 13 Member State in the scope of RIS (EUR 26.7 per hour), based on Eurostat Structure of earnings survey (in 2022 prices), has been used to estimate the costs.

Similar views were also uncovered in the first consultation with the DINA and NAIADES Expert Group meeting (in the course of this study), where it was reiterated that most of the issues related to the effectiveness of the RIS Directive are linked to the implementation by Member States. In particular, it was highlighted that if guidelines would be developed for competent authorities, RIS information from different countries could become more comparable. In an industry where a sizeable proportion of voyages are conducted internationally, this was seen to hold many positive benefits.

Problem driver 1 also encapsulates issues which were flagged by stakeholders during Survey 1 when asked whether there are additional problem drivers or problems which should be addressed as part of the revision of the RIS Directive. In particular, five stakeholders referred to the implementation of measures and issues related to it, such as the large variations in the practical implementation in Member States, and national bodies not fully following the implementation standards creating problems for EU wide implementation States. Both problem driver covers issues 1, which embodies a “catch-all” problem driver and feeds directly into the problem at hand, namely a slow and fragmented deployment of RIS.

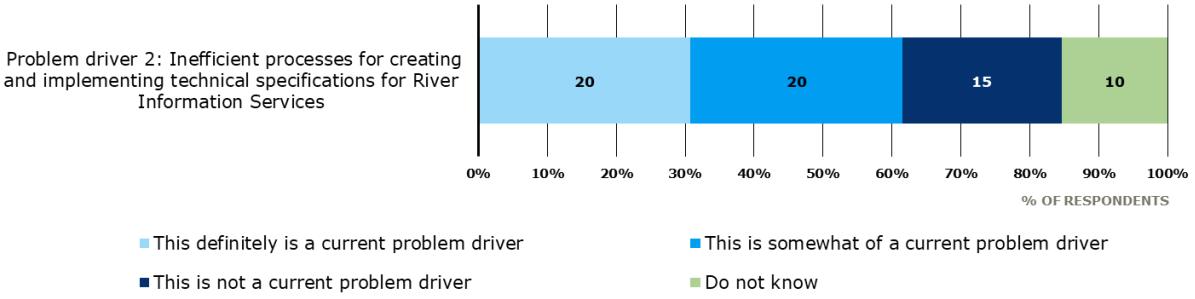
Problem driver 2: Inefficient processes for creation and implementation of technical specifications for River Information Services

The Commission SWD concluded that while the RIS guidelines and technical standards are still relevant and necessary, there is a clear need for these to be more flexible to keep up with the evolving needs of the sector. Indeed, stakeholders noted strong indications that the technical standards are not updated quickly enough, which may cause problems in terms of their continued relevance in the future due to the sector using outdated standards[73]. For instance, the RIS Guidelines are still from 2007 and the technical specifications for electronic reporting took nine years to be revised. Overall, 20 out of 65 stakeholders[74] perceived problem driver 2 as *definitely* being a current problem. These stakeholders primarily represented the views of IWT/RIS users and international/national level public bodies.

[73] European Commission (2021). Pg. 57

[74] In Survey 1, most of the respondents who found problem driver 2 to reflect a current problem or to somewhat reflect a current problem (in both cases more than 30% of total respondents), were IWT/RIS users and international/national level public bodies. Out of 20 respondents who found problem driver 2 to reflect a current problem, the majority of them (9) are Inland Waterway Transport/RIS users, (in particular, three are ship masters (skippers), three are ship owners/operators, one is a Vessel Traffic Services provider, one is a fleet manager/operator, and one is a cargo owner/shipper). The problem driver was also deemed to reflect a current problem by three River Commissions at the international level, two national level public bodies, (one national administration and one Shipping Regulation/Technical Certification Authority), two private companies (two marine/RIS equipment manufacturers), by two representative organisations (two European level professional associations), and one River Commission at the EU level.

Figure 13: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65)[75]



Inland skippers currently face imperfections with regard to RIS data as a result of inefficiencies. Necessary information on waterways, for example, is not provided by waterway authorities because there is not always a legal basis for it. As a result, it takes longer to search for the required data. Another issue relates to the fact that over the years, **several other implementing acts** (discussed in Section 0) **have been adopted in line with the RIS Directive**. These serve to help specify and implement crucial parts of the RIS Directive. As a result, technical specifications are spread across various legislative measures, complicating their clarity and consequent uptake. This leads to problems in ensuring the timely uptake of RIS in accordance with evolving technical innovations. During Survey 1, one of the stakeholders noted that even the implementation process of technical specification themselves is slow, leading to inefficiencies. This was also confirmed during Stakeholder Workshops 1 and 2, where participants flagged the existence of a wide variety of technical specifications and standards which need to be implemented to allow RIS to remain up to date with current technical developments.

New developments and new challenges (e.g. digital and green transitions) lead to the additional RIS data becoming useful to RIS users. To deal with these developments, the sector, for instance, needs to adapt to Smart Logistics by adopting Smart Shipping approaches. To do so, relevant information on waterway profiles, water levels and dimensions of structures forms an absolute necessity and RIS services could provide these. However, currently the inefficient processes for RIS technical specifications lead to delayed uptake of evolving technical innovation, also making IWT sector less competitive compared to other transport sectors.

As highlighted above, the fact that the technical specifications for RIS are not sufficiently up to date directly contributes to the problem at hand, i.e. a slow and fragmented deployment of RIS.

Problem driver 3: River Information Services do not support the integration of inland waterways transport into multimodal supply chains (modal shift)

The Commission SWD outlined several emerging new needs that involve all transport modes. For instance, green, smart and congestion-free transport and logistics are the key concepts on which the whole transport sector has been geared towards as part of the European Green Deal. However, the Commission SWD found that the IWT sector does not properly respond and adapt to these changes. Notably, it concluded that the integration of inland waterway transport into multimodal supply chains is lacking[76]. Similarly, while the RIS

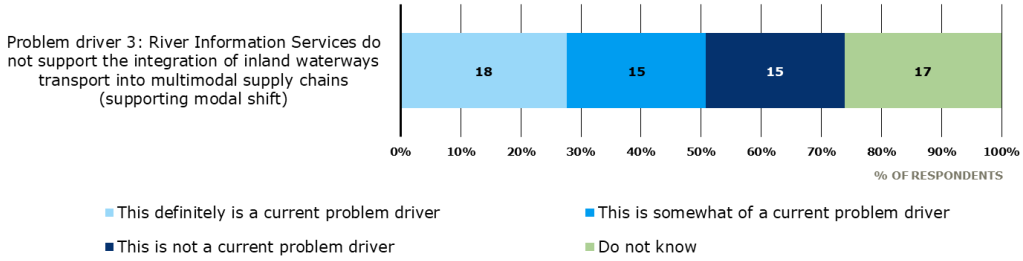
[75] For what concerns the 20 respondents who found problem driver 2 to *somewhat* reflect a current problem, the response was mostly popular among Inland Waterway Transport/RIS users, (including 8 ship owners/operators and two ship masters (skippers)) and national level public bodies, (three national RIS authorities, one Port Authority and one national administration).

[76] European Commission (2021). Pg. 57

Directive primarily focuses on the safety of navigation, the evaluation noted that the IWT sector has a need for improving its efficiency and establishing stronger links with other modes of transport.

This was particularly evident from Survey 1, where most respondents who found problem driver 3 to *definitely* reflect current problems, (18 out of 65 respondents[77]), or to *somewhat* reflect current problems (15 out of 65 respondents[78]), were national level public bodies and Inland Waterway Transport/RIS users.

Figure 14: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65)



EU transport policy aims to reduce road transport in favour of less polluting and more energy efficient modes of transport, and developments have been made to support multimodal and combined transport as can be seen by the Combined Transport (CT) Directive. This opens opportunities for the IWT sector, although currently not enough attention is being paid to market developments such as the need for inclusion of inland waterway transport in logistics supply chains, or the move towards synchro-modality, as well as developments relating to EMSWe and eFTI.[79] Concerning logistics supply chains, respondents to Survey 1 reported that the integration of IWT into multimodal supply chains will not just happen by virtue of harmonised RIS information but that, instead, logistic operators need to better integrate IWT within their transport modes for a real shift to occur.

In a different vein, one the respondents in the DINA and NAIADES Workshop 1 highlighted that as eFTI and EMSWe are used for different purposes, new developments for the two mechanisms would not be relevant for integrating different transport modes. Stakeholder Workshop 1 also shed some light on the need to find a common denominator between different navigation transport modes, suggesting the possibility for RIS to accommodate the integration of IWT into multimodal supply chains by mandating ports to meet the same RIS technology standards in delivering information.

[77] In particular, out of 18 respondents who found problem driver 3 to reflect current problems, the majority of them (7) are national level public bodies, (with four national administrations, two national RIS authorities and one Shipping Regulation/Technical Certification Authority). In addition, five Inland Waterway Transport/RIS users, (including one fleet manager/operator, one ship master (skipper), two ship owners/operators and one Vessel Traffic Services provider), and three representative organisations, (specifically, two European level professional associations and one national professional association), found problem driver 3 to definitely reflect current problems.

[78] Problem driver 3 was also found to somewhat reflect current problems by 15 respondents, specifically six national level public bodies, (consisting of four national administrations, one national RIS authority and one Port Authority), five Inland Waterway Transport/RIS users, (with three ship owners/operators and two ship masters (skippers)), and three international level public bodies, (specifically, three River Commissions). The problem driver was also deemed to somewhat reflect current problems by one citizen.

[79] p.95, Vanessa Ludden, Dr. Karolina Wrona, Lara Jansen, Elisa Colaiacomo (Ramboll) Dr. Edwin Verberght, Prof. Thierry Vanelslander, Prof. Edwin van Hassel (University of Antwerp) Linus Hoet (DLA Piper) (2020), Study supporting the evaluation of Directive 2005/44/EC on Harmonised River Information Services (RIS)

Notwithstanding, it emerged that the awareness of the IWT sector in this area is low and, moreover, there is a lack of a "one-stop-shop" approach due to the strong concentration of SMEs working in IWT and little investment being made in marketing and development to increase this awareness.[80] A more concrete root cause for this problem driver is that there are information gaps in ports (e.g. missing or outdated information on transhipment infrastructure, terminals and not synchronised information flows between the different modes of transport). Furthermore, it emerged from Survey 1 that the development of a multimodal routing tool to plan voyages which prioritises sustainable transport modes would greatly boost the integration of IWT into multimodal supply chains.

This problem driver directly impacts the part of the problem related to the competitiveness of the IWT sector and related to this, its contribution towards the European Green Deal objectives.

Problem driver 4: Inefficient exchange of information (including cross-border) and reporting

The Commission SWD concluded that the limited data exchange between countries, and the inefficiencies brought about as a result, lead to a high number of resubmissions of electronic reports and associated time and monetary investments for public and private stakeholders[81]. Indeed, despite improved Member State cooperation, there is still a lack of digitalisation of reports in general and some Member States continue to use different reporting applications. Moreover, there has been no substantial reduction in resubmissions of electronic ship reports at borders (as established in the 2021 Evaluation), due to differences in legal reporting obligations. IWT users still face avoidable administrative/time costs using RIS across borders. When asked about problem driver 4, 19 out of 65 respondents[82] found this problem driver to *definitely* reflect current problems, while 24 out of 65 respondents[83] found it to *somewhat* reflect current problems.

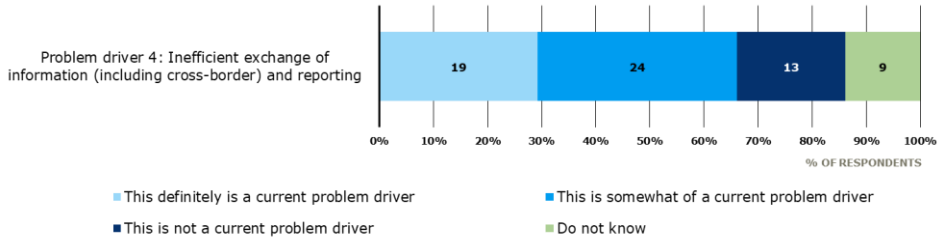
[80] Neat et. al., Medium and Long Term Perspectives of IWT in the European Union (2011), see: https://cedelft.eu/wp-content/uploads/sites/2/2021/04/4330_IWT_EU_main_report_1326970049.pdf

[81] European Commission (2021). Pg. 66

[82] Out of 19 respondents who found problem driver 4 to definitely reflect current problems, the majority (10) are Inland Waterway Transport/RIS users, (specifically, five ship owners/operators, three ship masters (skippers), one fleet manager/operator and one cargo owner/shipper). In addition, the problem driver was found to reflect current problems mostly among national level public bodies, (including one national administration, one Port Authority, one Shipping Regulation/Technical Certification Authority), two European level professional associations and two stakeholders identifying themselves as belonging to other categories.

[83] The problem driver was found to somewhat reflect current problems by 24 respondents. Within them, the majority (10) are national level public bodies, (most notably, seven national administrations and three national RIS authorities), followed by eight IWT/RIS users (including four ship owners/operators and three ship masters (skippers)), and three private sector companies, (with two marine/RIS equipment manufacturers and one logistics service providers).

Figure 15: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65)



The DINA report (2017) outlined that during a journey on the Danube, more than 20 different forms have to be filled in in different languages, which the study has estimated as taking ten to twenty minutes per border-crossing depending on the type of trip. These problems also occur outside the Danube, although with the help of BICS (Barge Information and Communication System) and SWINg (Single Window for Inland Navigation) today there is some form of harmonisation.

This was also recognised by respondents during Survey 1, where recent developments in RIS COMEX (e.g. CEERIS or the digitalisation of DAVID forms) would also help to resolve this problem. Notwithstanding, Stakeholder Workshop 1 and the DINA and NAIADES Expert Group 2 both revealed that the uptake the two derivative platforms of the RIS COMEX project, (the EuRIS and CEERIS platforms), is slow both on the authorities' side and on the side of RIS users, while considerably increasing the administrative burden for vessels. In addition, while the introduction of eFTI will be useful in tackling inefficient report, exchange of information with third countries will remain a challenge.

To provide an estimation of the scale of the problem driver, based on interviews with stakeholders, it was estimated that 30% of border crossings require repeat reporting in 2020 (106,622)[84]. Each resubmission is estimated to require 15 minutes for vessel operators. Thus, vessel operators are estimated to have spent 25,841 hours for the resubmissions of electronic reports in 2020, equivalent to EUR 689,759[85].Two-thirds of the border crossings that require repeat reporting (67%) occur in the Rhine basin and one-third of the border crossings that require repeat reporting (33%) in the Danube. Considering the traffic intensities on the Danube, this amounts to all border crossings in that area. The voluntary variant reduces half of the inefficiencies in the Rhine catchment, the obligatory variant provides for a complete harmonisation of all reference data, as a result of which there will be no repeat reports in the Rhine catchment.

In addition, based on the survey and the interviews with inland skippers it is estimated that inland skippers spend on average 10 minutes on reporting obligations in inland ports, with an estimated annual total cost of EUR 1.3 million in 2020[86]. A significant part of these costs stem from duplications that could be reduced or eliminated if a proper exchange of information between RIS and ports were in place.

[84] Due to the COVID-19 pandemic the number of border crossings in 2020 was particularly low (i.e. 19% lower than in 2015).

[85] The weighted average of the tariff per hour for non-manual workers (ISCO 8 - Plant and machine operators and assemblers) in the 13 Member State in the scope of RIS (EUR 26.7 per hour), based on Eurostat Structure of earnings survey (in 2022 prices), has been used to estimate the costs.

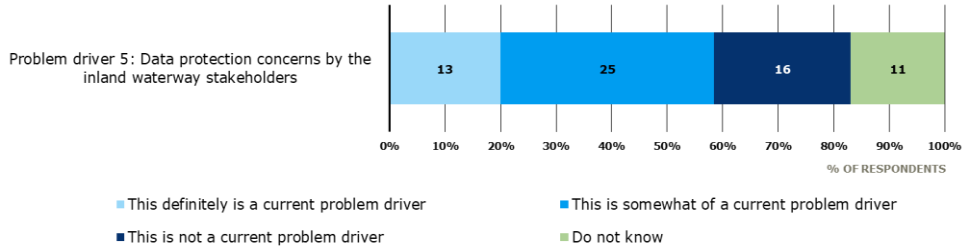
[86] Considering the 294,774 port calls in 2020 and 10 minutes on average spent on reporting obligations per port call, around 49,129 hours were estimated to be spent on reporting obligations in ports, or around EUR 1.3 million. The weighted average of the tariff per hour for non-manual workers (ISCO 8 - Plant and machine operators and assemblers) in the 13 Member State in the scope of RIS (EUR 26.7 per hour), based on Eurostat Structure of earnings survey (in 2022 prices), has been used to estimate the costs.

This problem driver leads directly to the problem at hand, namely a slow and fragmented deployment of River Information Services from a cross-border perspective.

Problem driver 5: Data protection concerns by the inland waterway stakeholders

The Commission SWD found that stakeholders were of the opinion that data protection concerns hinder the degree to which data is shared between competent authorities. To ensure compliance with the provisions of the General Data Protection Regulation (GDPR), the evaluation noted that Member States should conclude additional data exchange agreements for exchanging personal data for RIS purposes[87]. 13 out of 65 stakeholders[88] in Survey 1 were found to substantiate this statement as they believed that problem driver five *directly* reflects a current problem, whilst 25 out of 65 respondents[89] deemed it to *somewhat* reflect current problems.

Figure 16: Stakeholder survey 1: Q. In your view are the problem drivers listed below problems which the IWT/ RIS sector currently faces? (n=65)



Several studies point at the fact that data protection concerns hinder the degree to which data from electronic ship reporting is shared between competent authorities (see Appendix 14 of the Technical Annex includes an analysis on the legal framework envisioned by the current RIS Directive). Indeed the legal analysis found that the RIS Directive contains only very general rules on data flows, referring to a considerable extent to the provisions of the GDPR. Using the GDPR as a basis may considerably restrict the type of information that can be shared, as its definition of “personal information” may encompass also non-personal data.

For example, as emerged during Stakeholder Workshop 2, it is often the case that barge owners live inside their barge. In these situations, information about the position of their vessels becomes personal information. While this makes this data subject to the GDPR for sharing purposes, the lack of information on the position of surrounding vessels greatly impairs the possibility for skippers to plan their voyage efficiently. The uncertainty regarding the data protection status of RIS data directly leads to the problem at hand, i.e. a slow and fragmented deployment of River Information Services due to a reluctance to share data and a default position not to share data to be sure not to potentially break any rules.

[87] European Commission (2021). Pg. 37

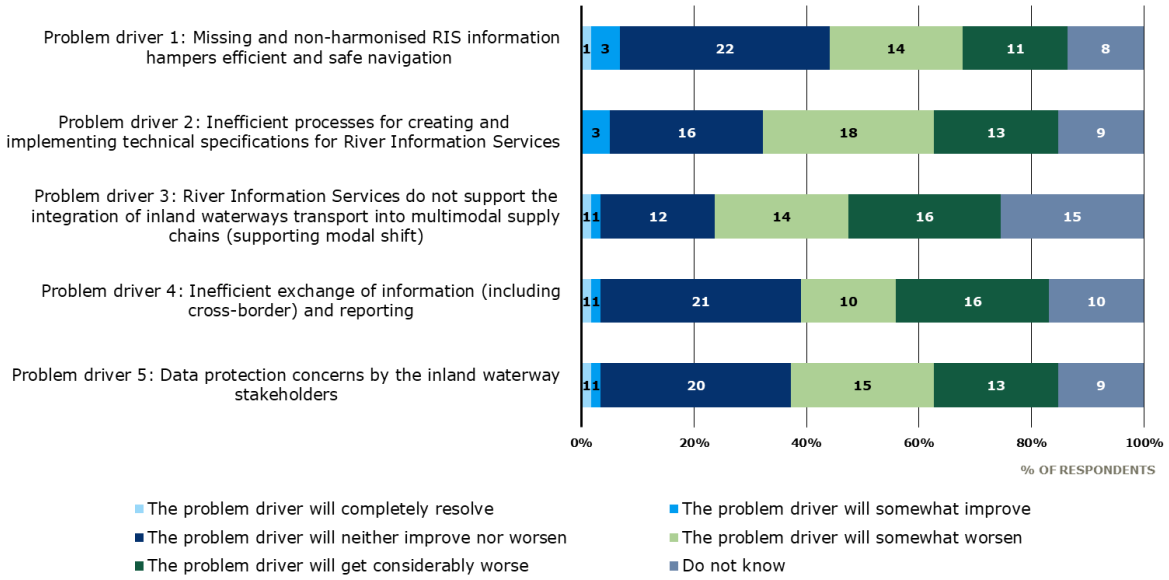
[88] Out of 13 respondents who found problem driver 4 to definitely reflect current problems, the majority (7) are Inland Waterway Transport/RIS users, (specifically, five ship owners/operators, one ship master (skipper) and one cargo owner/shipper). Moreover, three national level public bodies found the problem driver to reflect current problems, (with two national RIS authorities and one national administration).

[89] Out of 25 respondents who found problem driver 4 to somewhat reflect current problems, the majority (8) are Inland Waterway Transport/RIS users, (with five ship owners/operators, two ship masters (skippers) and one fleet manager/operator). In addition, 8 national level public bodies, (with one six national administrations, one Port Authority and one Shipping Regulation/Technical Certification Authority), two private sector companies, (one European level association and one marine/RIS equipment manufacturer) and two River Commissions at the international level found the problem driver to somewhat reflect current problems.

Future development and possible impacts of the problem drivers

Regarding the expected future development of the problem drivers, Figure 17 shows what stakeholders expected to happen if no revisions are made to the current RIS Directive. The majority of stakeholders across the five problem drivers stated that the problem will either get (somewhat/considerably) worse or will at least neither improve nor worsen (i.e. on average 46 out of 59 respondents across the five problem drivers). Only one (1) out of 59 stakeholders believed that the problem driver will completely resolve for four of the five problem drivers. The main problem drivers that the stakeholders judged would get considerably worse in the future were problem driver 3 (*River Information Services do not support the integration of inland waterways transport into multimodal supply chains*) and problem driver 4 (*Inefficient exchange of information and reporting*).

Figure 17: Stakeholder Survey 1: If the current RIS Directive is not revised, how do you expect the following problem drivers to develop in the future? (n=59)



Source: Survey 1 to stakeholders on the identified problems and drivers, and potential policy measures organised by the contractor (2022)

During the NAIADES/DINA Expert Group in July 2022, a similar question was asked of all respondents through a Mentimeter poll, namely: *if no revisions were made to the RIS Directive (i.e. the baseline scenario), how do you expect each of the identified problem drivers to develop (rate from 1 to 5)*. The findings were also similar as most of the ratings were around 3 (will stay the same) indicating that the situation in relation to the problem drivers will stay relatively similar. In relation to the last problem driver (inefficient exchange of information, including cross-border, and reporting, and data protection concerns by the inland waterway operators) the distribution of votes was rather uneven and some people voted 5 (will get much better).

When asked during Survey 1 whether there are additional problem drivers or problems which should be addressed as part of the revision of the RIS Directive, 20 stakeholders responded positively (out of a total of 65). Five stakeholders referred to the implementation of measures and issues related to it, such as little consideration given to the large group of large (>20 metres) recreational crafts that are obliged to use an AIS. Automation, specifically automated navigation, two stakeholders mentioned automation of vessel operation and automated vessel command.

Concretely speaking, three possible consequences can be connected to the identified problem drivers: Risk of internal market distortions (1), Inefficient use of River Information Services with negative consequences on inland waterways transport competitiveness and

safety, and limited contribution to emissions reductions (2), and Missed opportunities brought by digitalisation, and data protection concerns (3).

Overview of the impact to stakeholders in relation to the identified problem drivers

Small and Medium-sized enterprises (SMEs)

Considering the importance of SMEs within the European IWT sector (see Section 0), the SME test (i.e. tool 23 of the better regulation toolbox[90]) helps to assess the importance which should be placed on this particular category of stakeholders during this study. In particular, it helps to identify specific impacts on SMEs to minimise the burden imposed on them as they account for a large share of enterprises in the EU. According to the toolbox, SMEs are split into "three main categories (micro, small and medium), based on the following criteria: staff headcount, financial parameters (annual turnover or balance sheet) and the ownership criterion."[91]

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 38,373 in 2021, of whom around 61% are in freight transport and the other 47% in freight transport (see Table 1 for more details). No standardised datasets, displaying the number of SMEs within the IWT sector current exist. To provide an estimation, from available data (see Table 2) and assuming that only firms with more than 2 vessels could be non-SMEs, approximately 90% of enterprises that in the IWT sector can be considered as SMEs.

The level of relevance of the RIS Directive for the SMEs (i.e. among 'not relevant,' 'relevant' or 'highly relevant') was assessed as "relevant" in the inception phases of the IA. As the sector is largely composed of microbusinesses and SMEs, the revision of the Directive is relevant for them. The reasons for not assessing the relevance as "high" are the following:

- The IWT sector is a specific sector only present in 13 Member States (see Section 0)
- The estimated number of SMEs operating in IWT represents a small proportion of total SMEs within the transport sector in the EU as the overall sector is naturally much bigger covering much more than IWT only
- Possible revisions to the RIS Directive could lead to equipment/software costs (e.g. see sections 0 and 0) but these costs are one-off costs and should not be high enough to impact their competitiveness or economic viability
- Ultimately, the increased digitalisation and availability of information will represent a benefit for SMEs

A first important fact to highlight is that all but two of the respondents (i.e. 63 respondents) to stakeholder survey 1 have fewer than 250 employees and could thus be considered SMEs. The study also held a stakeholder workshop with RIS users, in particular skippers, with a view to gathering insights and perspectives on the contractor's estimates on potential costs or expected benefits stemming from the proposed policy measures to update the RIS Directive. Despite attempts to gather a broad stakeholder buy-in from direct users, only eight

[90] Better regulation: guidelines and toolbox. https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en

[91] p.182, Better regulation toolbox. To quantify as an SME, a company should employ less than 250 staff and have either a net turnover of less than €50 million or a balance sheet total of less than €43 million. Small companies have less than 50 employees and either a net turnover or balance sheet of €10 million, while micros have less than 10 employees and either a net turnover or balance sheet of €2 million.

participants took part in the workshop. Nevertheless, the insights from the workshop proved vital in trying to ensure that the calculations for the estimate of impacts were as close to reality as possible.

With regards to the calculation of the actual impact on SMEs; the calculation has been integrated in the assessment of impacts section per policy measure, as presented in section 0.

Problem tree

Based on the analysis presented in section 2.3, a "problem tree" was developed with the intention of providing a graphical representation of the problem analysis by mapping the cause-and-effect relationships underpinning it. The problem tree is comprised of three main elements:

Drivers: the main underlying causes of the problem which have an impact on the magnitude and scope of the problem at large: five have been identified

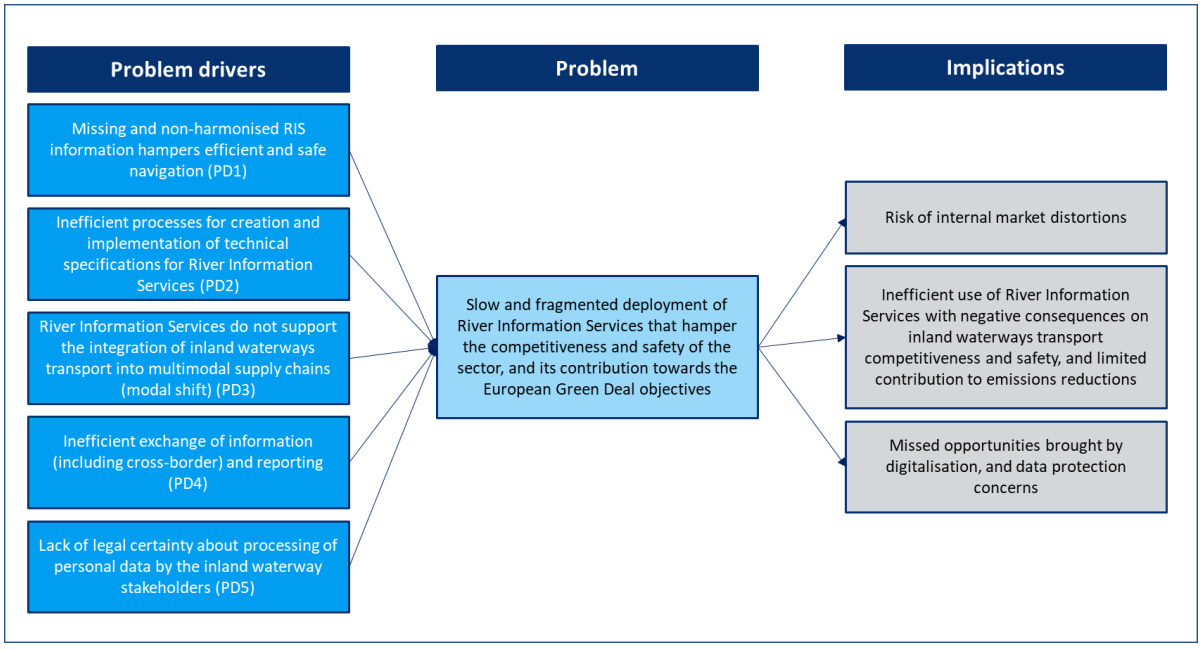
Problems: the core issue(s) which hinder or have an impact on a matter or situation: – one main problem has been identified

Implications: the change which is a result or consequence of an action or other cause: three have been identified

The problem analysis is based on findings from the previous evaluation of the RIS Directive, desk research, stakeholder consultations, and discussions with the European Commission, DG MOVE.

Moreover, the problem tree in the figure below shows the links between each of the elements using arrows.

Figure 18: Problem tree (problem driver, main problem and implications)



Source: elaboration of the contractor (2022)

EU Intervention

This section discusses the justification for EU intervention in the area of RIS. Firstly, the rationale for EU action is followed, followed by a brief discussion on the added value of EU action based on the results from the 2021 Evaluation.

Rationale for EU action

The rationale of public intervention at EU level in the area of RIS is laid down very clearly in preamble 12 of the RIS Directive:

Box 3: Rationale of the RIS Directive

> "*Since the objective of this Directive, namely, to establish harmonised RIS in the Community, cannot be sufficiently achieved by the Member States and can therefore, by reason of its European dimension, be better achieved at Community level, the Community may adopt measures, in accordance with the principle of subsidiarity as set out in Article 5 of the Treaty*."

Directive 2005/44/EC, Preamble 12

From this, it is important to acknowledge the principle of subsidiarity which ensures that any intervention is taken at the appropriate governance level.[92] To ensure that this principle is observed in this instance, it has been clearly outlined in the RIS Directive, as reflected in the quote displayed above. As the rationale for EU action has largely been unchanged since the adoption of the RIS Directive, and strongly outlined in the 2021 evaluation, the subsidiarity principle should still apply and be considered with any revision of the Directive. The concrete measures proposed all consider this as further highlighted in Section 0.

To further outline the role of the EU, the rationale can be traced back to the cross-border, international character of the IWT sector. At the time of the Directive's adoption in 2005, RIS was being developed at different rates, with different technologies and applications throughout Europe, potentially creating barriers to cross-border voyages. The aim of the Directive was to harmonise technologies across Europe to enhance cross-border transport, and to minimise coordination costs.

The findings of the Commission SWD support this rationale, stating that the cross-border, international character of the IWT sector requires unified EU-level intervention. Its advantage over other international interventions such as the UNECE guidelines, is its mandatory nature. Nevertheless, all consulted sources stressed that the same results could not have been achieved at the national level.[93]

[92] According to the full definition, subsidiarity "seeks to safeguard the ability of the Member States to take decisions and action and authorises intervention by the Union when the objectives of an action cannot be sufficiently achieved by the Member States, but can be better achieved at Union level, 'by reason of the scale and effects of the proposed action." See: https://www.europarl.europa.eu/factsheets/en/sheet/7/the-principle-of-subsidiarity.

[93] pp. 88-91, Vanessa Ludden, Dr. Karolina Wrona, Lara Jansen, Elisa Colaiacomo (Ramboll) Dr. Edwin Verberght, Prof. Thierry Vanelslander, Prof. Edwin van Hassel (University of Antwerp) Linus Hoet (DLA Piper) (2020), Study supporting the evaluation of Directive 2005/44/EC on Harmonised River Information Services (RIS)

Added value of EU action

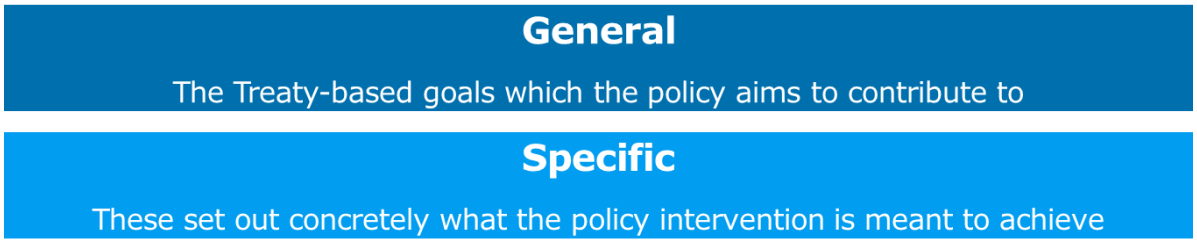
As described above, the Commission SWD uncovered a strong rationale for EU action in this policy area. Stakeholders who responded to the evaluation's consultation activities noted that the same benefits would not have been achieved by comparable interventions at the international, regional or national level. In particular, the push towards standardisation and harmonisation of RIS across Europe resulting from the common technical standards was highlighted. A stronger cooperation between ports and countries, as well as increased momentum of the IWT were mentioned as benefits stemming from RIS. Furthermore, other mentions of the RIS Directive's added value include the increased safety and perceived optimised use of infrastructure. This was confirmed during the data collected from stakeholders during this IA support study, especially from the interviews, where the added value of an EU intervention in the area of RIS was consistently mentioned as beneficial.

Indeed, the Commission SWD found no indications to suggest that the same benefits could have been achieved at the national level, with all evidence suggesting that intervention at the national level would be counterproductive, primarily due to high fragmentation of standards and implementation practices. Fragmentation would be particularly likely to occur in the areas of type-approval of equipment, increase in the number of resubmissions of electronic ship reports for international voyages, information comparability and accessibility issues. This would consequently impose significant monetary losses and a decrease in efficiency for both users and competent authorities.

Objectives

Following the problem tree (see section 2.6) and the detailed discussion of the problem definition (see section 0) and the objective tree presented in this section sets out the objectives to be achieved with a revised RIS Directive. The figure below depicts the several types of objectives that a legislative instrument like the RIS Directive would aim to achieve and the place of the specific objectives within it.

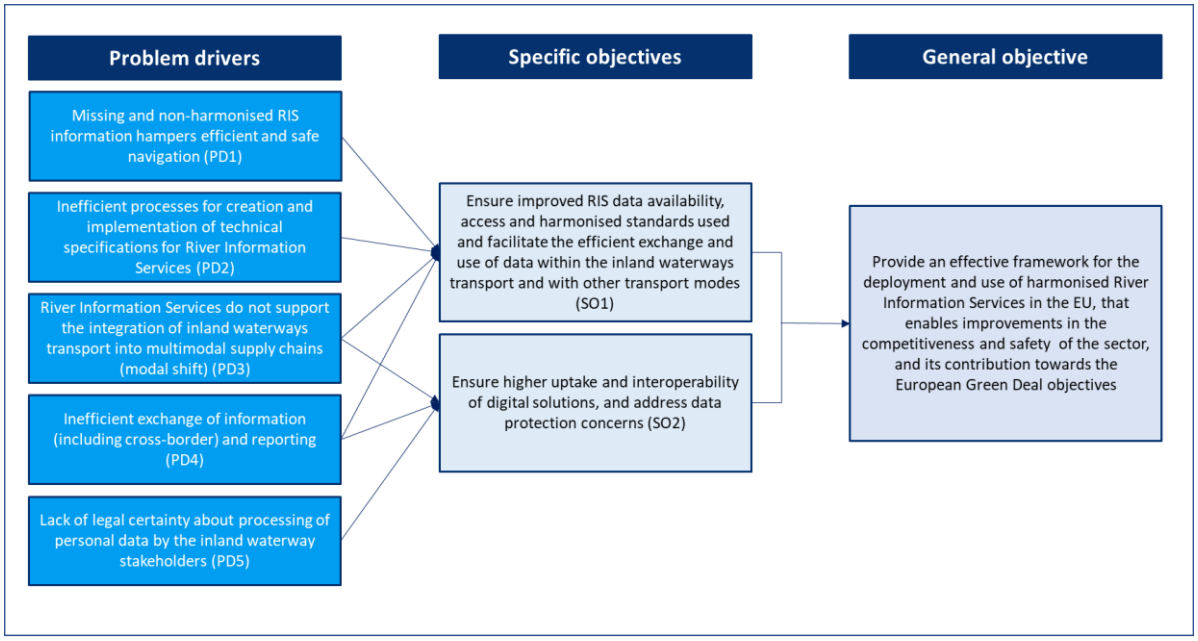
Figure 19: Various levels of objectives



Source: elaboration of the contractor (2022)

Following this logic, the figure below presents the five problem drivers and the policy objectives of the study split between specific objectives (two) which link to the concrete results envisaged with the RIS Directive and one general objective to which the RIS Directive contributes, but for which it is not the only relevant intervention. Moreover, the figure shows the links between each of the elements with arrows.

Figure 20: Objective tree



Source: elaboration of the contractor (2022)

The specific objectives and the general objective are described in more detail in the following sections.

There are two **specific objectives,** which aim to address the five problem drivers. The first specific objective aims to address four main policy drivers, namely missing and non-harmonised RIS information (PD1), inefficient processes for creation and implementation of technical specifications (PD2), role of RIS towards multimodal supply chains (PD3) and the inefficient exchange of information (PD4). To address these problem drivers, the first specific objective sets out three primary areas:

- **To ensure improved RIS data availability** – As outlined in problem driver 1 (see section 0), a core problem for IWT users is the fragmented or low-quality information from Member States via RIS, which has negative consequences for voyage planning and efficiency and safety of navigation.
- **To ensure access and harmonised standards used** - As outlined in problem driver 2 (see section 0), while the RIS guidelines and technical standards were found to still be relevant and necessary, there is a clear need for more flexibility to keep up with the evolving needs of the sector.
- **To ensure the facilitation of the efficient exchange and use of data within the inland waterways transport and with other transport modes** - As outlined in problem driver 4 (see section 0) within the IWT sector there is limited data exchange between countries, and the inefficiencies brought about as a result, lead to a high number of resubmissions of electronic reports and associated time and monetary investments for public and private stakeholders.

The second specific objective aims to address three main problem drivers, including the role of RIS towards multimodal supply chains (PD3), the inefficient exchange of information (PD4), and data protection concerns by stakeholders (PD5). As such, specific objective two is structured into primary areas:

- **To ensure higher uptake and interoperability of digital solutions** – As outlined in problem driver 3 and 4 (see sections 0 and 0) the IWT sector does not properly respond and adapt to changes as required by the European Green Deal. Notably, in the integration of IWT into multimodal supply chains. Similarly, while the RIS Directive primarily focuses on the safety of navigation, there is a need for improving its efficiency and establishing stronger links with other modes of transport.
- **To address data protection concerns** – As outlined in problem driver 5 (see section 0), stakeholders found data protection concerns to hinder the degree to which data is shared between competent authorities.

The above specific objectives sit within an overarching objective that a revised RIS would aim to achieve. The **general objective** sets out the ambition to provide an effective framework for the deployment and use of harmonised RIS in the EU, with a focus on enabling improvements in the competitiveness and safety of the sector, and its contribution towards the European Green Deal objectives. It should be caveated that this general objective (and subsequent specific objectives) does not aim to replace other IT systems, or for RIS to become the only system that should be in operation in the IWT sector, rather the objectives aim to encourage collaboration between different RIS systems and services.

Furthermore, on the basis of the findings from the Commission SWD, the objectives do not aim to deviate substantially from the original scope of the RIS Directive, but rather to update the legislation to accommodate recent developments, make it more resilient to current and future challenges and address particular areas that did not work well, as outlined in the analysis of the problem and problem drivers in section 0.

Policy measures and comprehensive policy options

This section sets out the policy measures and policy options put forward by the Commission to address the challenges identified in problem analysis (see section 2). The following section is structured as follows; [1] baseline scenario, [2] list of policy measures, including those retained and discarded, and [3] policy options.

Baseline scenario

The baseline scenario is the situation against which all policy alternatives are compared. The baseline scenario can be seen as the situation where established policies are implemented but the Commission does not formulate new policies regarding RIS (in other words, there will be no changes to the RIS Directive). However, other developments in the sector (e.g. at international or Member States' level or technological developments from private actors) will still be going on, including the effects of projects such as RIS COMEX. To establish a baseline scenario, a trend analysis was conducted on historical data, complemented with forecasts of the European Commission (i.e. EU Reference Scenario) and the contractor's own analyses. Whilst Annex VII provides more detailed information on the methodology for the baseline scenario, this section presents its main outcomes; full results are presented in the calculation Excel file in Annex VIII.

Firstly, a set of more general mega-trends and other ongoing initiatives affecting inland navigation are described in the next section. This is followed by a more detailed description of each of the themes which have been used to build the baseline scenario around and which relate to a series of indicators are presented, one after the other:

- Development of transport volumes in inland waterway freight transport
- Indicators derived from transport performance (i.e. vessel journeys, border crossings and vessel kilometres)
- Development of the fleet
- Development of energy consumption in the inland navigation sector
- Development of emissions in inland navigation (i.e. carbon dioxide, nitrogen oxides and particulate matter)
- Development of safety in the inland navigation sector
- Transport cost development in inland navigation

Mega-trends and other ongoing initiatives affecting inland navigation

General trends and developments relevant to developments in the inland waterway sector discussed impacting RIS identified in this report are seven-fold:

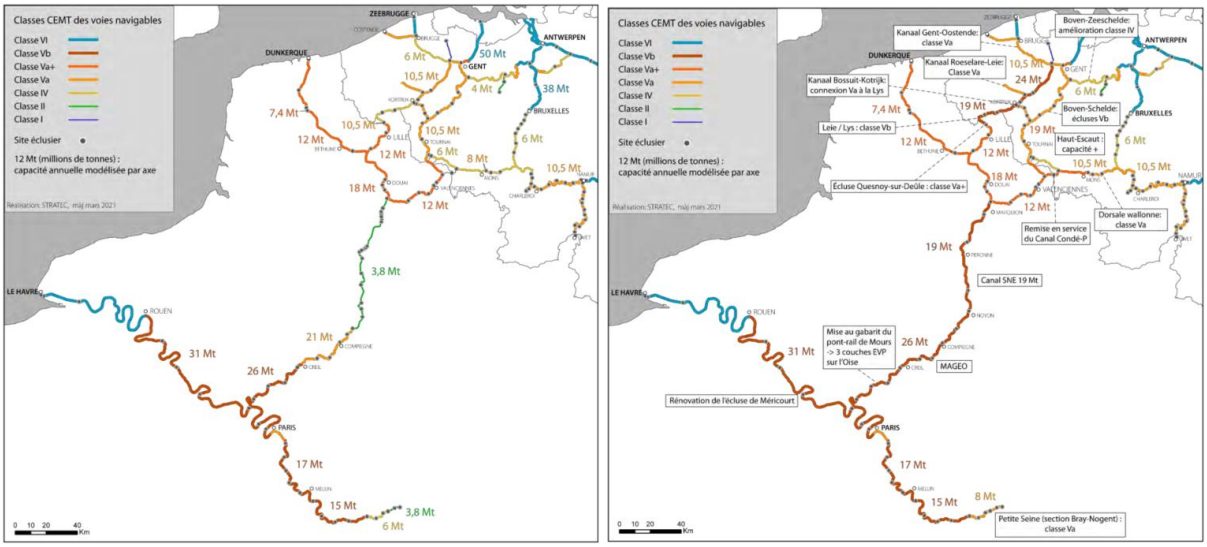
- Completion of the TEN-T transport network
- Globalisation or slow balancing
- Circular economy
- Sustainability
- Autonomous sailing and digitalisation
- Climate change
- RIS COMEX

Each of these are described in more detail below.

Completion of the TEN-T transport network

On the European waterway network, some important infrastructure works for inland navigation are being conducted. The most notable of these is the realisation of the Seine-Scheldt link in northern France, which will also link the interconnected European waterway network (i.e. Rhine, Danube, Elbe) to the Seine basin. This will make it possible for (large) inland navigation vessels to also reach Paris. There is a large potential for increasing cargo volumes here; studies indicate that around 15 million tonnes of cargo can shift from road transport to inland navigation on this axis by 2035[94].

Figure 21: Overview of forecasted volume of the current network (left) with Canal du Nord (CEMT I) and future network with Canal Seine-Scheldt (right) (CEMT Vb)



Source: Stratec (2021)

To make a good connection possible, various infrastructural works are also being conducted in Belgium, aimed in particular at bringing the capacity of the connecting waterways into line with the dimensioning of the Seine-Scheldt Canal. Work is also being done in a European context to achieve Good Navigation Status[95], for instance by further deepening the Rhine to make it more climate-proof, and developing maintenance works on the Danube to improve navigability and raise the height of various bridges to encourage multimodal transport (interchangeability of cargo across modes), as container vessels will be allowed to transport more containers per ship, thus resulting in lower transport costs. Soft components of a Good Navigation Status include the implementation of standards set by the RIS Directive. The length of waterways under scope of the RIS Directive will increase by approximately 106 kilometres.

Globalisation or slow balancing

Partly due to developments such as the covid-19 pandemic, the climate crisis and the war in Ukraine, doubts about globalisation have been growing. The question here is whether production will continue to spread around the world and whether the finished products will then continue to be moved to final destinations by ever-expanding ships. Or will there instead

[94] The most recent study was carried out bij Stratec (2021) – Prevision de trafics pour preparation du dossier mie 2 du project Seine – Escaut.

[95] Good Navigation Status in inland waterways refers to a condition where the waterway is safe and navigable for boats and ships to travel through without any significant obstructions or hazards. This includes adequate water depth, sufficient width for vessels to pass safely, clear channels free from debris or other obstacles, and appropriate aids to navigation such as buoys, markers, and lights.

be a development where production is done closer to the end consumer. After an extended period of globalisation, the world, influenced by the above developments, seems to be tending more towards "slow-balisation"[96]. For inland navigation, this has consequences. A large part of the cargo transported is related to seaports. Raw materials are delivered by (liquid) bulk carriers, while semi-finished and agricultural products are transported by ship. When supply chains are shortened, this will thus also affect the position of inland navigation as a large part of seaport-related traffic is transported by inland waterways to its final destination[9798]. The density of the network is relatively low and inland shipping will therefore lose market share[99100]. It has no direct impact on RIS though.

Circular economy

Circular economy is an important development that will affect inland ports and their activities in the coming decades. To process circular flows, but also in the context of the required (physical and environmental) space, inland ports play a significant role. The various components of the circular economy present opportunities for inland ports. For inland navigation, the circular economy probably means an increase in cargo flows[101]. Erasmus University indicates a possible increase of cargo volumes of approximately 5%[102]. Among other things, the amount of empty shipping seems to be greatly reduced as a result. It has no direct impact on RIS though.

Sustainability

In line with the European Green Deal[103], the Smart and Sustainable Mobility Strategy[104] and the Fit-for-55 package[105], inland navigation also needs to reduce emissions of greenhouse gases and air pollutants as much as possible. Several options exist to this end, although in recent years, innovation has mainly focused on reducing emissions from existing and new vessels in the form of pilot projects. For instance, there are opportunities for battery-electric ships[106], hydrogen ships[107] and methanol-fuelled ships[108]. But biofuels combined with clean combustion engines are also an option.

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[96] Report by the Clingendael Institute and Erasmus University: https://www.clingendael.org/sites/default/files/2022-11/Navigating_an_Uncertain_Future__China_maritiem-logistieke_hubfunctie.pdf

[97] https://www.europarl.europa.eu/RegData/etudes/STUD/2015/540350/IPOL_STU(2015)540350_EN.pdf

[98] https://www.espo.be/media/ESPO%20Valancia%20DEF%20Bart%20Kuipers.pdf

[99] https://www.eur.nl/en/upt/media/2021-01-bijlage-2-onderzoek-impact-coronavirus-op-maritieme-sectoren-definitief

[100] Dutch Ministry of Infrastructure and the Environment (2019), Goederenvervoercorridors. en Zuidoost. Handelingsperspectieven. Tussenrapportage. September 2019

[101] https://www.ccr-zkr.org/files/documents/om/om21_IV_en.pdf

[102] https://www.eerstekamer.nl/overig/20201126/onderzoek_naar_de_impact_van_het/document

[103] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

[104] https://transport.ec.europa.eu/system/files/2021-04/2021-mobility-strategy-and-action-plan.pdf

[105] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

[106] The first zero-emission ship was launched in 2021 with the Alphenaar, making use of Zero Emission Services' battery packs. https://zeroemissionservices.nl/en/zero-emission-services-commences-operation/

In 2021, the Central Rhine Navigation Commission published a roadmap containing two transition paths by which the inland navigation sector can move towards a virtually emission-free sector by 2050. There is a more conservative path, which is based on already matured technologies that are cost-effective in the short term, but involve uncertainties regarding the availability of certain fuels, and a more innovative path, which is based on technologies that are still in their infancy but are promising in terms of reducing emissions in the longer term. The transition pathways also describe the role the different technological solutions will play in the context of the energy transition challenge, as it evaluates their suitability for the different ship types in Europe and the vessel profiles. The two transition pathways are both ambitious enough to achieve the targets. A key conclusion is that there is no technological solution that would be suitable for all types of ships and vessel profiles as "one size fits all", i.e. as a general solution. To achieve energy transition, a technology-neutral approach within the sector should therefore be sought. It also discusses the financial challenge and the possible form of "no-regret" investments.

River Information Services' role in facilitating the energy transition is limited. However, new data on, for example, current waiting times at locks can stimulate more efficient navigation. It is also clear that electric without fuel conversion is the most energy efficient. This thus requires the presence and quality of the necessary infrastructure. On the other hand, the density of energy is a vital component in the choice of propulsion. Electric-direct has the smallest density, thus it is suitable for short, fixed journeys. Within a few years, current issues will lead to targeted solutions where available, and the costs will be decisive for the spread of the different solutions. Moreover, inland ports and (alternative) refuelling stations could also indicate the availability of clean energy facilities by means of River Information Services. This would increase the uptake of greener vessels with environmental benefits This allows an up-to-date overview to be offered of the availability of such alternative energy sources along the European waterway network.

Smart Shipping (including automated and/or autonomous navigation) and digitalisation

Sensors are already widely used on ships to monitor all processes. Towards 2050, further digitalisation is foreseen as well as ‘smartening’ of ships. Technological developments, deployed to allow ships to sail remotely controlled, or at some point even autonomously, is an example of this, but also the deployment of technology to work towards predictive maintenance instead of corrective maintenance. This also requires a shore-based organisation and a topic like cybersecurity is important from this perspective. Smart ships offer opportunities to counter the labour shortages that play a role in the inland navigation sector. The same transport performance can thus be delivered with less personnel. Innovative companies such as SEAFAR already offer remote-controlled sailing solutions and, for instance, clear shipping lanes without (narrow) openings at bridges and with a predictable traffic pattern already result in less labour pressure. Towards the future, developments will have to make it possible to enter and exit locks independently and pass other vessels on narrow waterways. However, this will also require good digital infrastructure.

RIS can therefore be considered as one of the key-enablers for automated navigation and digitalisation, amongst others such as a Sustainable Crewing System. As indicated in several reports, including Panteia (2021)[109] and Platina3 (2022)[110], the extent to which far-reaching

[107] On May 25th, 2023, the first H2-powerered ship was launched in the Netherlands: https://futureproofshipping.com/news/2023/future-proof-shipping-launches-first-hydrogen-powered-inland-container-ship/

[108] VT-Group expects to launch the first methanol powered inland waterways tanker vessel by 2024: https://duurzamescheepvaart.nl/24-miljoen-euro-subsidie-voor-methanol-als-alternatieve-scheepsbrandstof/

[109] https://zoek.officielebekendmakingen.nl/blg-1038578.pdf

automated navigation is taken up by the industry is partly linked to the further development of River Information Services. This was emphasised by the Flemish Waterway's operations director at the launch of the Zulu 4's automated test sail.

"What specific data needs exist and how can a waterway operator better support certain operational processes. What data can be made available in the future to facilitate Smart Shipping? For example, digitising and sharing data such as the status of bridges and locks, light signals or lock schedules[111]"

Extensively automated sailing vessels have additional information needs that are currently not covered by the RIS Directive. These include up-to-date traffic information, the information communicated visually via shipping signals, etcetera. As the majority of shipping takes place internationally, it is necessary to find European coordination when offering such services to inland navigation. Suppliers of technical systems to enable or support automated shipping can be developed at lower cost if they can rely on a European standard, rather than 13 national standards.

Climate change

Climate change affects the navigability of Europe's main rivers. Both the Rhine and the Danube are (largely) undammed rivers where water levels can fluctuate. Dry years, such as recently in 2003, 2009, 2011, 2015, 2018 and (the summer of) 2022 showed that inland navigation is strongly affected by climate change. Water levels in rivers sank to such levels that the capacity of the inland navigation sector was greatly reduced. Forecasts by meteorological institutes in the IPCC point to more frequent extreme water levels. Inland navigation should be prepared for this and adapt to these conditions. Several parties are already launching vessels specifically designed for low water levels to offer longer-term transport certainty to customers, but digital solutions can also help. Accurate medium-term forecasts, such as those recently developed by the *Bundesanstalt fur Gewässerkunde* (BafG) in Germany, make it possible to gain insight into (possible) water levels on the Rhine, Elbe and Danube up to six weeks ahead. Moreover, software developers such as COVADEM make it possible to use echo lopes from ships to monitor the bottom of rivers in real time. This allows a small keel clearance to be maintained with more certainty during low water levels. Finally, waterway authorities and meteorological institutes continue to make increasingly accurate short- and medium-term water level forecasts available. It is important that accurate water level measurements and predictions are provided to the IWT sector, for instance by means of River Information Services.

Climate change will further increase the need for River Information Services. . Inland waterway operators will have a greater need for accurate data on both the bottom location of waterways and forecasts of river discharges and associated water levels. In addition, due to more frequent low water levels, channels will become narrower, and the volume of shipping traffic will increase. This phenomenon only makes the need to share accurate traffic images with the inland navigation sector more urgent.

RIS COMEX

RIS COMEX is a CEF-funded project which aims to implement and operate cross-border river information services based on operational RIS data exchange. These RIS-based Corridor (information) services better enable traffic management by authorities and transport

[110] https://platina3.eu/digital-and-automated-infrastructure/

[111] https://www.schuttevaer.nl/nieuws/actueel/2023/06/02/zulu-04-vaart-autonoom-over-schelde-maar-pas-eind-2024-operationeel/

management by the logistics sector. They make use of available national infrastructures and services.

RIS COMEX started during 2016 and ended 2022. The project area covers a total of 13 different European countries, with 14 partners joining forces under the coordination of the Austrian Viadonau with the common goal of realising RIS services on the corridor. In addition, Poland joined the project as a cooperation partner.

For the inland navigation sector, the RIS Comex project means that a one-stop-shop platform is created where all relevant information on European waterways is available. The project contributes to further harmonisation of (interpretations of) the current directives, allowing more unambiguous information to reach the sector. It also allows for easier exchange of information between ship and shore and between ships, reducing the administrative burden for the sector.

Box 4: The need for up-to-date information for reliable voyage and route planning

For skippers and logistics partners, up-to-date information for reliable voyage and route planning is indispensable. Access to static and dynamic information that provides a 24/7 picture of the situation on the waterways is of significant importance. This is why Rijkswaterstaat, in cooperation with 13 European countries, has set up an entirely new online environment: EuRIS - European River Information Services.

This new platform (www.eurisportal.eu) helps waterway users plan their travel and arrival times across Europe in one user-friendly environment. Previously, boaters had to consult numerous websites and information sources to retrieve all relevant information, especially for cross-border trips. EuRIS now offers one-stop shopping for all relevant fairway and traffic-related information by combining data from 13 countries in one central place. Real-time information Skippers and other users can gather real-time information at any time and gain insight into the current traffic situation on their shipping lane, waiting times, incidents or disruptions that affect travel time. They can also share information with others, such as their ETA. All information is in a protected environment to ensure privacy.

Interconnected inland navigation network in Europe

The platform covers the main interconnected inland waterways in Europe, with the 7 main corridors (Rhine, Danube, Elbe, Moselle, Dunkirk - Scheldt, Amsterdam - Antwerp - Liège, Amsterdam - Antwerp - Brussels) and many more.

The current partnership consists of the following countries: Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, Luxembourg, the Netherlands, Romania, Serbia and Slovakia. The cooperation has resulted in this jointly designed cross-border system, which is unique in its size and high value-added services offered. The countries will continue their cooperation to further develop the platform in the coming years, depending on needs and user requirements.

Source: elaboration of the contractor (2022)

Each of the seven developments described above are impacting the inland navigation sector as a whole, its volume, and therefore any potential benefits of adaptations of the RIS Directive in separate ways. In the following sections, the identified indicators are mapped, both historically and in the form of future projections to show some of the (expected) developments related to these mega-trends.

Development of transport volumes in inland waterway freight transport

Firstly, the past development of this indicator is described, followed by the future outlook for it. The transport volume is an important indicator. One of the problems identified regarding the current RIS directive is that it does not contribute to a better integration of inland navigation in the multimodal supply chain (PD3). Measures are aimed at achieving such integration. Therefore, it is important to gain insights into the modal shift potential. For this we need insights into the current and future (expected) transport performance of inland navigation and the modal split ratios. Moreover, missing and/or non-harmonised information does not sufficiently promote efficient and safe navigation. In order to understand to what

extent the RIS guidelines could possibly contribute to this, we also need to know the current transport performance and, from this, the development of the number of trips and border crossings.

- Outlook

In the outlook, we distinguish between freight transport and passenger transport.

Freight transport

The following graph shows the expected development of transport demand in inland navigation in the future.

Figure 22: Transport performance in IWT (in Giga tonne*kilometre)

	2015	2020	2025	2030	2035	2040	2045	2050
Inland waterways (freight)	147	132	165	178	186	195	203	212

Source: EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling)) and Eurostat, table IWW_GO_QNAVE

The graph shows that the inland navigation sector is expected to grow strongly in the future. Compared to 2015, a growth of 44% in transport performance is expected by 2050 from 147 Gtkm to 212 Gtkm. This corresponds to an average annual growth of 1%. This growth mainly results from targets set at European and national level in:

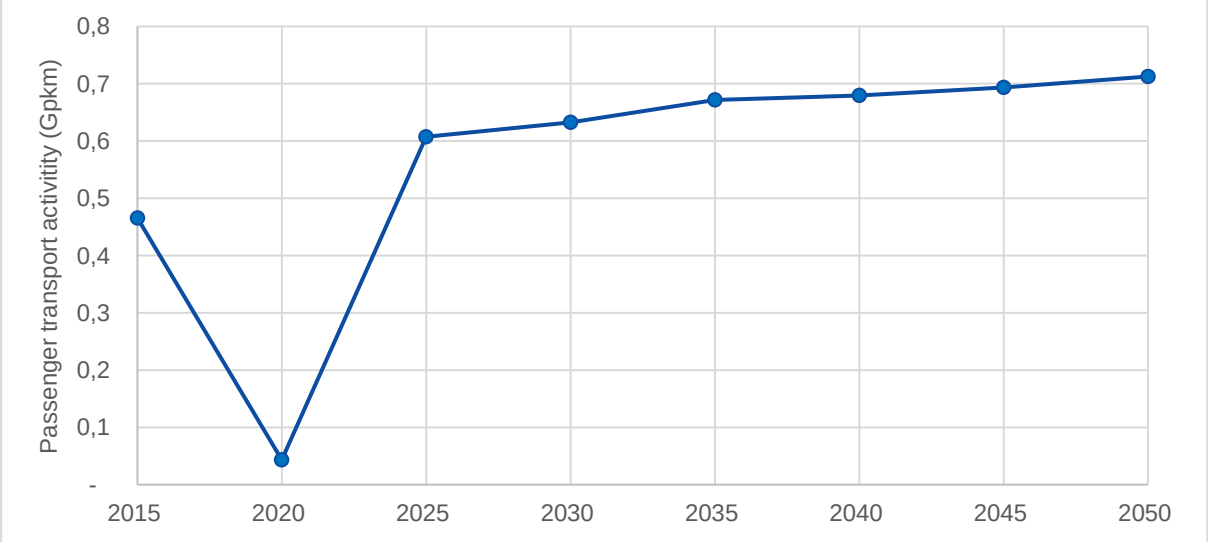
The European Green Deal, which says that a substantial part of the 75% of inland freight carried today by road should shift onto rail and inland waterways

The Sustainable and Smart Mobility Strategy, in particular its point 45: “Transport by inland waterways and short sea shipping will increase by 25% by 2030 and by 50% by 2050”

Passenger transport

The figure below shows the development of transport demand in passenger shipping towards 2050.

Figure 23: Development of transport demand in passenger shipping towards 2050 (in Giga passenger kilometres)



	2015	2020	2025	2030	2035	2040	2045	2050
Inland waterways	0,5	0,04	0,6	0,6	0,7	0,7	0,7	0,7

Source: Own data and projections based upon EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling))

The graph shows that passenger shipping is expected to undergo solid growth towards 2050. The number of passenger kilometres is expected to increase by 53% compared to 2015 from 0,5 Gpkm to 0,7 Gpkm. The transport demand for passenger shipping is based on the volume of passenger shipping in 2019 (based on CCNR data)[112], the assumed average sailing distance per passenger in inland navigation is 350 km and growth figures for the growth of domestic maritime passenger shipping have been applied.

- Transport volume of IWT in relation to other land modes

One of the problems identified regarding the current RIS directive is that it does not contribute to a better integration of inland navigation in the multimodal supply chain (PD3). Measures are aimed at achieving such integration. Therefore, it is important to gain insights into modal shift relationships in the current and future situation. The graph below shows insights into the expected development of modal split ratios in the baseline.

	2015	2020	2025	2030	2035	2040	2045	2050
Road	1.628	1.721	1.882	2.102	2.179	2.245	2.339	2.424
Rail	396	382	479	564	635	679	727	777
Inland waterways	147	132	165	178	186	195	203	212

Source: EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling)) and Eurostat, table IWW_GO_QNAVE

The graph shows that modal split ratios are gradually changing on a European scale. What stands out most is that rail freight transport will increase in share, at the expense mainly of road transport but also of inland navigation. Very gradually, inland navigation is expected to lose market share. This is mainly due to the specific type of goods currently transported by inland navigation: petroleum products and coal. Under the influence of energy transition, these flows will decrease. Although growth is expected in the container segment, this growth cannot stop an overall decline in the share of the total split.

Indicators derived from transport performance

For freight transport, transport performance is measured in tonnes transported times the distance travelled. For passenger transport, transport performance is measured in passengers transported times the distance travelled. Three important indicators are derived from transport performance. These include:

Development of the number of vessel movements: the number of vessel movements indicates how many trips are started, without considering the cargo load or the transport distance

Development of the number of border crossings: the total number of border crossings

Development of the number of vessel kilometres: the number of vessel kilometres shows how many kilometres all vessels travel annually, with or without cargo

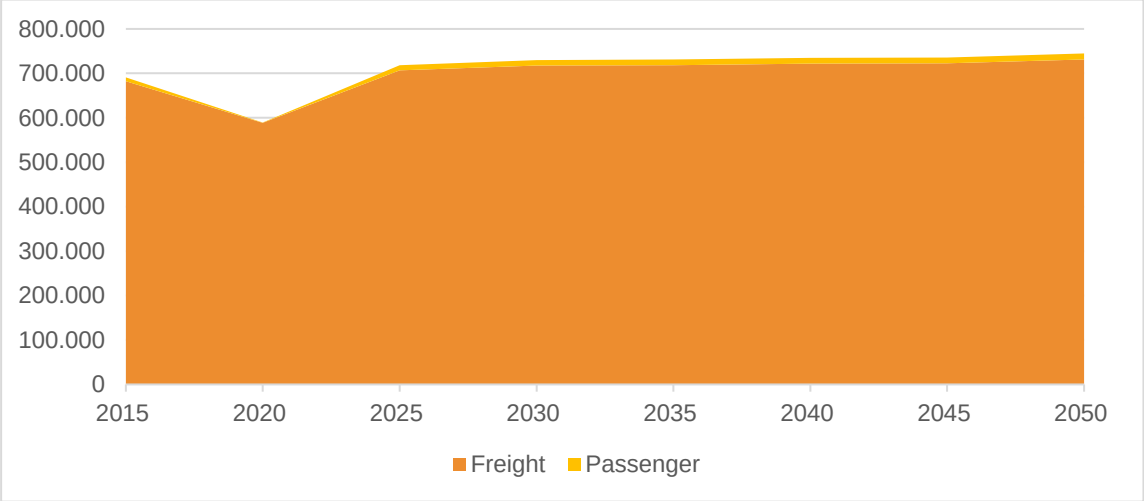
Below, we go into more detail for vessel journeys, border crossing and vessel kilometres.

[112] CCNR Market Observation Annual Report 2019, p133: https://www.ccr-zkr.org/files/documents/om/om20_II_en.pdf

- ## Vessel journeys

The graph below shows the number of ship trips in Europe on an annual basis. It shows that the number of voyages per year has historically been approximately 650,000 to 700,000 and is expected to increase both for passengers and freight Passenger vessel journeys are projected to rise from 8,867 in 2015 to 12,043 in 2030 and 13,572 in 2050, corresponding to an increase of 53% between 2015 and 2050. The number of freight vessel journeys are projected to increase by 7%, from 682,120 in 2015 to 731,234 in 2050. The dip in the number of vessel journey in 2020 is due to Covid after which a swift recovery took place.

Figure 24: Number of vessel journeys



	2015	2020	2025	2030	2035	2040	2045	2050
Number of vessel journeys (#)	**690,987**	**589,548**	**718,186**	**729,880**	**731,380**	**734,529**	**735,804**	**744,806**
Passenger	8,867	827	11,567	12,043	12,795	12,940	13,212	13,572
Freight	682,120	588,721	706,619	717,838	718,585	721,589	722,591	731,234

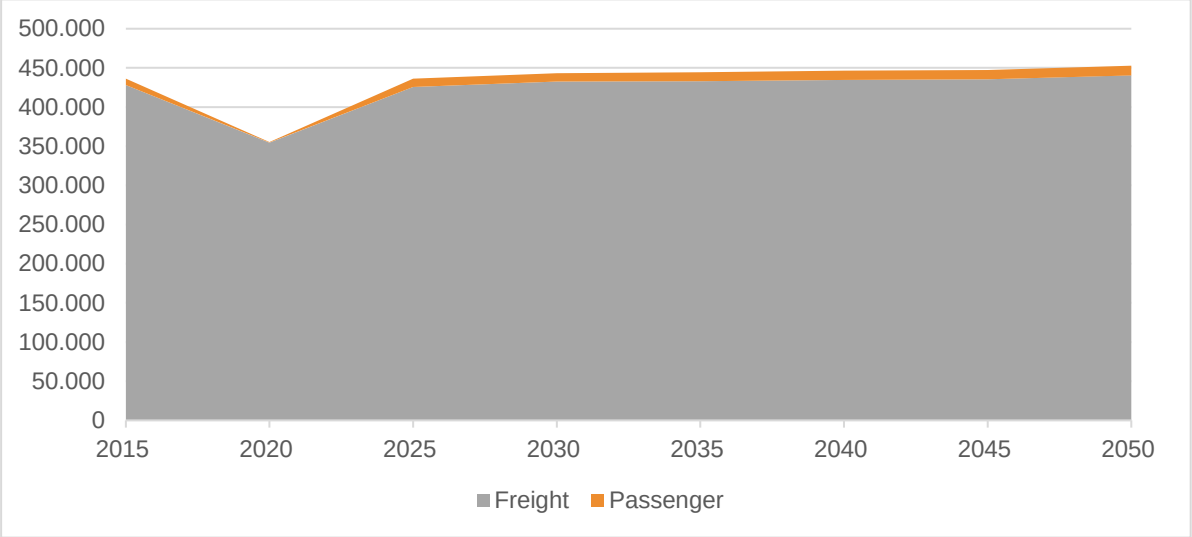
Source: EU Reference scenario and Eurostat, table IWW_GO_QNAVE (full availability for CCNR countries since 1982, full availability for Danube countries since 2005 – earlier years based on statistics of the Danube Commission)

It is noteworthy that the amount of ship trips does not grow along with cargo volume. We observe a 31% growth in transport volume against only a 7% growth in the number of voyages. The explanation for this is a further increase in scale of the inland shipping sector, which results in more cargo volume per journey.

- ## Border crossings

Specifically for RIS, it is also important to gain insight into the number of border crossings in inland navigation as 60% of the vessel journeys cross at least one border The figure below describes the annual number of border crossings in inland navigation.

Figure 25: Number of border crossings



	2015	2020	2025	2030	2035	2040	2045	2050
Number of border crossings (#)	**436,291**	**355,406**	**436,135**	**443,324**	**444,454**	**446,395**	**447,244**	**452,776**
Passenger	8,344	747	10,452	10,882	11,562	11,693	11,939	12,264
Freight	427,947	354,659	425,683	432,442	432,892	434,702	435,305	440,512

Source: EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling)) and Eurostat, table IWW_GO_QNAVE figures edited by Panteia (number of border crossings per country-country relation per voyage; see methodology in Annex VII)

The number of border passages by inland vessels is relevant when it comes to RIS. When a ship crosses the border, it enters a control area of another waterway authority. This authority must obtain information from the ship that has just entered the country from the point of view of safety, traffic flow and statistics. This information must be passed on from inland shipping. However, authorities do not always pass on the data correctly during international travel, which means that the same travel reports have to be made repeatedly. It is therefore relevant for this study to have insight into the amount of border passages in inland shipping.

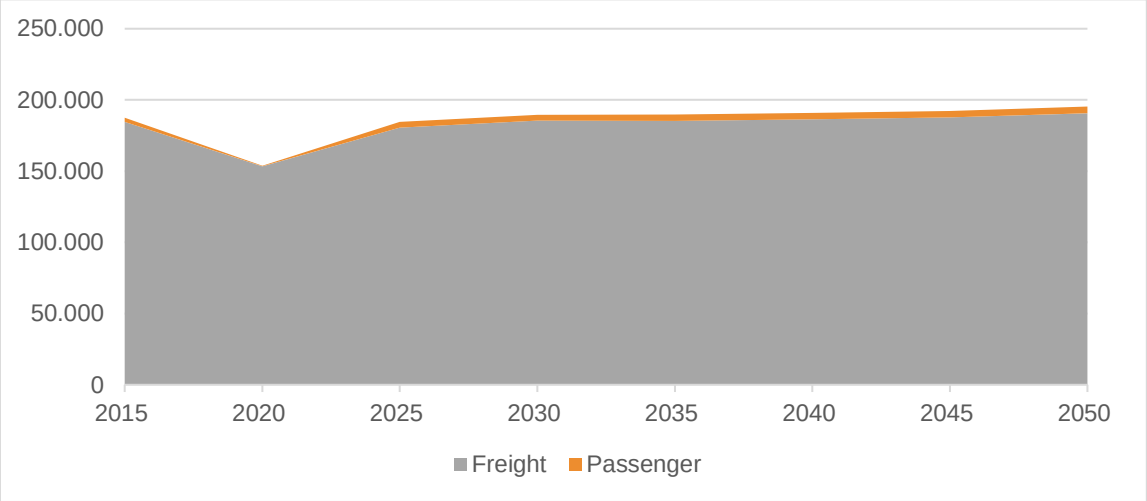
International inland water vessel journeys involve on average 1.3 borders per journey. This means that in many cases these are journeys between neighbouring countries (e.g. the Netherlands-Belgium or the Netherlands-Germany) and to a much lesser extent journeys that pass through three or more countries (e.g. Belgium-the Netherlands-Germany or Ukraine-Romania-Bulgaria), although these journeys do happen, which makes the average number of border crossings higher than 1 but not by much.

The attached table describes the amount of border crossings for EU ship trips. A ship sailing between the Netherlands and Germany usually passes the border only once (on the Waal/Rhine at Lobith/Emmerich. A ship sailing from France to Romania, Bulgaria or Ukraine passes a multitude of borders ((1) France-Belgium at Mortagne du Nord, (2) Belgium-Netherlands at Antwerp or Zelzate, (3) Netherlands-Germany at Lobith/Emmerich, (4) Germany-Austria at Passau, (5) Austria-Slovakia, (6) Slovakia-Hungary, (7) Hungary-Croatia, (8) Croatia-Serbia, (9) Serbia-Romania, (10) Romania-Bulgaria. Any border crossing in inland navigation can lead to administrative hassle and having to re-notify cargo data.

- Vessel kilometres

The graph below shows the expected future development of vessel kilometres.

Figure 26: Number vessel kilometres



	2015	2020	2025	2030	2035	2040	2045	2050
Number of vessel kilometres (1.000 km)	**187,579**	**153,713**	**184,607**	**189,632**	**189,743**	**190,987**	**192,337**	**195,349**
Passenger	3,103	289	4,048	4,215	4,478	4,529	4,624	4,750
Passenger	184,476	153,423	180,559	185,418	185,265	186,458	187,713	190,599

Source: EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling)) and Eurostat, table IWW_GO_QNAVE

It can be seen that in the coming years, the amount of vessel kilometres will remain constant at a level of approximately 180 to 190 million kilometres per year. Combining this with the expected increased transport performance indicates an efficiency increase. The assumptions and expectations for the number of vessel kilometres are based on the expected development of the transport performance of inland navigation and the expected development of the growth of carrying capacity. Due to economies of scale (see also megatrends) in inland navigation, ships are increasingly expected to carry more cargo per movement, despite climate change (small negative effect).

Development of the fleet

Firstly, the past development for this indicator is described, followed by the future outlook for it.

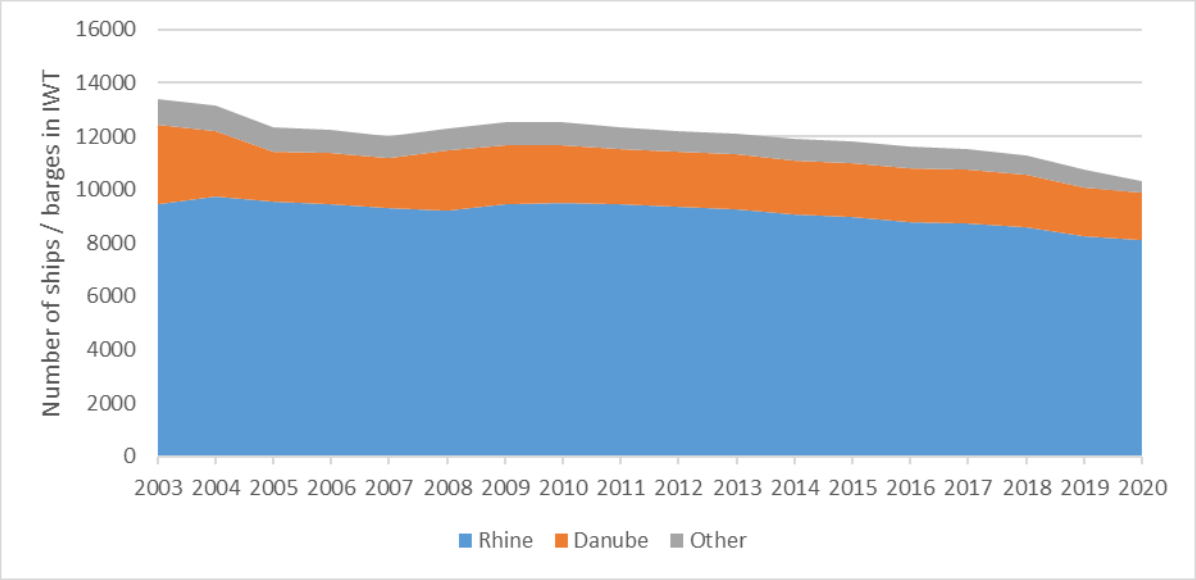
- ### Past developments

In the analysis below, we distinguish between freight transport and passenger transport.

Freight transport

The figure below shows the development of the inland navigation fleet in Europe during the period 2003-2020.

Figure 27: Number of ships / barges in IWT



Source: Eurostat and CCNR

It can be noted that the number of ships has decreased significantly in the period 2003[113]-2020. In 2003, there were still 13,385 ships in Europe, but by 2020 this number has fallen to 10,332, a decline of 23%. The number of ships decreased because of scale enlargement (larger quantities per ship) and better functioning of the transport market (liberalisation). At the same time, the combined carrying capacity of the fleet has decreased much less, by only 3%[114]. The ships have thus become larger on average. In total, the average tonnage of a ship increased from 1260 tonnes in 2003 to 1583 tonnes in 2020 - an increase of 26%[115]. More information on the composition of the fleet, for instance, on the presence of SMEs, can be found in Table 1.

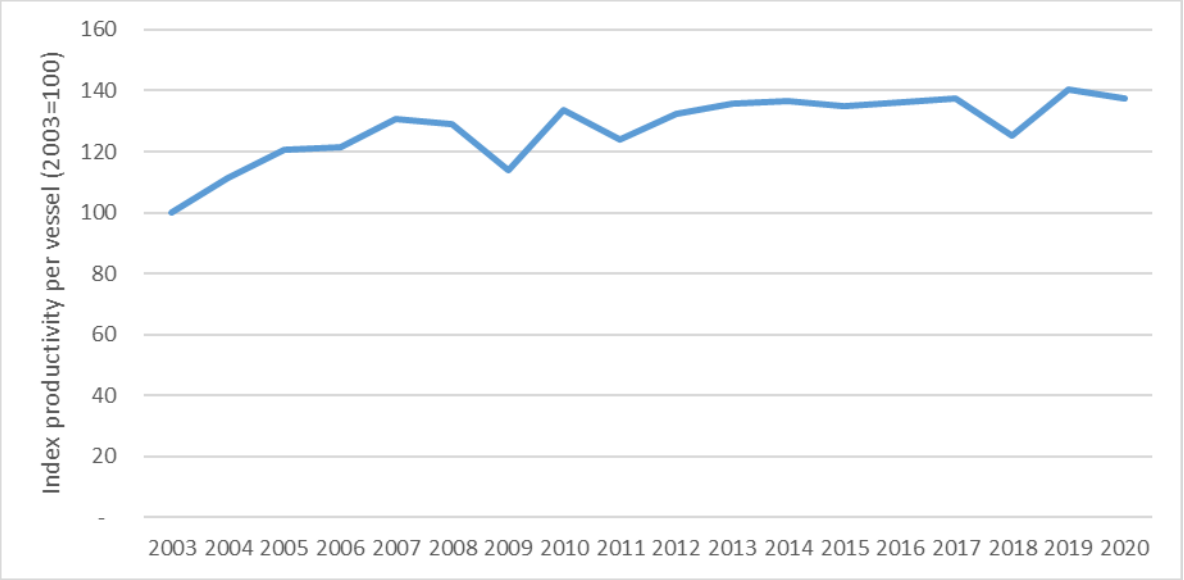
If we include the growth in traffic performance in the calculation, the scale increase becomes even clearer. From the combination of the data shown in Figure 26 and Figure 27 it can be calculated that in 2003, the average transport performance per ship was still 926,000 tonne-kilometres; in 2019, it had increased to 1.3 million tonne-kilometres per ship. This means a 40% increase in productivity per ship (an average of 2.1% per year). Earlier, we noted that the average load capacity of ships increased by 26%; this also means that the number of kilometres sailed per ship per year increased by approximately 11% between 2003 and 2019 (on average 0.7% per year). The remainder of 14% can be justified by means of larger operation windows of bridges and locks (i.e. 24/7 services), quicker loading/unloading of vessels and the introduction of smart shipping (more sailing hours with less personnel). The graph below shows the growth in productivity per vessel in inland navigation between 2003 and 2020.

[113] 2003 was chosen because of data availability on the number of ships in both the Rhine, Danube and other river basins.

[114] Source: Eurostat

[115] Source: Eurostat

Figure 28: Index productivity per vessel (2003=100)



Source: Consortium based upon figures from Eurostat and CCNR

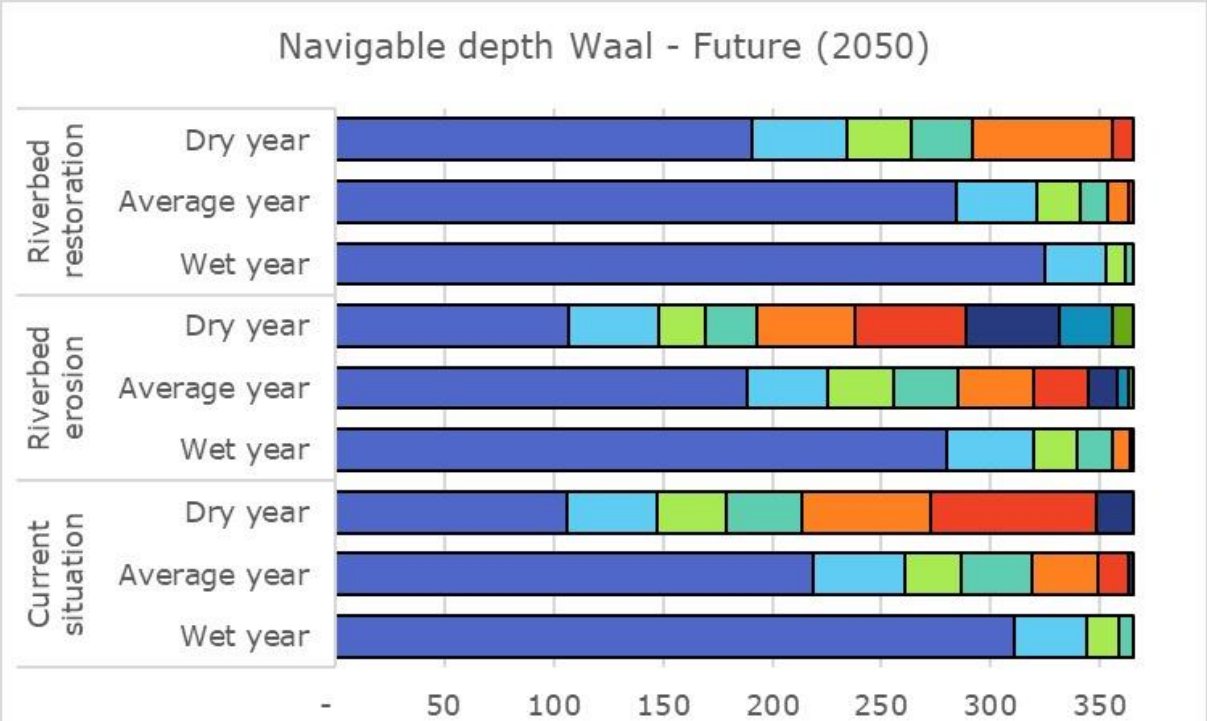
From the chart come interesting observations:

- First, a sharp increase in productivity can be observed from 2003 to 2008. This period was characterised by complete liberalisation of transport markets in inland waterway transport (which therefore led to a strong increase in productivity), and by the introduction of relatively large types of vessels (110 x 11.45 and larger), which led to an increase in the amount of carrying capacity per vessel.
- After 2008, productivity growth stalled. This was partly because the economic crisis caused part of the cargo volume to disappear, and partly because overcapacity had arisen in the sector precisely because of the increase in scale.
- The graph shows that low water years such as 2003, 2011 and 2018 (and also the ongoing year 2022) can have a considerable negative effect on productivity. A higher frequency of drought years is considered when estimating future productivity growth and illustrated in the picture below. This is based upon forecasts from the Royal Netherlands Meteorological Institute (KNMI) and Deltares (2014)[116] These projections are still somewhat conservative - the more recent IPCC projections (2021)[117] already assume more extreme scenarios with more frequent periods of both high and low water levels as far as river discharges are concerned. This is also confirmed in the Climate Signal (KNMI, 2021)[118] as far as Rhine discharge projections are concerned. The figure below shows the expected number of days of low water on the Dutch part of the Rhine (Waal).

[116] https://publications.deltares.nl/1220042_004.pdf

[117] Reports can be accessed through: https://www.ipcc.ch/report/ar6/wg2/

[118] https://cdn.knmi.nl/knmi/asc/klimaatsignaal21/KNMI_Klimaatsignaal21.pdf



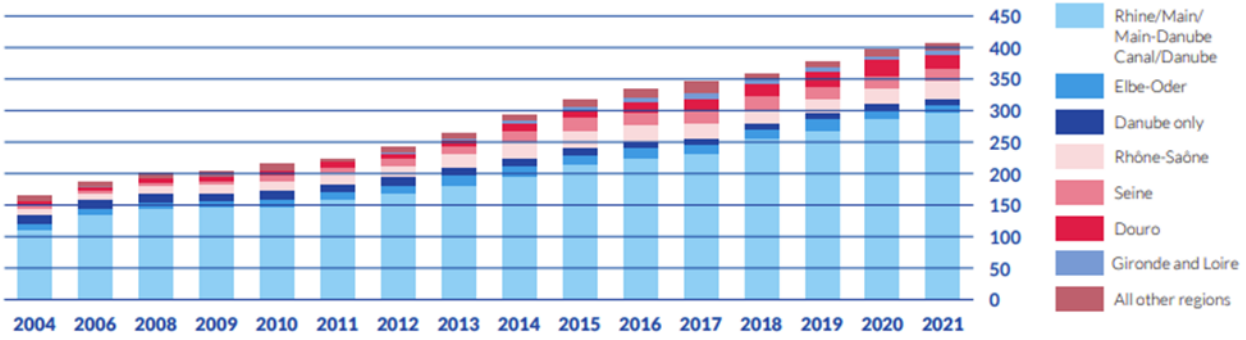
	Current situation			Riverbed erosion			Riverbed restoration		
	Wet year	Average year	Dry year	Wet year	Average year	Dry year	Wet year	Average year	Dry year
> 350 cm	311	218	106	280	188	107	324	284	191
320-350 cm	33	42	41	40	37	41	28	37	44
300 - 320 cm	15	26	32	20	30	21	9	20	29
280 - 300 cm	7	32	35	16	29	24	4	12	28
250 - 280 cm	-	30	59	8	35	45	-	10	64
220 - 250 cm	-	14	76	2	25	51	-	2	10
200 - 220 cm	-	3	17	-	13	42	-	-	-
180 - 200 cm	-	-	-	-	5	24	-	-	-
< 180 cm	-	-	-	-	2	10	-	-	-

Therefore, we estimate that the growth in productivity will be 1.5% per year. That is, per ship/barge the transport performance increases by 1.5% per year. This increase can be justified by both technical and operational developments: for instance Smart Shipping (including automated and autonomous navigation) which may result into a larger quantity of the fleet being able to sale 24/7 (despite labour shortages in the sector), increased attention to good navigational status of waterways (including 24/7 operation of bridges and locks on the major waterways) and scale enlargement in IWT of both companies (larger number of vessels per company) and vessels (larger load capacities for vessels).

Passenger transport

The following chart shows the historical development of the number of inland passenger ships in Europe.

Figure 29: Historical development of the number of inland passenger ships in Europe



Source: CCNR, data on river cruises

It can be seen that the number of river cruise ships in Europe has increased significantly, even doubled from approximately 160 ships in 2004 to 405 ships in 2021. In addition, there is a large number of day-tour ships and smaller cycle holiday ships. Prominent (2017) estimated that in 2015 there were a total of 2,553 passenger ships operating in Europe, including day-tour ships and smaller cycle holiday ships.

- Outlook

In the outlook section, we distinguish between freight transport and passenger transport.

Freight transport

Based on the above developments, we expect a further downward trend in the number of cargo vessels in European inland navigation. Economies of scale in the sector will continue and productivity per vessel will also increase. As a result, despite the significant increase in transport performance, the fleet of cargo vessels on inland waterways will not grow significantly. The graph below shows how the number of ships will develop in the future.

Figure 30: Development of number of self-propelled cargo vessels

	2015	2020	2025	2030	2035	2040	2045	2050
Number of vessels	11,792	10,332	12,050	12,371	12,299	12,270	12,208	12,223

Source: Eurostat and EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling))

The graph shows that between now and 2025, a substantial fleet expansion will have to take place to meet the expected growth in transport demand. After 2030, the number of vessels will continue to decline under the influence of autonomous productivity growth. Thus, no increase in the number of vessels is foreseen for inland navigation in Europe.

Passenger transport

The graph below shows the expected development of the number of passenger vessels in Europe.

Figure 31: Development of number of passenger vessels

	2015	2020	2025	2030	2035	2040	2045	2050
Passenger vessels	2,553	2,942	3,331	3,467	3,684	3,726	3,804	3,908

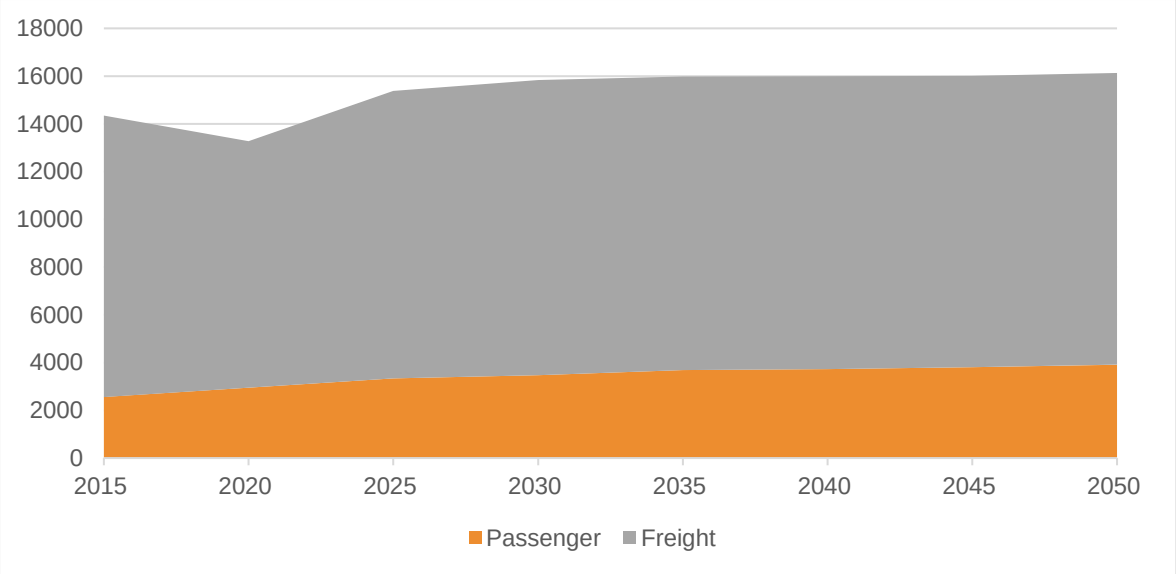
Source: CCNR and EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling))

Based on the expected growth in the number of passengers in passenger shipping, the number of ships is also expected to grow. Whereas there were approximately 2,900 passenger vessels in the European fleet in 2020, this number is expected to grow to 3,908 in 2050. In contrast to inland navigation, no further growth in scale or productivity is expected for passenger shipping.

Overall development of the number of ships

The graph below combines Figure 30 and Figure 31 and shows the overall development of the number of ships in Europe, regarding freight as well as passenger transport.

Figure 32: Development of the number of ships in Europe, freight as well as passenger transport



Category	2015	2020	2025	2030	2035	2040	2045	2050
Vessel stock (#)	**14,345**	**13,274**	**15,381**	**15,838**	**15,983**	**15,996**	**16,012**	**16,131**
Passenger	2,553	2,942	3,331	3,467	3,684	3,726	3,804	3,908
Freight	11,792	10,332	12,050	12,371	12,299	12,270	12,208	12,223

Source: CCNR and EU Reference scenario (PRIMES-TREMOVE Transport Model (E3Modelling))

It can be seen that the foreseen growth is mainly caused by a strong increase in passenger shipping.

Development of energy consumption in the inland navigation sector

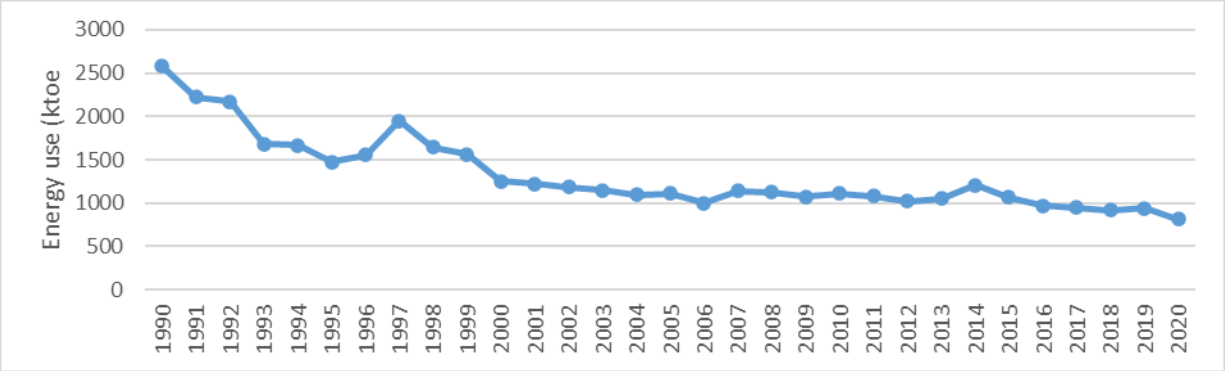
One of the goals is to make the inland shipping industry more efficient. We can interpret that as more energy efficient and with fewer harmful emissions. Since this is an important goal in revising the Directive, it is relevant to provide insights into the current energy and emission performance of the sector and to establish an outlook toward 2050 in which no new policy adjustments are made.

Firstly, the past development for this indicator is described, followed by the future outlook for it.

- ## Past developments

The figure below shows the energy consumption in inland navigation per kilotons of oil equivalent (ktoe) during the period 1990-2020. The tonne of oil equivalent (toe) is a unit of energy defined as the amount of energy released by burning one tonne of crude oil.

Figure 33: Energy consumption in inland navigation

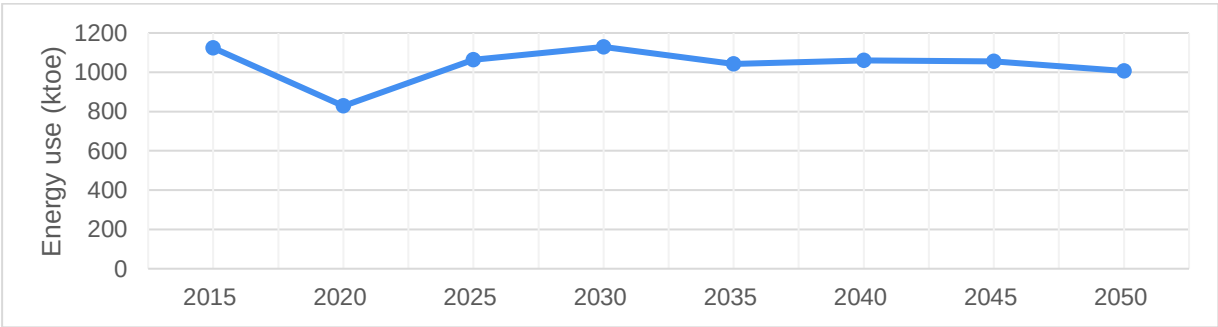


Source: Eurostat

- ## Outlook

The graph below shows the expected development of energy consumption in inland navigation.

Figure 34: Development of energy consumption in inland navigation



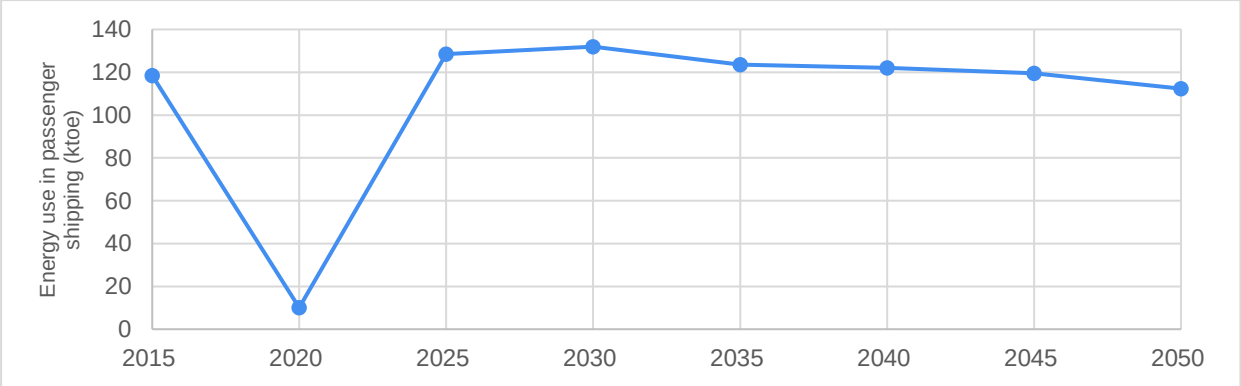
	2015	2020	2025	2030	2035	2040	2045	2050
Energy use in inland waterways (ktoe)	**1,124**	**828**	**1,063**	**1,129**	**1,042**	**1,060**	**1,055**	**1,007**
Passenger	119	10	128	132	124	122	119	112
Freight	1,006	818	935	997	918	938	935	895

Source: EU Reference scenario, Eurostat

Energy consumption in the inland navigation sector will continue to rise slightly in the coming years, before falling again after 2030. Freight inland waterways and national maritime achieve energy efficiency improvements in the order of 1% by 2030 and 11% by 2050 relative to 2015. The EU reference scenario states that 'the catalyst for the decoupling between activity and energy demand is the uptake of more fuel-efficient technologies and fuel substitution.' In specific for inland navigation, the consultant does expect that modern technology, scale enlargement and in particular the switch to electric propulsion will reduce the energy intensity of operations.

Little data is available for passenger shipping. The energy consumption was estimated on the basis of the consumption of gas oil (Prominent 2017 states 54 m³ per vessel, 2553 vessels). The development in cargo shipping, corrected for the increase in the services provided, was then also applied to passenger shipping. This gives the following picture in terms of energy consumption.

Figure 35: Total energy use in passenger shipping



Source: EU Reference scenario, CCNR, Prominent (2017)

Energy consumption will decrease in the coming years, despite the expected growth in the number of passengers.

Development of emissions in inland navigation

The environmental impacts of IWT concern, in particular, the emission of the greenhouse gas CO_2 and other air pollutants such as NOx and PM. The emissions from inland navigation can be derived from the energy consumption. The extent to which fossil fuels are still used and the extent to which alternative propulsion systems are introduced will determine the carbon consumption of the sector. The cleanliness of combustion engines will then determine the emissions of CO_2 and particulates. What is relevant here is that the recent non-road mobile machinery (NRMM) Directive leads to a (greater) reduction of nitrogen oxides and particulates than the reduction of CO_2.

Each of the emissions can be expressed in different units, such as grams per vehicle kilometre (vkm) or grams per tonne kilometre (tkm). Nevertheless, each substance has a different impact on the human health and the ecosystem and is thus treated differently. Moreover, emissions and the related external costs produced by the IWT sector depend on different parameters, for example: the type and volume of goods carried, the transport distance, the vessel type and loading capacity, loading factor, loaded kilometre factor, transportation speed, the specific energy consumption and emission profile of the engine used and the region where the vessel sails.

Below, we discuss separately the emission of carbon dioxide, nitrogen oxides and particulate matter. Air emission inventories as presented by Eurostat are used for estimating shipping- and transport emissions at the EU level. These emission inventories provide key inputs for policies on air quality and climate change and are collected by the EEA, which uses these to compile EU aggregates on behalf of the European Commission. The EEA emission values of CO_2 emissions are extracted from Eurostat, series Greenhouse gas emissions by source sector (ENV_AIR_GGE), of which the data source is the European Environment Agency. The emission values of pollutants PM, NOx and HC (NMVOC) are extracted from the same source Eurostat as well (EC, 2021), from the series ENV_AIR_EMIS.

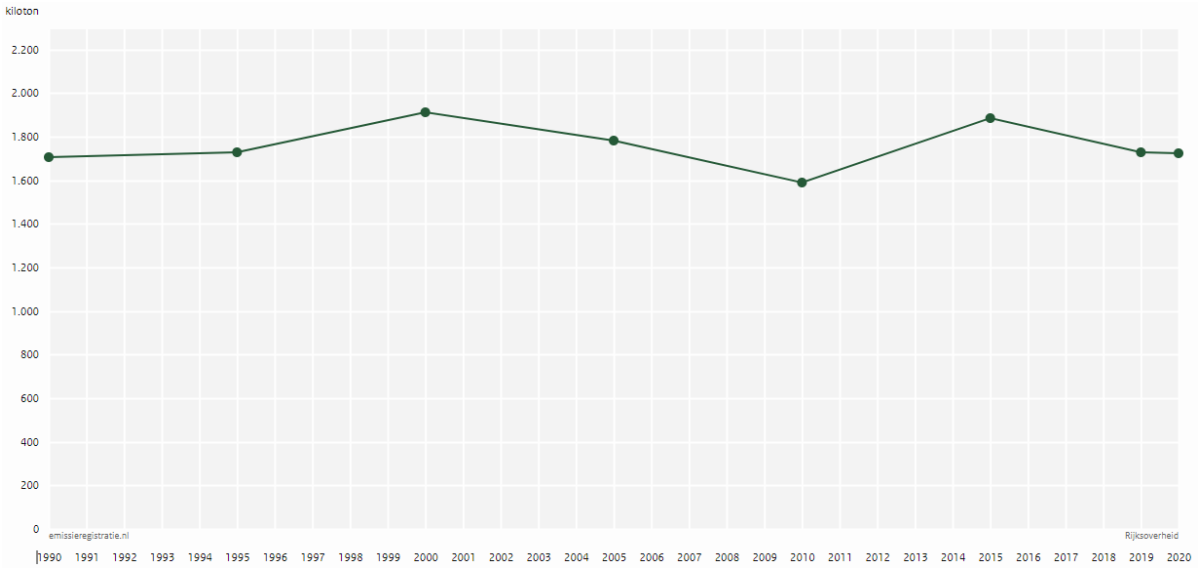
- Carbon dioxide

Firstly, the past development for this indicator is described, followed by the future outlook for it.

Past developments

As with all other data, the European sources for national maritime transport include the inland navigation sector. Therefore, it is not possible to simply use these figures without first separating the inland navigation sector. Data on the level of the inland navigation sector is sometimes available from individual Member States, for example, the Netherlands, in which inland navigation has a significant share in the modal split (>40%). Moreover, the Netherlands is interesting as approximately 50% of the fleet is of Dutch origin. Combining these different data sources, the graph below shows the emissions of inland vessels of CO_2on Dutch territory plotted between 1990 and 2020.

Figure 36: Emissions of CO_2 of inland vessels on Dutch territory plotted between 1990 and 2020 (kton)

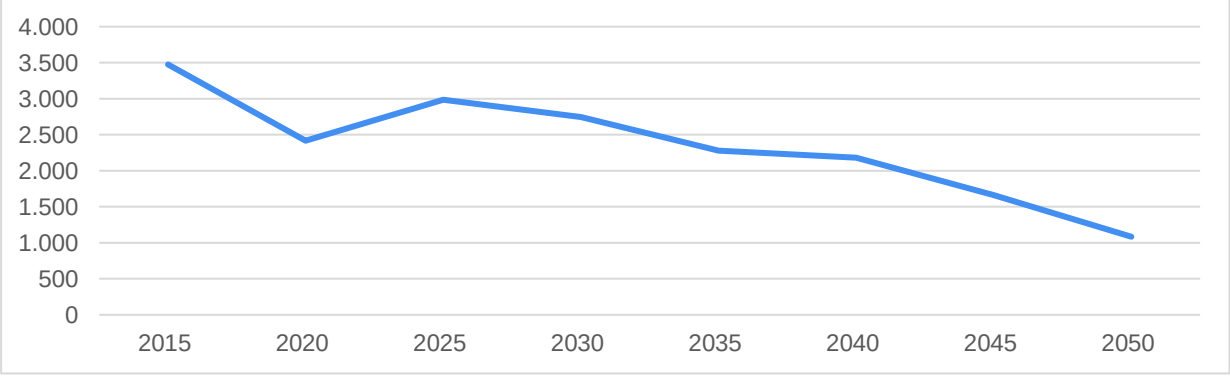


Source: www.emissieregistratie.nl

Outlook

For a European perspective, the Greenhouse gas emissions by source sector (ENV_AIR_GGE) from the European Environment Agency is used. The graph below shows the expected development of CO_2 emissions from inland navigation.

Figure 37: CO_2 emissions from EU inland navigation



Source:www.emissieregistratie.nl, Eurostat and EU Reference scenario, European Environment Agency

Ultimately in 2050, according to the EU reference scenario, CO_2 emissions from inland navigation are expected to be reduced to 30% of the level in 2015. This can be substantiated by the expected rapid introduction of alternative energy carriers in inland navigation, such as hydrogen and batteries and the introduction of biofuels in line with the Renewable Energy Directive.

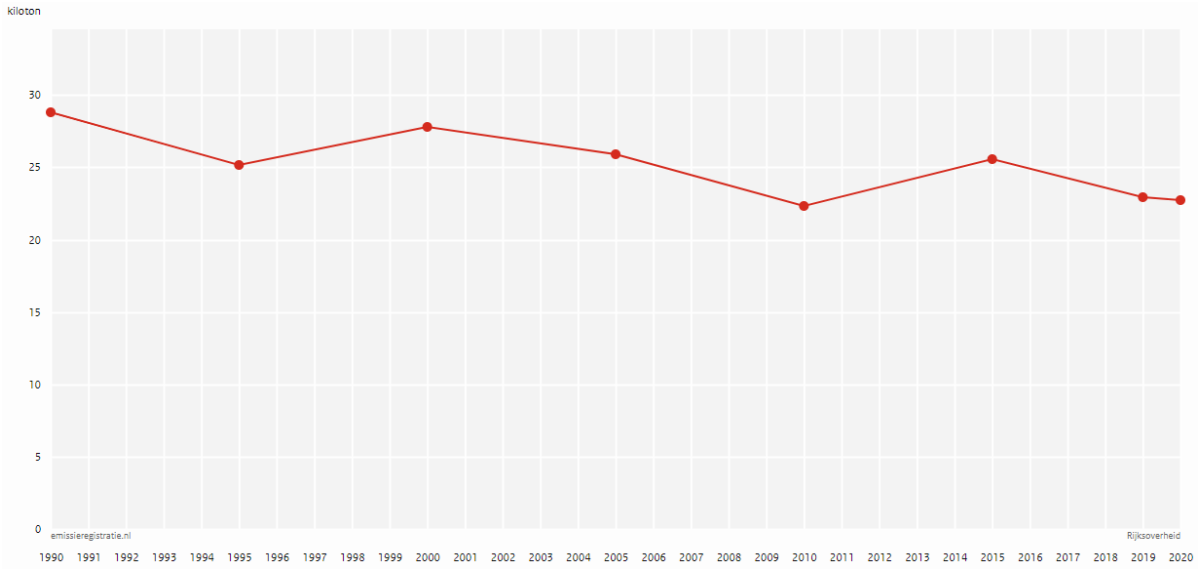
- Nitrogen oxides

The main sources of nitrogen oxides (NOx) are traffic, agriculture, the energy sector and industry. Nitrogen oxides can be harmful to people by causing respiratory problems and asthma attacks. Firstly, the past development for this indicator is described, followed by the future outlook for it.

Past developments

The graph below shows the emissions of nitrogen oxides in the Netherlands from inland navigation between 1990 and 2020. It can be seen that the amount of nitrogen oxides has been reduced by about 25% during this period. This is a limited reduction, which is mainly due to the limited regulation of ship engines in these periods. It was not until 2019 that strict emission requirements for ship engines in inland navigation were introduced[119].

Figure 38: Emissions of NOx of inland vessels on Dutch territory plotted between 1990 and 2020 (kton)



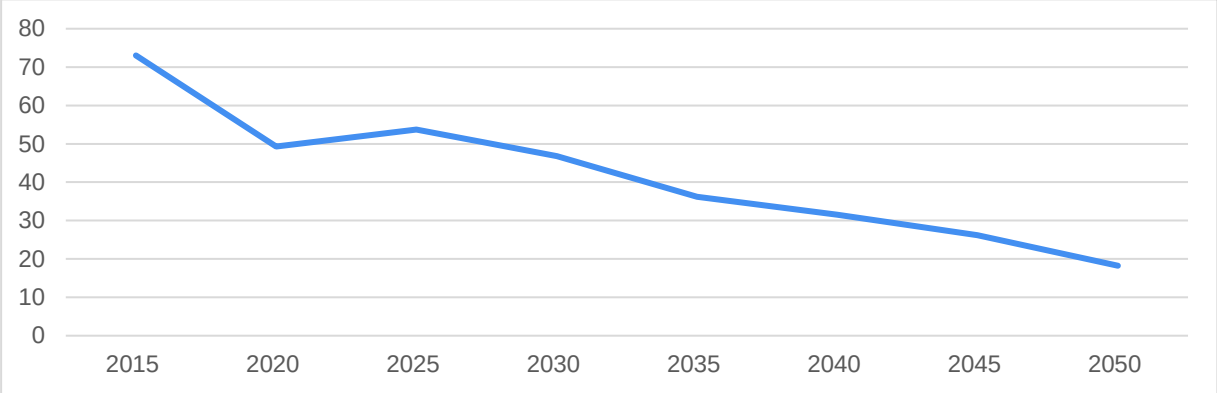
Source: www.emissieregistratie.nl

Outlook

Using the historical figures from above (which are the only reliable ones we have) and using the EU reference scenario to translate these to the entire EU and to project these into the future, the following graph shows the expectations for nitrogen emissions from inland navigation.

[119] REGULATION (EU) 2019/1242 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 June 2019 setting CO_2 emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC

Figure 39: NOx emissions from EU inland navigation (in ktons)



Source: www.emissieregistratie.nl, Eurostat and EU Reference scenario

This shows that the emission of nitrogen from inland navigation has been reduced considerably. This is due to both decarbonisation (fewer internal combustion engines) and the fact that the ships that continue to operate with internal combustion engines are becoming cleaner.

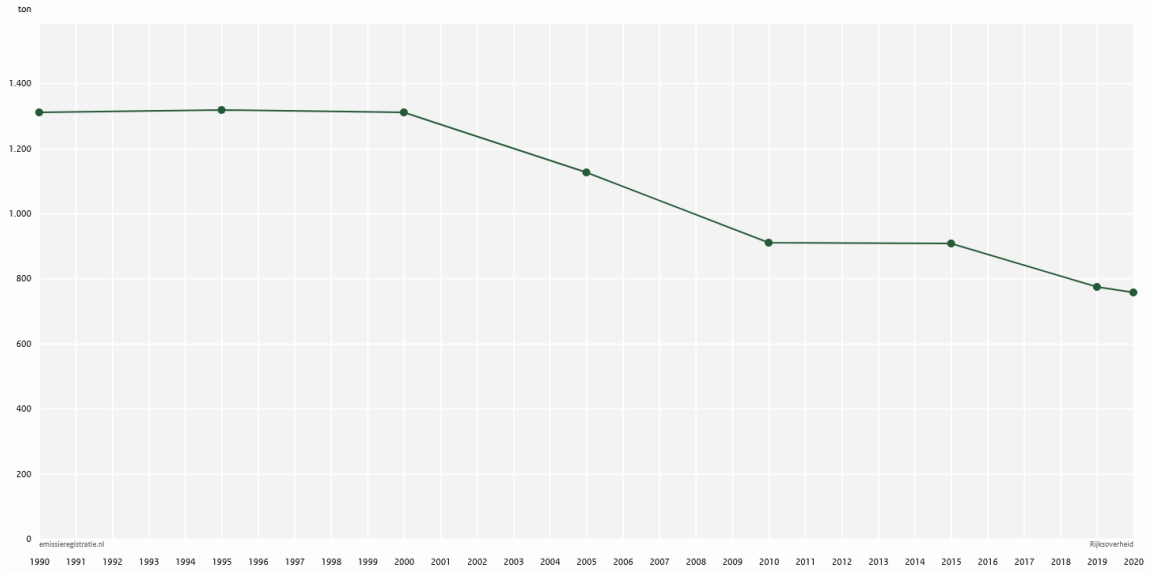
- Particulate matter

Particulate matter is the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope. Some particles less than 10 micrometres in diameter can get deep into your lungs and some may even get into your bloodstream. Usually, three groups of Particulate matter are considered: ≤0.1µm, ≤2.5 µm and ≤10µm. Of these, particles less than 2.5 micrometres in diameter, also known as fine particles or $PM_{2.5}$, pose the greatest risk to health. Therefore, data on this group is considered in this section. Firstly, the past development for $PM_{2.5}$ is described, followed by the future outlook for it.

Past developments

The graph below shows the emission of particulates by inland navigation in the Netherlands in the period 1990-2020.

Figure 40: particulate matter emissions of inland vessels on Dutch territory plotted between 1990 and 2020 (ton)



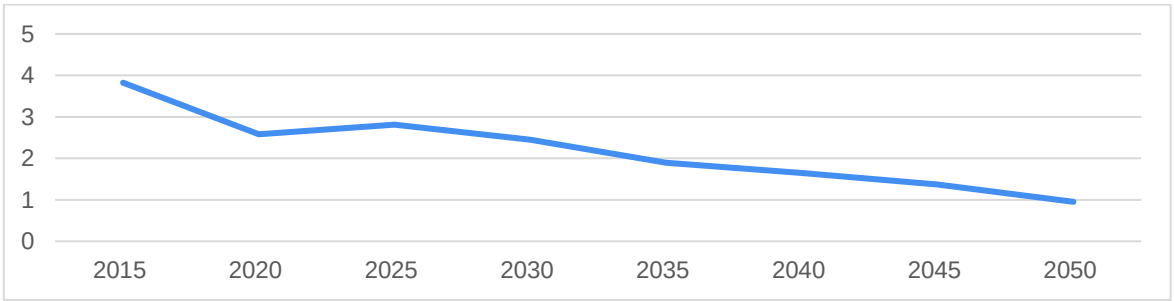
Source: www.emissieregistratie.nl

The graph shows that the particulate emissions from inland navigation have fallen from around 1,300 tonnes in 2020 to around 800 tonnes in 2020. The decrease is due to modern ship engines. It is worth noting that the decline starts after 2000, the date when regulations for engines used in inland navigation were first introduced.

Outlook

Using the historical figures from above (which are the only reliable ones we have) and using the EU reference scenario to translate these to the entire EU and to project these into the future, the graph below shows the forecast of fine particulate emissions from the inland navigation sector for the whole of Europe up to 2050. It shows that the amount of particulate matter emitted by inland navigation is falling sharply. From about 3.8 ktons in 2015 to about 1 kton in 2050. This is related to the decarbonisation of the inland navigation sector, which means less use of combustion engines and more use of alternative propulsion forms. In addition, since 2020 new combustion engines are considerably cleaner (NRMM Stage 5).

Figure 41: particulate matter emissions from EU inland navigation (in ktons PM2.5)



Source: www.emissieregistratie.nl, Eurostat and EU Reference scenario

Development of safety in the inland navigation sector

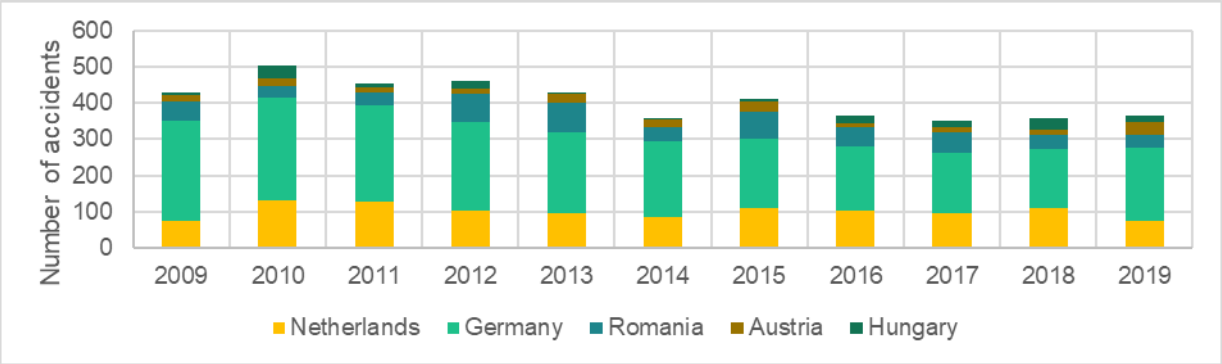
One of the problem drivers (PD1) relates to the fact that missing and non-harmonized RIS information results in insufficient efficiency and safety of navigation. The goal is to of the adjustments to the directive is to increase both the competitiveness and safety of the

industry. Accurate and up-to-date information on traffic conditions can help achieve this. Therefore, it is important to gain insights into the historical and expected developments of the level of safety in the inland navigation sector. This will also allow us to weigh the impact of measures. Firstly, the past development for this indicator is described, followed by the future outlook for it.

- ### Past developments

There is little consistent data on safety in the inland navigation sector. Although there is a Eurostat table, it is filled in on a voluntary basis (by the Danube riparian states in particular). So, this table contains no data on the number of accidents per year in Western European countries. However, the Netherlands and Germany do have extensive databases with accident statistics. The graph below shows the development of the number of accidents in the Netherlands, Germany, Romania, Austria and Hungary per year.

Figure 42: Registered accidents in inland navigation in the EU (2009-2019)



Source: Scheepsongevallenregistratie Rijkswaterstaat, Eurostat

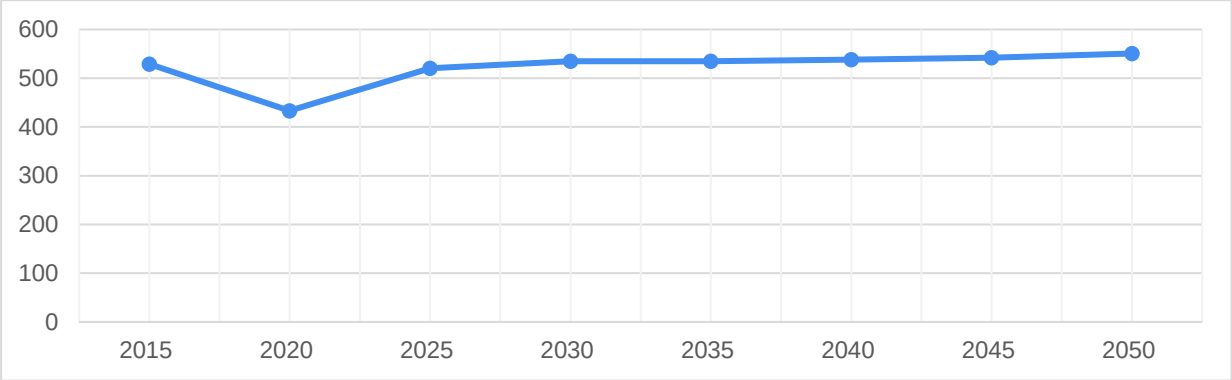
The graph shows, that in the countries mentioned, the number of accidents fell from around 450-500 in 2009-2010 to around 350 in recent years.

Since the Eurostat Table is voluntary and only covers Danube states, the data provided below is a mixture of both national and European sources. Within the Dutch and German Database, some indications can be derived on the type of accident (ship vs. ship, ship vs. infrastructure), the causes (human error, technical failure, etc.). From the Dutch database we also have indications on the magnitude of the damage.

- ### Outlook

The figure below shows the expectation for the baseline development of the number of accidents until 2050 for the EU as a whole. The expectation is based on the growth in vessel kilometres. Due to scaling-up in inland shipping, the total number of vessel kilometres has decreased, and the number of accidents has fallen with it. For our projection, we assume that the relationship between vessel kilometres and the number of accidents seems to be more or less constant.

Figure 43: Number of accidents in EU inland navigation (2015-2050)



Source: Scheepsongevallenregistratie Rijkswaterstaat, Eurostat and EU Reference scenario

Since the number of vessel kilometres is expected to remain (more or less) the same, due to further productivity improvements in inland shipping with the same demand for transport, we expect that the number of accidents will also remain approximately the same. We thus expect around 530 accidents per year for the period 2030-2050, with a slightly increasing trend to 551 in 2050. The number of accidents occurring in the inland navigation sector is also influenced by the extent to which innovation finds its way into the sector. In particular, smart shipping (including extensively automated or autonomous navigation) is expected to have a positive effect by reducing the number of human errors. In inland navigation, the majority of incidents are due to human error (IWT Platform, 2021)

Transport cost development in inland navigation

One of the goals in modifying the RIS guidelines is to make the inland shipping industry more competitive. In the transport sector there is fierce competition both between and within modes, and largely on price. If we can contribute to the competitiveness and efficiency of the sector through adjustments to the RIS Directive, this will have an impact on the cost level. And since the transportation sector is highly competitive with a lot of competition, it is to be expected that any cost benefits will be passed on to customer.

Firstly, the past development for this indicator is described, followed by the future outlook for it.

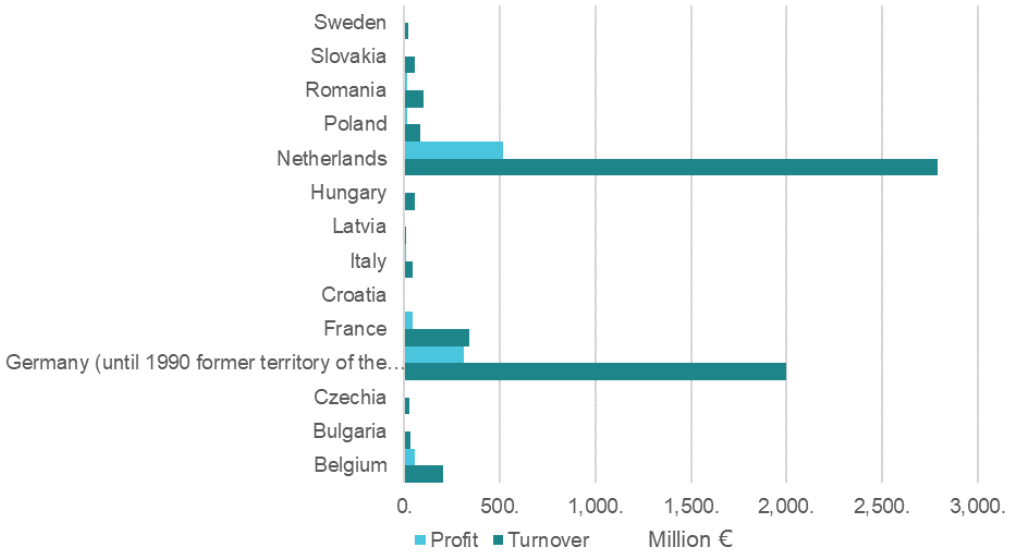
- ### Past developments

The following chart shows the turnover and profit of the inland shipping sector in 2015. This was the latest data available for all EU countries in Eurostat.

The cost level can be determined by subtracting profit from the turnover[120].

[120] See Annex VII – transport costs, for the Methodology used and a justification for this assumption.

Figure 44: Turnover and profit of the inland shipping sector in 2015

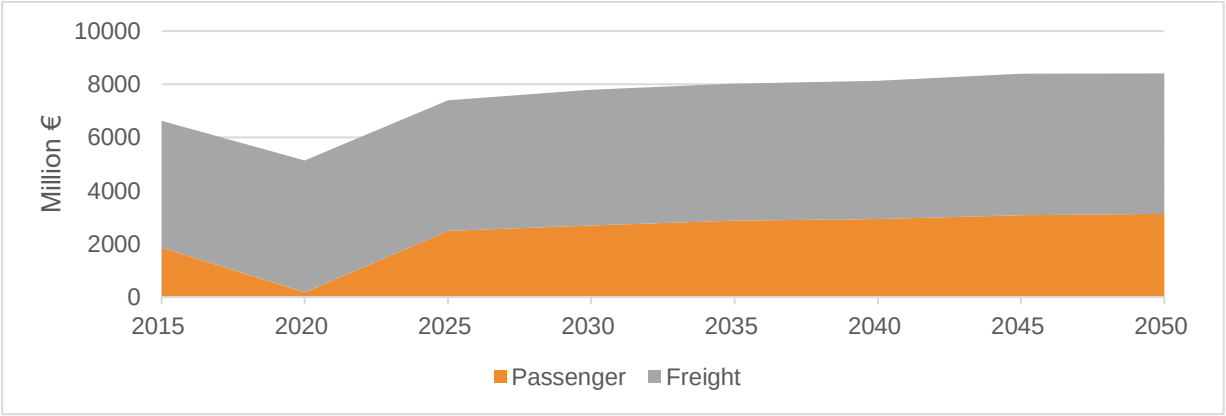


Source: Eurostat, DG Move

- Outlook

The following graph shows the expected development of transport costs in the inland shipping sector by sector. The graph shows that the transport costs in the freight transport sector remain stable at around EUR 5 billion per year. A stable cost level is also expected for passenger transport, despite an increase in volume. Cost efficiency is also an issue in passenger shipping. There is also fierce competition in this market with many providers. Berths in cities are becoming more accessible to large vessels. In addition, ships are also becoming more efficient and energy efficient. This creates economies of scale in this sector as well, which means that volume growth can be accommodated without increasing cost levels. In other words, river cruises will become cheaper and cheaper. This means that the price per tonne kilometre transported is decreasing, about 25% in the period 2015-2050. Because of the stable cost level, the efficiency improvement keeps pace with the increase in transport performance (see also Figure 7).

Figure 45: Transport costs in inland navigation



	2015	2020	2025	2030	2035	2040	2045	2050
Inland waterways and domestic maritime - total costs (M €)	**6,622**	**5,134**	**7,397**	**7,800**	**8,021**	**8,134**	**8,401**	**8,410**
Passenger	1,848	179	2,482	2,688	2,875	2,936	3,073	3,129
Freight	4,774	4,955	4,915	5,112	5,147	5,198	5,328	5,281

Source: Eurostat, DG MOVE and EU Reference scenario

Policy measures

The list in Table 4 presents the retained policy measures developed after extensive consultations with stakeholders, expert meetings, independent research and the Commission's own analysis. To establish this list, a longer list with more measures was screened based on the likely effectiveness, efficiency and proportionality of the proposed measures in relation to the given objectives, as well as their legal, political and technical feasibility. The discarded measures based on this analysis are presented in Section 0.

Each policy measure addresses one or more of the problem drivers that were described in Sections 2.3.1 - 2.3.5 and this is reflected in the second column of the table below. In addition to the problem drivers addressed, the table includes a concise explanation of the 17 policy measures.

Table 7: Long list of policy measures

No.	Problem driver addressed	Title	Explanation
1	PD1	Increase the harmonisation of RIS through guidelines	Under this measure, the European Commission, would develop guidelines to increase harmonisation requirements relating to the interpretation of the RIS technical specifications and the European Standard-River Information Services (ES-RIS). These guidelines, will help to improve the quality of the information provided to the users through RIS, and the sector to identify required information more easily.
2	PD1	Introduce a harmonised complaint mechanism (in Member States)	This measure would require Member States to designate a competent (existing or new) governmental body to directly manage complaints filed by RIS users. It would thus lead to a bottom-up monitoring of implementation of the Directive.
3	PD1	Introduce a new Performance Measurement Framework	This measure aims to improve the monitoring of the implementation of the RIS Directive, by requiring Members States and relevant authorities to report to the Commission on regular basis on key performance indicators (e.g. the number of shipping messages issued in accordance with standards and interpretations from the most recent RIS encoding guide, and the number of electronic cargo reports received in relation to the number of voyages.
4	PD1 PD3	Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index)	This measure aims to strengthen the requirements of Annex I of the current RIS Directive by introducing new technical specifications ('standards') on data for navigation and voyage planning ('RIS Index'), and strengthen provisions under Article 4, paragraph 3, for the supply of such data by the Member States. In addition, this measure introduces new requirements into the RIS Directive that, relate to the efficiency of navigation (e.g. current and expected waiting times at bridges and locks).
5	PD1 PD3	Require electronic voyage plan reporting	This measure would require vessel operators and skippers to report their voyage plan to competent authorities at the start of their journey and update this with any further changes to their estimated time of arrival. This will allow authorities to plan traffic and operations in the fairways.
6	PD1 PD3	Introduce provisions for supplying data to the ERDMS and its operation	Under this measure, Member States would be required to provide and update regularly all information required by the RIS Directive also to the European Reference Data Management System (ERDMS), which is owned and operated by the European Commission, DG MOVE. This will improve the completeness and quality of available information.
7	PD1, PD3, PD4	Encourage cargo-related information exchange through the eFTI mechanism	This measure will require that standards be developed so that RIS cargo related information (i.e. electronic ship reports as specified in Commission Implementing Regulation 2019/1744) can be shared on a voluntary basis through the electronic freight transport information (eFTI) platforms, will be developed but not made mandatory for use. This includes both authority / ship and authority / authority information.
8	PD1, PD3, PD4	Mandate cargo-related information to be	This measure will mandate that all RIS cargo related information (i.e. electronic ship reports as specified in

No.	Problem driver addressed	Title	Explanation
		exchange through the eFTI mechanism	Commission Implementing Regulation 2019/1744) is shared through the electronic freight transport information (eFTI) platforms, for exchanges between authority / authority and authority / ship. The necessary standards will be developed under a RIS implementing act.
9	PD1, PD3, PD4	Require information exchange through the RIS COMEX platform	This measure aims to mandate a common platform for the sharing of RIS data. The CEF funded and already operational RIS COMEX information platform will be designated as a basis. The necessary standards will be developed under a RIS implementing act.
10	PD2 PD3	Involve CESNI in the development and adoption of technical specifications	In order to ensure faster development of standards, this measure will designate CESNI (the European Committee for drawing up standards in the field of inland navigation) as the relevant body for developing RIS related standards.
11	PD3	Link RIS requirements with those of the TEN-T Regulation	The measure will seek alignment of the scope of application of the RIS Directive with the scope of the TEN-T Regulation. Thus, the scope of application of RIS will be the TEN-T waterways. Member States may also choose to apply the Directive to other waterways in their territory.
12	PD3	Develop new standards and technical specifications for the exchange of information relating to IWT ports	The aim of this measure is to develop new standards and technical specifications for the exchange of information between vessels and IWT ports, including transhipment capacity, availability of alternative fuels, availability of berths, etc. Data exchange with IWT ports will be voluntary, but if RIS users do share data, these standards will need to be applied. The necessary standards will be developed under a RIS implementing act.
13	PD3	Require the exchange of information with IWT ports according to new standards and technical specifications	This measure will mandate the exchange of certain data (transhipment capacity, availability of alternative fuels, availability of berths, etc) between vessels and IWT ports. The necessary standards will be developed through under a RIS implementing act.
14	PD4	Improve harmonisation between RIS and information services for other modes of transport (e.g. maritime)	This measure aims to strengthen the interoperability of RIS with other modes of transport. As such requirements for exchanges of data will be introduced with mechanisms and provisions of EMSWe, the Combined Transport Directive and others as appropriate. The necessary standards will be developed through under a RIS implementing act.
15	PD3	Require sharing of all necessary cross-border data for traffic management and transport management by Member States	The measure aims to improve the sharing of RIS related information between authorities mutually and with the private sector stakeholders, especially cross-border. Under this measure, all the data authorities require would be submitted once the journey starts and then re-shared by the authorities.
16	PD5	Specify more clearly the cases for exchange of personal data	Under this measure, the RIS Directive would provide more information on the specific cases where exchange of personal data would be justified (e.g. for reasons of safety, to streamline the process, etc). It would also provide information on why this is proportionate (i.e. on what is aimed to be achieved) and why it is the least intrusive way to exchange personal data.
17	PD5	Develop templates and standards for the exchange of personal data	This measure will develop and mandate new standards and technical specifications for the exchange of personal information when this is required by national or international legislation. This measure goes beyond measure 16, in that it will not only clarify the cases when personal data can be exchanged but will define the exact templates and standards to be followed when such an exchange can take place, in line with existing legal provisions.

Source: Elaboration of the contractor (2023), based on discussion with DG MOVE

The first survey, aimed at understanding the adequacy of the proposed policy measures to tackle the problem drivers, revealed that respondents believe that these policy measures are

sufficient to address the identified problem drivers. However, stakeholder feedback also exposed that policy measures are considered to be most effective in addressing problem driver 2 (Inefficient processes for creation and implementation of technical specifications for River Information Services) and 5 (Data protection concerns by the inland waterway stakeholders).

In terms of what were identified to be the least relevant policies, the findings of the NAIADES/DINA Expert Group held in July 2022 are somewhat different when compared to the results of the stakeholder survey. As a matter of fact, whilst in the survey only 30-35% of stakeholders reckoned that (i) ending the resubmission of electronic ship reports by making use of the eFTI platform and (ii) the introduction of provisions for supplying data to the ERDMS and its operation, would address the identified problem to a large extent or to some extent, the NAIADES/DINA Expert Group considered these two measures to be the third most efficient ones for their respective problem drivers.

Eventually, most policy measures were found to be adequate in tackling problem driver 1 (Missing and non-harmonised RIS information hampers efficient and safe navigation) and 3 (River Information Services do not support the integration of inland waterways transport into multimodal supply chains). On the same fashion as the results of the first survey, the proposed policy measures addressing problem driver 1, 2 and 3 (or a combination thereof), have remained unchanged.

The number of proposed policy measures addressing problem driver 4 (Inefficient exchange of information (including cross-border) and reporting) was reduced, with some policy measures being either removed, (such as *the introduction of an obligation on electronic ship reporting*) or changed (such as the *encouragement of information exchange through the RIS COMEX platform*, which was strengthened by turning the measure into enforcement of information exchange through RIS COMEX). In addition, most policy measures considered to be effective in tackling problem driver 4 were also deemed to be relevant in addressing problem driver 1 and 3.

For what concerns problem driver 5, two measures were identified, (i) increase in clarity for Member States to share all necessary data cross-border that are required for traffic management and transport management and (ii) define more clearly the cases for exchange of personal data that go beyond the current RIS Directive.

Aside from the measures which were removed or changed from the first survey, the list of policy measures to be potentially included in the initial analysis was originally longer, but some of these were discarded, as reflected in the table below. The table also includes a brief explanation of why they were discarded.

Discarded measures

The table below summarises the relevant information on the policy measures which have been discarded during the process of this study.

Table 4: List of discarded measures

#	Title	PD	Brief description	Reason for Discarding
1	Expand scope to all waterways	PD1, PD4	The scope of the Directive would be expanded to cover all waterways (i.e. going beyond the current scope of those waterways of CEMT-class IV or higher)	CEMT-class III and below waterways exist in the Czech Republic, Croatia, France, the Netherlands, Poland, Belgium and Hungary where these form a significant share of the IWT network. However, as there is limited commercial navigation taking place on these waterways, bringing these waterways under

				scope of a RIS Directive will result in a significant administrative burden for waterway authorities and hardly any benefits.
2	Create a role for the European Maritime Safety Agency (EMSA)	PD2	During the stakeholder consultation it was proposed that EMSA could have a role within the detection and tackling of cross-border inefficiencies and therefore facilitate the harmonisation of IWT procedures.	EMSA has a clearly defined role relating to the safety of the maritime sector. RIS have a different scope which is not in line with the mandate of EMSA.
3	Align with DIWA Masterplan	PD1	This measured aimed to align the RIS Directive with the DIWA Masterplan. The objective is to develop the Masterplan Digitalisation of Inland Waterways that will be a joint, uniform and integral digitalisation strategy for IWT under the responsibility of the participating fairway authorities.	Work on the Digitalisation of Inland Waterways("DIWA") Masterplan is still ongoing, and its outcome is not yet clear. As such it does not mature to be considered as input at this stage.
4	Provide incentives for private sector IWT users to make better use of RIS.	PD4	This measure aimed to provide incentives for private sector IWT users to make better use of RIS, as a way for better harmonisation of the implementation of the RIS Directive across all relevant Member States.	The private sector already uses RIS to a considerable extent. Financial support for RIS may be provided under the Connecting Europe Facility (CEF) and is thus out of scope of this impact assessment.
5	Embed the operation of the existing DINA expert group (E03505) into the Directive	PD2	Stakeholders considered that there should be a formal requirement in the RIS Directive for the future inclusion of the operation of the DINA expert group within the legal text.	The involvement of Commission expert groups is well defined in the decision-making process and no further requirements are necessary.
6	Integrate the Directives of River Information Services (RIS), Intelligent Transport Services (ITS) and the Maritime Vessel Traffic Monitoring and Information System (VTMIS) Directive into one integrated Directive.	PD3	Stakeholders considered that several Directives dealing with digital aspects could be merged in a single legal act (Directive). This would allow for better exchange of information between transport modes	While all of the mentioned Directives (RIS, ITS, VTMIS) manage digital aspects, they each have different scope and area of application and aim to cover diverse needs. The merging of separate legal obligations would not necessarily create a simplified system but could increase complexity and legal challenges. Better interconnection between the digital systems developed should be pursued instead.
7	Expand the set of shipborne navigation systems	PD3	To better align the RIS Directive to the Connecting Europe Facility, this measure proposed to expand the scope of the Directive to consider a broader range of shipborne	Out of scope for RIS and would be more appropriately covered under CEF.

			navigation systems.	
8	Align investment in digital and physical infrastructure	PD3, PD4	Stakeholders considered that, investments in both digital and (smart) physical infrastructure should be aligned to each other, as both are equally necessary to allow optimal results for multimodal evolving towards synchro modal, resilient and climate-neutral transport.	Out of scope for RIS and would be more appropriately covered under CEF.
9	Roll out of 5G in the framework of CEF along waterways	PD4	Stakeholders considered that, where relevant, RIS, ERTMS and ITS actions will be coordinated with 5G corridors deployment.	Out of scope for RIS and would be more appropriately covered under CEF.
10	Link to cross-disciplinary digital information and operation systems for water- and waterway management	PD4	The NAIADES II implementation expert group proposed that a future RIS should develop and implement cross-disciplinary information and operation systems for water- and waterway management using collaborative data harvesting	This is a technical element relating to the standards to be developed and is thus relevant for the implementing acts and not the main Directive itself.
11	Ensure that regulations and operational practices take interoperability of both sea and inland waterway systems (RIS/VTS) into account	PD3	Stakeholders proposed that as river-sea shipping play a more dominant role in these waterways and duplication of similar systems should be avoided, that maritime Vessel Traffic Services (VTS) regulations and operational practices should take interoperability of both sea and inland waterway systems (RIS/VTS) into account.	The development of a common VTS system between maritime and IWT is beyond the scope of the RIS directive. Technical aspects for the interoperability of such services relate to the standards to be developed and is thus relevant for the implementing acts and not the main Directive itself.

Source: elaboration of the contractor (2023) based on discussions with DG MOVE

Comprehensive policy options

The next step of the IA involves packaging the identified policy measures into comprehensive policy options. BRG Tool #16 (How to identify policy options) provides guidance for this step in the process. While policy measures only address certain aspects of the problems (or these are only effective when taken in combination with other measures), policy options are more encompassing and address the problems in their entirety. A policy option is thus a combination (or a package) of policy measures.

When selecting the policy options, a crucial step is to choose the level of aggregation of the policy options. The BRG provide several options for this:

Broad alternative options

Alternative packages of measures

Individual sets of measures targeting specific issues to be bundled together at the end of the analysis

A mix of high-level options and sub-options

Considering the specificities of this study (i.e. the fact that there are only two specific objectives and that only one main problem has been identified with a limited number of five problem drivers), it is most logical to employ an approach whereby a set of differing policy options are designed addressing this problem in its entirety. The most logical approach is thus to group the measures around the way in which the problem would be addressed, which leads to the following options:

Option A: Providing guidelines to clarify key issues. This policy option would rely on the contribution of CESNI or the European Commission in order to develop guidelines that ensure a universal interpretation of some of the key concepts of the RIS Directive.

Option B: Updating key parts of the RIS Directive. This policy option encompasses all the policy measures that seek to partially update some of the key elements of the RIS Directive, (such as some of the requirements imposed on RIS users and on Member States).

Option C: Providing for increased data exchange. This policy option mandates data exchange beyond what is currently envisioned under the RIS Directive by necessarily imposing an obligation on the Member States.

Table 8 below groups each of the 17 identified policy measures under the corresponding policy options, as emerged from further discussions with DG MOVE and the rest of the Steering Group. The numbering of Table 8 is the same as in Table 7. The table demonstrates that several policy measures may be addressed by means of more than one policy option, and that, in most cases, providing guidelines to clarify key issues (Option A) has not been deemed sufficient to adequately tackle the problem driver(s) each policy measure refers to.

Table 5: Policy options grouping policy measures

	Problem driver and specific objective	Policy Measures	Option A: Providing guidelines to clarify key issues	Option B: Updating key parts of the RIS Directive	Option C: Providing for increased data exchange
1	PD1 SO1	Increase the harmonisation of RIS through guidelines	X		
2	PD1 SO1	Introduce a harmonised complaint mechanism (in Member States)	X	X	
3	PD1 SO1	Introduce a new Performance Measurement Framework			X
4	PD1, PD3 SO1, SO2	Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index)		X	X
5	PD1, PD3 SO1, SO2	Require electronic voyage plan reporting			X
6	PD1, PD3 SO1, SO2	Introduce provisions for supplying data to the ERDMS and its operation	X	X	X
7	PD1, PD3, PD4 SO1	Encourage cargo-related information exchange through the eFTI mechanism	X		
8	PD1, PD3, PD4 SO1	Mandate cargo-related information to be exchanged through the eFTI mechanism		X	X
9	PD1, PD3, PD4 SO1	Require information exchange through the RIS COMEX platform		X	X
10	PD2, PD3 SO1, SO2	Involve CESNI in the development and adoption of technical specifications	X	X	X
11	PD3 SO1	Link the RIS requirements with those of the TEN-T Regulation		X	X
12	PD3 SO1, SO2	Develop new standards and technical specifications for the exchange of information relating to IWT ports		X	
13	PD3 SO1, SO2	Require the exchange of information with IWT ports according to new standards and technical specifications			X
14	PD3 SO1, SO2	Improve the harmonisation between RIS and information services for other modes of transport (e.g. maritime)		X	X
15	PD4 SO1, SO2	Require sharing of all necessary cross-border data for traffic and transport management by the Member States			X
16	PD5 SO2	Specify more clearly the cases for exchange of personal data	X	X	
17	PD5 SO2	Develop templates and standards for the exchange of personal data			X

Source: elaboration of the contractor (2023) based on discussions with DG MOVE

Assessment of impacts

The assessment of impacts for this study has been done through a social cost-benefit analysis (SCBA). A SCBA is an evaluation tool that determines the social return on investment. To this end, it includes all effects (both costs and benefits) that affect people's welfare (including well-being). Those effects consist of the difference in development with and without the investment as outlined below (fictitious project).

Discounting future costs and benefits

An important property of the effects is whether they are monetisable (i.e. expressible in monetary terms). If this is the case, amounts can be added up and compared in a cost-benefit analysis. A complicating factor is then that the amounts may be scattered over time. To still be able to compare investments made now with future benefits, a technique called discounting is applied. This expresses future monetary amounts as an amount at the same time as when the investments are made, the so-called Present Value (PV). Adding up the Present Value of both costs and benefits yields the Net Present Value (NPV).

The effects of a measure are calculated back by a fixed percentage per year. Another word for this percentage is the discount rate. The discount rate can be interpreted as a return requirement to be imposed on a public investment or on a public measure from a societal point of view. A social discount rate of 3% is usually used for European projects. For all measures, we use a time horizon of 2050.

Below, firstly the expected impacts are discussed measure by measure with one overview table of all expected impacts, followed by a short narrative explaining the most important impacts. Following this, the expected impacts per Policy Option (taking together all expected impacts for each of the measures included in these) are presented in the same way. More detailed information on the calculations and assumptions used can be found in Annex IX of the Technical Annexes, whilst the methodology is described in detail in Annex VIII.

Impacts per policy measure

Below, the expected impacts for each of the 17 policy measures covered in this study are presented.

Measure 1: Increase the harmonisation of RIS through guidelines

The first measure relates to the publication of guidelines for RIS authorities to improve the harmonisation of RIS standards. Under this measure, the European Commission, would develop guidelines to increase harmonisation requirements relating to the interpretation of the RIS technical specifications and the European Standard-River Information Services (ES-RIS). These guidelines will help to improve the quality of the information provided to the users through RIS, and the sector to identify required information more easily. This measure would require Member States to designate a competent (existing or new) governmental body to directly manage complaints filed by RIS users.

The table below describes the impacts.

Table 6: Overview of costs and benefits of measure 1 ('Increase level of harmonisation of RIS by providing guidelines for competent authorities') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs to **national public authorities**	[€]	0.47				0.47
Recurrent adjustment cost savings to **software service providers**	[€]		0.07	0.07	0.07	1.25
Recurrent adjustment cost savings for **vessel operators**	[€]		0.50	0.50	0.50	8.61

Source: Elaboration of the contractor (2023)

The following impacts are expected for this measure.

Economic impacts:

Interviews with national public authorities revealed that increasing the level of harmonisation of RIS by providing guidance to competent authorities could be achieved through mandates given to national public authorities through relevant working groups of PIANC and CESNI. This is estimated to lead to a one-off adjustment cost of EUR 0.5 million. Also in the current situation, waterway authorities apply guidelines regarding their RIS data. However, the rate at which the most up-to-date guidelines are adopted, and the interpretation of the guidelines may differ between waterway authorities. This measure aims at more consistency between waterway authorities, making it easier for international inland navigation to consult RIS information. Consequently, no additional annual costs compared to the current situation are expected.

On the other hand, benefits on the private sector are expected. Firstly, the work of software service providers will be facilitated. It has been estimated by means of two targeted interviews in which the major parties in this field were consulted, that this will enable them to reduce the price of the product by 1%. This corresponds to around EUR 70,000 per year (2025 value) in cost savings for the industry (NPV 2025-2050: EUR 1.2 million).

Secondly, it is expected that vessel operators will be facilitated in their trip planning. When travelling across the management areas of several RIS authorities, it is easier to compare and interpret the data. As a result, trip preparation time (recurrent adjustment cost savings) are expected to decrease. This effect is estimated at EUR 470,000 per year (2030 value). The net present value in the period 2025-2050 is EUR 8,610,000.

Measure 2: Introduce a harmonised complaint mechanism (in Member States)

This measure aims to introduce a complaint mechanism (in Member States) to ensure a higher degree of harmonisation for RIS. The measure would require Member States to allocate the responsibility of dealing with complaints to an existing governmental body or establish a new one to do so. RIS users could file complaints under this measure.

The table below presents the expected impacts.

Table 7: Overview of costs and benefits of measure 2 ('Introduce complaint mechanism (in Member States) to ensure a higher degree of harmonisation for RIS') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs to **national public authorities**	[€]	2.76	0.00	0.00	0.00	2.76
Recurrent administrative costs for **national public authorities**	[€]		0.92	0.92	0.92	16.02
Recurrent adjustment cost savings to **software service providers**	[€]		0.04	0.04	0.04	0.63
Recurrent adjustment cost savings for **vessel operators**	[€]		0.35	0.36	0.36	6.16
Administrative costs savings for **vessel operators**	[+/-]		PM	PM	PM-	PM

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure.

Economic impacts:

Administrative costs for national public authorities of around EUR 920,000 (NPV 2025-2050: EUR 16.0 million) are expected for all European RIS-authorities to run the complaint mechanism. This would involve staff who administer the complaints, forward these to the right person and coordinate the process further. We expect a total of 19 FTE to be added to the workforce of waterway authorities. Estimations at country level are shown in the table below (x EUR 1,000):

Table 8: Estimated costs to run complaint mechanism (in Member States) x EUR 1,000), per country

	BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
FTE	1.1	2,5	0,5	3,1	5,8	0,7	0,0	0,4	3,9	0,3	0,2	0,5	0,2
Costs	63.62	21.37	12.13	260.22	321.36	15.70	1.44	14.96	150.00	15.21	5.90	31.13	6.67
Total	**Total: EUR 919,984**												

Source: Elaboration of the contractor (2023) based on survey inputs and further estimations

Moreover, introducing a complaints procedure would involve estimated **one-off investment costs** of EUR 2.76 million for **national public authorities**. In fact, governance needs to be considered and people need to be recruited to manage the complaints. On top of this, there should be an IT system that allows complaints to be registered, assigned to the right people and followed up, interacting of course with the complainant. These organisational costs are estimated to be three times the recurring annual costs for running the complaint mechanism. This is analogous to the assumption made by EMSA when setting up the e-certificate registry[121]. The table below presents the estimations per Member State (x EUR 1,000).

Table 9: Estimated one-off investments costs related to the complaint mechanism (in Member States) x EUR 1,000), per country

BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
191	64	36	780	964	48	4	45	450	46	18	93	20
Total: EUR 2,760												

Source: Elaboration of the contractor (2023) based on survey inputs and further estimations

Moreover, it is expected that **software service providers** will make use of the complaints' procedure. They often struggle to find the right desk at RIS authorities. This makes fixing incorrect data or reporting deviations from the standard difficult and time-consuming. The complaints procedure will streamline this process and also lead to better data quality. As a result, it is expected that the annual cost of navigation software could fall by 0.5%. On an annual basis, this corresponds to EUR 40,000 (NPV 2025-2050: EUR 0.63 million)

Inland shippers' **voyage planning** (Recurrent adjustment cost savings for vessel operators) is also expected to improve as a result of the complaints' procedure. It is expected that inland shippers will file complaints when they encounter missing data or incorrect data, both for domestic voyages and international voyages. This can be illustrated with an example. Suppose inland waterway operators complain about poor information on bridge heights across German canals. These inland waterway operators then complain to the German authorities about the deficient information and, as a result of the complaint, the German waterway authorities have to act accordingly. They will have to publish the information (in accordance with applicable standards). Moreover, this measure would contribute to the publication of RIS data in a harmonised way, making it easier to interpret the data. This would lead to an estimated annual benefit of EUR 350,000 (NPV 2025-2050: EUR 6.16 million).

[121] In line with the calculations made for the Impact Assessment for the Directive of the EP and Council amending Directive 2009/21/EC on compliance with flag State requirements

With regard to **Administrative costs savings for Vessels' operators,** the following applies: Vessel operators that may lodge a complaint would benefit of administrative costs savings relative to the baseline due to the use of a structured mechanism. However these costs savings are expected to be limited and are not further estimated.

Measure 3: Introduce a new Performance Measurement Framework

This measure aims to improve the monitoring of the implementation of the RIS Directive, by requiring Members States and relevant authorities to report to the Commission on regular basis on key performance indicators (e.g. the number of shipping messages issued in accordance with standards and interpretations from the most recent RIS encoding guide, and the number of electronic cargo reports received in relation to the number of voyages.

The table below presents the expected impacts.

Table 10: Overview of costs and benefits of measure 3 ('Introduce a new Performance Measurement Framework') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
Recurrent administrative costs for national public authorities	[€]	0.65	0.65	0.65	0.65	11.97
Recurrent adjustment cost savings to **software service providers**	[€]		0.02	0.02	0.02	0.31
Recurrent adjustment cost savings for **vessel operators**	[€]		0.18	0.18	0.18	3.08

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

Setting up the structure of the new performance measurement framework will be done in the context of the existing working groups, for example CESNI and PIANC. They will identify the data necessary for the new framework and set up the terms of reference. This task can be considered within the mandate of those working groups and therefore will not lead to **additional one-off adjustment costs.**

Moreover, **administrative costs for national public authorities** are expected from this measure per Member State of EUR 50,000 – given 13 MS in total this would result into € 650.000.

Table 11: Estimated one-off investments costs related to the complaint mechanism (in Member States) x EUR 1,000), per country

BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
50	50	50	50	50	50	50	50	50	50	50	50	50
Total: EUR 650												

Source: Elaboration of the contractor (2023)

This involves collecting and analysing the necessary data. Moreover, a report will have to be drawn up on this basis. It can be expected that in countries with multiple RIS authorities, this would be somewhat more complex (e.g. Belgium (with the Vlaamse Waterweg and Voies Hydrauliques Wallonie) and France (with the VNF and a separate waterway authority for the Rhone)). It can also be complex in the Netherlands: although there is one RIS authority (Rijkswaterstaat), there is a vast number of waterway authorities. In total, annual costs of EUR 650,000 are expected for all 13 Member States; the related NPV 2025-2050 comes to EUR 11.97 million.

Moreover, **software service providers** will benefit from a Performance Measurement Framework by means of recurrent adjustment cost savings. It makes Member States aware of their level of compliance to current standards. It would thus be an indirect incentive to keep the data in order and publish in line with the standards. This would increase the harmonisation of RIS within Europe and thereby reduces the workload of navigation software providers. After all, they need to spend fewer resources on harmonising data for the benefit of navigation software. The effect is nevertheless considered relatively minor compared to measure 1 ('providing guidelines for competent authorities') and measure 2 ('complaint mechanism (in Member States)'). Concretely, it is estimated that the subscription fee of navigation software will decrease by 0.25%. On an annual basis, this would correspond to EUR 20,000 in cost savings with a Net Present Value over the period 2025-2050 of EUR 0.31 million.

Finally, the Performance Measurement Framework is expected to make a limited positive contribution to the annual level of **adjustment costs for vessel operators** as voyage planning will be eased. It is expected that the harmonisation of RIS would improve as a result of the measure. The estimates are that total recurrent adjustment costs for vessel operators will decrease by EUR 250 thousand per year which would represent a Net Present Value (NPV) over the period 2025-2050 of EUR 3.08 million.

Measure 4: Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index)

This measure aims to strengthen the requirements of Annex I of the current RIS Directive by introducing new technical specifications ('standards') on data for navigation and voyage planning ('RIS Index'), and strengthen provisions under Article 4, paragraph 3, for the supply of such data by the Member States. In addition, this measure introduces new requirements into the RIS Directive that, relate to the efficiency of navigation (e.g. current and expected waiting times at bridges and locks).

The table below presents the expected impacts.

Table 12: Overview of costs and benefits of measure 4 ('Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs for national authorities	[€]	4.55	0.00	0.00	0.00	4.55
Administrative costs for national public authorities	[€]	0.00	1.14	1.14	1.14	19.81
Adjustment costs savings for RIS service providers	[€]		0.14	0.14	0.15	2.50
Adjustment costs savings for vessel operators	[€]		0.63	0.64	0.65	11.09

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

This measure would lead to substantial **one-off adjustment costs** for national public authorities as the new data needs to be collected which can contribute to more efficient navigation. This includes data on actual clearance heights at bridges, information on fairway profiles and digitisation of vessel traffic signs. It would also involve information on the current traffic situation, such as current and expected waiting times at locks. Making data available requires investment in both hardware (to make new data available) and software (to unlock already available data). It is expected that a one-off investment of EUR 4.55 million is required to achieve the goals.

The following table describes how the investment costs (one-off) are distributed among European member states.

Table 13: Estimated one-off investments costs related to the measure 'Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency'(x EUR 1,000), per country

BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
313	87	80	1,127	2,067	97	7	78	500	81	38	41	35
4,551												

Source: Elaboration of the contractor (2023) based on survey inputs and further estimations

Moreover, the newly collected data should require not only one-off investments, but also **recurring administrative costs** to national public authorities. This includes yearly costs to maintain and upgrade the software. It is assumed that the annual maintenance costs amount to 25% of the initial investment costs, aligning this with the assumptions also made in DINA (2017). For European waterway operators, this would correspond to a cost of EUR 1.14 million per year and a Net Present Value of EUR 19.81 million.

The following table shows how the recurrent adjustment costs are distributed among European member states.

Table 14: Estimated recurrent adjustment costs related to the measure 'Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency'(x EUR 1,000), per country

BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
78	22	20	282	517	24	2	19	125	20	10	10	9
1,138												

Source: Elaboration of the contractor (2023) based on survey inputs and further estimations

Software service providers are now building their own smart software to offer added value to their customers. More data on waterway conditions and the actual traffic situation, for instance via AIS stations at bridges on waterways with variable water levels (free flowing rivers) could help. This is estimated to lead to a cost reduction of 2.0%. On an annual basis, this corresponds to as estimated EUR 150 thousand in recurrent adjustment cost savings which would represent a Net Present Value over the period 2025-2050 of EUR 2.5 million.

With regard to **recurrent adjustment cost savings to vessel operators**, the measure 'Strengthen requirements for RIS standards by adding new standards on data for navigation and voyage planning (RIS Index) and new provisions that contribute to increased efficiency' is expected to facilitate voyage preparation and thus decrease recurrent adjustment costs. Indeed, the inland navigation sector has a strong need for data that is currently not (always) available. This includes longer and more accurate water level predictions, current and predicted underpass heights at bridges and current and predicted waiting times at locks. If this data would be made available, the amount of time needed for voyage preparation and planning would be substantially reduced. It is estimated this would lead to annual cost savings of EUR 630,000 (2025 value) which represents an expected Net Present Value (2020-2025) of EUR 11.09 million.

Measure 5: Require electronic voyage plan reporting

This measure would make it mandatory for inland skippers to report their voyage plan (ERIVOY) to authorities, which in return could provide (more accurate) feedback on estimated waiting times at locks and advised navigation speeds. Therefore, ships approaching locks can reduce their speed. This would lead to energy savings, cost savings (less fuel required) and a lowering of air pollution emissions and greenhouse gases.

Moreover, ports could have a better planning of their operations with savings there – and in addition, it would reduce delays at the ports and traffic managers could better plan/allocate

work on locks/bridges etc. Also in case of an emergency, they would have the ability to better respond.

However, it can be argued that the combination of (mandatory) cargo reports with mandatory use of Vessel Tracking & Tracing (VTT) systems can also lead to the above-mentioned benefits. Thanks to mandatory cargo reports (which can now also be done analogously), waterway authorities already have the visibility of transport flows over the network and the expected departure and arrival times of vessels. When this information is combined with up-to-date vessel position data from VTT systems, it is also possible to use already existing data to optimise port planning and make lock occupancy forecasts.

The table below presents the expected impacts.

Table 15: Overview of costs and benefits of measure 5 ('Require electronic voyage plan reporting') in the period 2025-2050

	Unit	2025	2030	2040	2050	Total
Economic impacts	[€]	-2,97	-22,74	-23,40	-24,05	-583,86
One-off adjuestment cost to national public authorities	[€]	-2,97				-2,97
Recurrent administrative cost to national public authorities	[€]		-0,74	-0,74	-0,74	-18,57
Recurrent adjustment cost savings to vessel operators	[€]		1,94	1,82	1,74	46,39
Recurrent administrative costs to vessel operators	[€]		-23,94	-24,48	-25,04	-608,70

Source: Elaboration of the contractor (2023)

The expected impacts from this measure are furter detailed below:

Economic impacts:

This measure would lead to **one-off adjustment cost by public authorities** because they must develop software that can process and convert ERIVOY messages from inland waterway shippers into more accurate lock predictions. For waterway managers, this could result in benefits, as (potentially) investments and capacity expansions of locks are expanded. The software must also be able to make accurate lock schedules based on all ERIVOY messages from ship owners, and therefore return the Requested Time of Arrival (RTA) to inland waterway shippers. Based on interviews with waterway managers, it has been estimated that the development of such software on a European scale will cost approximately EUR 3.07 million

The following table shows how the expected investment costs (one-off) are distributed among European member states.

Table 16: Estimated one-off investments costs related to the measure 'Require electronic voyage plan reporting' (x EUR 1,000), per country

BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
212	71	41	867	1071	53	5	50	500	51	20	104	22
3,067												

Source: Elaboration of the contractor (2023) based on survey inputs and further estimations

The new software and communication mechanisms should require not only one-off investments, but also **administrative costs to national public authorities** (maintenance). This includes yearly costs to maintain and upgrade the hard- and software. It is assumed that the annual maintenance costs amount to 25% of the initial investment costs, aligning this with the assumptions also made in DINA (2017). For European waterway operators, this would correspond to a cost of EUR 0.77 million per year and a Net Present Value (period 2025-2050) amounting to EUR 13.35 million.

Adjustment costs savings for vessel operators are expected due to PM5 through reduced speed of ships and less manoeuvring movements (e.g. braking the ship, mooring at waiting jetties, leaving and entering the lock). These savings are mainly related to the crossing of locks and adaptation of the speed in the proximity of a lock (i.e. the last hour). The

adjustment of speed in the proximity of a lock (i.e. during the last hour) is estimated to lead to 5% savings in fuel consumption relative to the baseline from 2026 onwards. Based on statistics for the Netherlands, vessel cross on average 4 locks per trip. Also considering the total number of voyages and a consumption of 60 litres per hour of sailing, savings are estimated at around 0.89% of total energy consumption. The energy savings in ktoe and the recurrent adjustment costs savings (fuel savings) relative to the baseline for 2030, 2040 and 2050 are provided in Table 18. Expressed as present value over 2025-2050 they are estimated at EUR 248.72 million.

The mandatory voyage plan reporting for inland navigation would lead to **large recurrent administrative costs to vessel operators,** even when it is assumed that ERIVOY messages completely replace ERINOT messages. In fact, in the analysis, it has been assumed that the ERIVOY messages would be added to the ERINOT messages. Considering the additional administrative obligation for inland navigation, combined with periodic updating of the travel plan based on current circumstances, this measure is estimated to result in an additional annual administrative burden of EUR 19.33 million for the entire sector[122]. The net present value of the additional administrative burden for the sector over the entire period 2025-2050 amounts to EUR 367.50 million.

Measure 6: Introduce provisions for supplying data to the ERDMS and its operation

This measure would introduce provisions for RIS authorities for supplying data to the European Reference Data Management System. This measure is an enabling measure for better RIS quality, and many other measures benefit from provisions set out by this measure (synergies)

The table below presents the expected impacts of this measure.

Table 17: Overview of costs and benefits of measure 6 (‘Introduce provisions for supplying data to the ERDMS and its operation’) in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
Administrative costs for national public authorities	[€]	0.66	0.66	0.66	0.66	12.18
Adjustment costs savings for RIS service providers	[€]	0.00	0.14	0.14	0.15	2.50
Adjustment costs savings for vessel operators	[€]	0.00	0.85	0.85	0.86	14.79

Source: Elaboration of the contractor (2023)

The following effects from this measure are expected:

Economic impacts:

However, there are **administrative costs for national public authorities** associated with this measure. At present, there are no obligations regarding reference data. RIS authorities sometimes still have outdated or even incorrect data about objects on the European waterways network. With this measure, Member States would be required to periodically update their data. It is estimated that total costs amount to EUR 0.66 million per year with a net present value over the period 2025-2050 of minus EUR 12.18 million. The following table shows the estimated distribution of costs over the Member States.

[122] We expect the first travel notification to take 34 minutes plus a mandatory (minimum daily) update of 14 minutes each time. Mentioned time efforts were obtained from the public consultation.

Table 18: Estimated costs to introduce provisions for supplying data to the ERDMS x EUR 1,000, per country

BE	BG	CZ	DE	FR	HR	LU	HU	NL	AT	PL	RO	SK
51	2	5	176	319	5	1	4	81	13	2	2	2
662												

Source: Elaboration of the contractor (2023) based on survey inputs and further estimations

Moreover, **software service providers** for the inland shipping sector are strong advocates for provisions for RIS authorities to provide reference data as inland shipping skippers currently can only complain to the suppliers about incorrect information. Following which, the software suppliers themselves conduct quality checks on the data and correct incorrect data if necessary. When RIS authorities would be required to periodically update the data as a result of this measure, the number of errors is expected to decrease. This would also reduce the efforts required from navigation software suppliers to obtain correct data in their software. According to estimates from the navigation software suppliers, this would result in a cost reduction of 2.0% per year, which would be reflected in the annual subscription prices. This is estimated to result in an annual impact of EUR 140,000 and a net present value over the period of 2025-2050 of EUR 2.5 million.

Finally, we see substantial ***adjustment cost savings for vessel operators***, as the time required for trip preparation decreases as a result of more current and accurate reference data. Industry estimates suggest a 20% reduction in the time required for voyage preparation. This includes looking up the current vertical clearance at bridges, bridge and lock operation times, maximum permitted dimensions on the waterway, etc. Considering the overall size of the inland navigation sector, this saving equates to around €0.85 million per year. The Net Present Value over the period 2025-2050 is €14.79 million.

Measure 7: Encourage cargo related information exchange through the eFTI mechanism

This measure would encourage Member States to exchange cargo related information (ERINOT) exchange through eFTI mechanisms. The table below presents the expected impacts of this measure.

Table 19: Overview of costs and benefits of measure 7 (Encourage cargo related information exchange through eFTI mechanisms') in the period 2025-2050

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs for national authorities	[€]	1.25	0.00	0.00	0.00	1.25
Administrative costs savings for national public authorities	[€]		0.62	0.68	0.74	11.45
Adjustment costs savings for vessel operators	[€]	0.00	0.29	0.29	0.29	5.01

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

The **one-off adjustment costs to national public authorities** of this measure are estimated at EUR 1.25 million. Currently, there are five active platforms in Europe: BICS (Netherlands), eRIBa (Belgium), VELI (France), NAMIB (Germany), and CEERIS (Rest of Europe) and these systems would need to be adjusted. RIS authorities have estimated that such an adjustment would cost EUR 250,000 per system. This measure does not require the electronic reporting of cargo information for the entire inland navigation sector, but the mandatory reporting requirements for specific ships (i.e. those transporting dangerous goods) would still apply. There is no expert group with the goal of setting the standards envisaged.

Administrative cost savings for national public authorities: The information exchange through the eFTI mechanism leads to the replacement of the paper cargo reports with the electronic reports. The number of paper cargo reports is assumed to grow in line with the transport activity in the baseline scenario. According to the estimates provided by the Dutch authorities during the interviews, a total elimination of the paper reports would lead to a reduction in the effort required equivalent to 8 full time equivalents (FTE) relative to the baseline. Considering the voluntary system in PM7, a 50% reduction in the paper cargo reports is assumed, equivalent to 4 FTEs saved relative to the baseline in 2026. This is extrapolated to the other Member States based on their respective transport activity (expressed in tkm) relative to that of the Netherlands. In addition, the growth in the number of paper cargo reports over time is also considered. Assuming 240 working days per year and 7.3 hours of work per day on average and using the tariff per hour for non-manual workers (ISCO 8 - Plant and machine operators and assemblers) from Eurostat Structure of earnings survey, the recurrent administrative costs savings for national public authorities are provided in Table 38. Expressed as present value over 2025-2050, they are estimated at EUR 11.45 million relative to the baseline.

The measure would lead to **administrative cost savings for vessel operators**. Interviews with waterway managers have revealed that incorrect reference information, such as regarding the loading/unloading location, coding of the cargo or hull information, is the cause of errors in data exchange and what follows is the need to re-register upon a border crossing. It is expected that as a result of this measure approximately 10 percentage points fewer repeat registrations will be required. This would correspond to an annual saving of EUR 0.3 million in administrative costs which equals a Net Present Value over the period 2025-2050 of EUR 5.01 million.

Measure 8: Mandate cargo-related information to be exchanged through the eFTI mechanism

This measure would enforce Member States to exchange cargo related information (ERINOT) through eFTI mechanisms. The table below presents the expected impacts of this measure.

Table 20: Overview of costs and benefits of measure 8 ('Enforce cargo related information exchange through eFTI mechanisms') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs for national authorities	[€]	1.25	0.00	0.00	0.00	1.25
Administrative costs savings for national public authorities	[€]	0.00	1.25	1.36	1.47	22.89
Adjustment costs savings for vessel operators	[€]	0.00	0.57	0.58	0.59	10.02

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

The **one-off adjustment costs to national public authorities** of this measure are identical to measure number 7 (Enforce cargo related information exchange through eFTI mechanisms). They are estimated at EUR 1.25 million.

This measure is expected to lead to many **administrative cost savings for national public authorities**. Although this measure does not require the exchange of electronic cargo reports between countries, in situations where such bi-lateral agreements exist, the exchanges will be smoothened. It is expected that all unnecessary resubmissions of reports in the Rhine area would disappear. In addition, the administrative burden for RIS-authorities would be reduced as a result of all current non-electronic cargo reports which would be

reported in an electronic manner. As a result, personnel costs could be saved. This benefit has been estimated at EUR 1.25 million per year (from 2030) for all Member States. Adjusting for growth in cargo volume and making these annual benefits net present value, this results in an estimated net present value over the period 2025-2050 of EUR 22.89 million.

This measure is expected to lead to **administrative cost savings for vessel operators**. Interviews with waterway managers revealed that incorrect reference information, such as regarding the loading/unloading location, coding of the cargo or hull information, is the cause of errors in data exchange and thus the need to re-submit the reports upon a border crossing. It is expected that as a result of this measure almost no resubmissions of (electronic) ship reports would be required anymore in the Rhine or Danube stream area.

There will be just a few border crossings that would still require resubmissions of reports: the border between the Netherlands and the Walloon part of Belgium, the border between France and the Walloon part of Belgium, the border between France and Luxembourg as well as the borders between Germany on the one hand, and Austria, Poland and the Czech Republic on the other hand. In the base year, this would amount to 34,000 border crossings where resubmission of electronic cargo information would still be required. Nevertheless, this measure would still result into large annual savings of EUR 0.6 million of administrative costs and an estimated total Net Present Value over the period 2025-2050 of EUR 10.01 million.

Measure 9: Require information exchange through the RIS COMEX platform

This measure would enforce Member States to exchange information through the RIS COMEX platform. RIS-Comex is a one-stop-shop platform for all RIS information in Europe. All other measures build on this platform and use it to distribute the information. The RIS-Comex platform has been developed by a consortium of European waterway operators and has been funded in several tranches through the Connecting Europe Facility.

The table below presents the expected impacts of this measure.

Table 21: Overview of costs and benefits of measure 9 (‘Enforce information exchange through the RIS COMEX platform’) in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs for national authorities	[€]	3.50	0.00	0.00	0.00	3.50
Administrative costs savings for national public authorities	[€]	0.00	0.50	0.50	0.50	7.71
Adjustment costs savings for RIS service providers	[€]	0.00	0.07	0.07	0.07	1.25
Adjustment costs savings for vessel operators	[€]	0.00	1.48	1.49	1.51	37.16
Administrative costs savings for vessel operators	[€]	0.00	0.22	0.22	0.23	3.90

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

One-off investment costs for national public authorities are expected due to PM9. They cover those countries that were not part of the initial RIS COMEX project (e.g. Italy, Spain, Portugal) and who will need to develop the necessary digital applications. They also cover elements in RIS COMEX that will need to be updated/completed (for example, the inland waters of a maritime character in Germany are missing). The **one-off adjustment costs** for national public authorities are estimated at EUR 3.5 million in 2025 relative to the baseline.

The ultimate aim of PM9 is to replace the national platforms that currently coexist. This can only happen if the functionality of RIS COMEX is equivalent to that of the national platforms and can also serve a broader purpose, such as providing information on waterways exclusively navigable for recreational navigation. When this is achieved, it is expected that the existing national platforms would be phased out. PM9 would thus lead to recurrent administrative costs savings estimated at EUR 500,000 per year from 2030 onwards. Expressed as present value over 2025-2050, they are estimated at EUR 7.71 million relative to the baseline.

The EURIS portal is an important platform for **software service providers**, where they can obtain the same information from a central place, instead of having to obtain information from various European RIS authorities. The platform is built on the already operational Visuris platform (Flanders), which means there are no adaptation costs. This would lead to cost savings, estimated at 1% of annual subscription costs per year, amounting to EUR 70,000 per year with a net present value over the period 2025-2050 of EUR 1.25 million.

CEERIS was developed under the RIS-COMEX banner. This tool should enable vessel operators on the Danube to create a one-stop-shop application for electronic reporting of cargo and voyage data. This can prevent many administrative operations. Interviews with waterway operators and users revealed that before the CEERIS platform became operational, it was not possible to cross a border on the Danube without having to report again. When the use of RIS-COMEX, including thus the CEERIS tool, becomes mandatory, vessel operators on the Danube could benefit from a single electronic notification of cargo data. On an annual basis, this results **in recurrent administrative cost savings for vessel operators** of around €220,000. The net present value in the period 2025-2050 is €3.9 million.

Moreover, the EURIS portal is a ground-breaking element when it comes to **recurrent adjustment cost savings for vessel operators** as voyage planning is eased. Where previously several national RIS portals had to be consulted, all relevant information is now offered from a single portal with the EURIS portal. Based upon consultation with vessel operators, it has been estimated that the time spent on international voyage preparation will be reduced by 50%. This equals yearly savings of EUR 1.48 million and a net present value of € 37.16 million.

Measure 10: Involve CESNI in the development and adoption of technical specifications

This measure will involve CESNI in the development and adoption of technical specifications by revising the governance structure and adoption procedure for technical specifications of the RIS Directive. The following effects are expected from this measure:

Economic impacts:

No one-off investment costs are expected as a result of this measure. There is already a CESNI working group dealing with RIS standards, so no new organisation would have to be set up. CESNI is funded already by the Commission as is working on standard

development in inland navigation on several topics, such as technical standards of vessels, professional qualifications of IWT crew, etc. The involvement of national experts in the current and proposed situation is about the same, but this measure definitively speeds up the work and brings adaptations on RIS quicker to the sector.

Moreover, there is no reason to assume that this measure would result in an increase in **annual adjustment costs**. There is already a CESNI working group dealing with RIS standards. This measure would only give the working group an expanded mandate. Interviews have indicated that RIS authorities expect that by involving CESNI, the RIS work programme will become more predictable. Qualitatively, it can therefore be assumed that their annual costs may decrease, as RIS authorities will need to hire less external expertise as a flexible layer. However, it is not possible to estimate the cost savings as the extent of the cost savings will depend on several factors, such as the scope of the CESNI working group's mandate, the level of involvement of RIS authorities in the working group, and the level of external expertise required for RIS implementation and adoption.

In the long term, a small positive impact is expected on the quality of the inland waterway **voyage planning** as a result of this measure as this measure would contribute to further harmonisation of RIS standards and faster development of new standards that enhance voyage planning.

Measure 11: Link RIS requirements with those of the TEN-T Regulation

This measure would seek at aligning the scope of the RIS Directive with the scope of the TEN-T Regulation. Currently, all interconnected waterways of CEMT class IV and higher (which refers to the size of the vessel they can accommodate) are within the scope of the RIS Directive. Member States may decide to include further waterways in this scope (for example Italy, Spain and Portugal). This scope does not match the TEN-T network, which with its current proposed revision will not refer any more to CEMT classification but will be based on the characteristics of the waterways themselves.

Under PM11, the scope of the RIS Directive is aligned with that of the TEN-T Regulation, which corresponds to the waterways of international importance. The waterways currently in the scope of the RIS Directive have a length of 14,400 km while the waterways under TEN-T have a length of 13,000 km. As a consequence, up to 1,400 km of waterways would potentially not be covered by the RIS provisions. Under this measure, Member States would still be able to voluntarily extend the RIS requirements to other parts of their network beyond what is in the TEN-T network.

The majority of these waterways appear to be in the Netherlands, which already applies RIS. During the interviews, the Dutch authorities indicated that they already now compile information outside the scope of the current RIS Directive. As the majority of the 1,400 km that would fall out of scope of the new Directive are within the Netherlands, it is assumed that they will remain in the network on a voluntary basis. However, because the Dutch waterway network is very dense and given the international nature of inland navigation, it is unlikely that any inland shippers will sail exclusively (year-round) on waterways that will fall out of scope of the Directive as a result of these measures. Moreover, for waterways that are currently voluntarily in RIS (e.g. in Italy, Spain and Portugal) and are currently in the TEN-T network, their participation will become obligatory. However, considering that there is a very limited number of waterways in these countries that are currently not covered, no investments are expected from the side of Italy, Spain and Portugal to adapt their voluntary implementation of RIS to an obligatory. Therefore, it is assumed that the change of scope brought by this measure will not lead to a net change in the kilometres' coverage, and thus no further economic impacts are considered.

Measure 12: Develop new standards and technical specifications for the exchange of information relating to IWT ports

This measure will develop new standards and technical specifications for the exchange of information relating to IWT ports. The table below presents the expected impacts of this measure.

Table 22: Overview of costs and benefits of measure 12 ('develop new standards and technical specifications for the exchange of information relating to IWT ports') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs to national public authorities (ports)	[€]	1.58				1.58
administrative costs to national public authorities (ports)	[€]		0.39	0.39	0.39	6.86
adjustment cost savings for RIS software service providers	[€]		0.05	0.05	0.05	0.94
Adjustment cost savings for vessel operators	[€]		0.17	0.17	0.17	2.92
Administrative cost savings for vessel operators	[€]		0.51	0.51	0.52	8.88

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

The **one-off adjustment costs** for this measure have been determined under the assumption that in the voluntary case all core ports of the European TEN-T network would implement the standards. In total, there are 54 inland ports of the core network for which no RIS data is available. There are also an additional 115 inland ports on the comprehensive network for which the same applies. As assumed in the DINA (2017) report, a cost of EUR 25,000 per port has been estimated. Indexing to 2022 price level results this would results in a one-off investment cost of EUR 1.58 million.

The **administrative costs to national public authorities (ports)** from this measure should be seen as management and maintenance costs of the data. These were assumed to be 25% of the one-off investment cost in DINA (2017). This would result in EUR 8,000 per port, per year and thus a total of EUR 390,000 per year. This would equal a net present value over the period 2025-2050 of EUR 6.86 million.

Software service providers currently have a lot of difficulty in collecting data on inland ports as established through interviews. They thus supported the implementation of this measure. If all inland ports provide reference data and keep this data updated, this could save navigation software suppliers substantial costs. Based on interviews with these parties, these adjustment cost savings have been estimated at 54,000 per year which represents a Net Present Value over the period 2025-2050 of EUR 900,000.

The **administrative cost savings for vessel operators** of inland shippers would also be reduced if inland ports would start applying RIS standards to a greater extent. Currently, (electronic) cargo reports are not yet passed on to inland ports. This means that inland shippers have to report again when entering a port. If ports would start applying these standards, reports could be forwarded, and part of the administrative burden could be alleviated. This potential of these savings has been estimated at EUR 170,000 a year equalling a Net Present Value over the period 2025-2050 of EUR 2.92 million.

Finally, the **adjustment cost savings for vessel operators** would decrease as **voyage preparation and planning** would also be facilitated if inland ports would provide data. If only core network ports would do so, the annual savings on hassle costs has been estimated at EUR 510,000, and a total Net Present Value over the period of 2025-2050 equalling EUR 8.88 million.

Measure 13: Require the exchange of information with IWT ports according to new standards and technical specifications

This measure will develop and mandate new standards and technical specifications for the exchange of information relating to IWT ports. The table below presents the expected impacts of this measure.

Table 23: Overview of costs and benefits of measure 13 ('mandate new standards and technical specifications for the exchange of information relating to IWT ports') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs to national public authorities (ports)	[€]	4.93				4.93
Administrative costs to national public authorities (ports)	[€]		1.23	1.23	1.23	21.48
Adjustment cost savings for RISservice providers	[€]		0.09	0.09	0.09	1.56
Adjustment cost savings for vessel operators	[€]		0.52	0.53	0.53	9.14
Administrative cost savings for vessel operators	[€]		1.62	1.63	1.66	28.35

Source: Elaboration of the contractor (2023

The following effects are expected from this measure:

Economic impacts:

The **one-off adjustment costs to national public authorities (ports)** for this measure have been determined under the assumption that in the mandatory case all (both core and comprehensive) ports of the European TEN-T network will implement the standards. In total, there are 54 inland ports of the core network for which no RIS data is available. There are also an additional 115 inland ports of the comprehensive network for which the same applies. As assumed in the DINA (2017) report, a cost of EUR 29,917 (2022 prices) per port is expected. Indexing to 2022 price levels results in an estimated one-off investment cost of EUR 4.93 million.

The **administrative costs to national public authorities (ports)** resulting from this measure should be seen as management and maintenance costs of the data. These were assumed to be 25% of the one-off investment cost in DINA (2017). This results in EUR 8,000 per port, per year and thus a total of EUR 1.23 million per year. As a Net Present Value over the period 2025-2050, the estimated annual adaptation costs amount to EUR 22.3 million.

Software service providers have great difficulty in collecting data on inland ports. They thus encourage this measure. If all inland ports provide reference data on their inland port and keep this data updated, it could save navigation software suppliers substantial adjustment costs. Based on interviews with these parties, the estimated cost savings amount to EUR 90,000 per year which would represent Net Present Value over the period of 2025-2050 amounting to EUR 1.56 million.

The **administrative cost savings for vessel operators** would also be reduced if inland ports would start applying RIS standards to a greater extent. Currently, (electronic) cargo reports are not yet passed on to inland ports. This means that inland shippers have to report again when entering a port. If ports would start applying the standards, reports could be forwarded, and this way part of the administrative burden could be alleviated. The estimated savings amount to € 1,63 million per year which would equal a Net Present Value over the period 2025-2050 of EUR 28.35 million.

Finally, the **adjustment cost savings for vessel operators** would decrease as **voyage preparation and planning** of inland shippers would also become easier if inland ports would provide the relevant data. If only core network ports do so, the annual savings on hassle costs are estimated at EUR 520,000 which would amount to a Net Present Value over the period 2025-2050 of EUR 9.14 million.

Measure 14: Improve harmonisation between RIS and information services for other modes of transport (e.g. maritime)

This measure will improve harmonisation between RIS and information services for other modes of transport (e.g. maritime). The table below presents the expected impacts of this measure.

Table 24: Overview of costs and benefits of measure 14 ('improve harmonisation between RIS and information services for other modes of transport (e.g. maritime)') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment cost to national public authorities	[€]	3.14				3.14
Administrative cost to national public authorities	[€]		0.79	0.79	0.79	13.68
Adjustment cost savings for RIS service providers vessel operators	[€]		0.02	0.02	0.02	0.31
Savings in external costs of congestion	[€]	0.00	4.71	5.15	5.60	86.77

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

Integration of RIS and information systems with other modes would require large **one-off adjustment cost to national public authorities**. RIS was originally developed from maritime standards. However, it has developed a lot over time and to properly embed RIS in the information standards for other modes, a large project is expected to be needed to integrate for instance River Information Services with the Maritime Single Window. Here, the assumption has been used that a project similar to CoRISma would be required. The European Commission contributed EUR 1,083,204 to this project, using a co-financing rate of 41%. At current price levels, this would correspond to about EUR 3.14 million which should be borne by national public authorities.

The **administrative cost to national public authorities** resulting from this measure should be seen as management and maintenance costs of the data. These were assumed to be 25% of the one-off investment cost in DINA (2017). This results in an estimated total of EUR 0.79 million per year. The Net Present Value over the period 2025-2050 of the annual adjustment costs would thus amount to EUR 13.68 million.

PM14 will result into maritime charts (ECDIS) and inland charts (Inland ECDIS) being better aligned and thus to time savings and adjustment cost savings for software service providers. The baseline scenario the average cost for software service providers for introducing the data into their systems is estimated at EUR 452 per year, per vessel (in 2022 prices)[123]. According to feedback provided by the RIS software service providers during the second stakeholder survey[124], PM14 would allow to reduce the average cost per vessel by 0.25% relative to the baseline (i.e. EUR 1.13 saved per vessel) from 2026 onwards. The recurrent adjustment costs savings for navigation software service providers for 2030, 2040 and 2050, relative to the baseline, are provided in Table 24. Expressed as present value over 2025-2050, they are estimated at EUR 0.31 million relative to the baseline (in 2022 prices)[125].

Measure 15: Require sharing of all necessary cross-border data for traffic management and transport management by Member States

This measure will oblige Member States to share all necessary data cross-border that are required for traffic management and transport management. The table below presents the expected impacts of this measure.

Table 25: Overview of costs and benefits of measure 15 ('oblige Member States to share all necessary data cross-border that are required for traffic management and transport management') in the period 2025-2050

	Unit	2025	2030	2040	2050	Total	NPV
One-off adjustment cost to **national public authorities**	[€]	5.00				5.00	5.00
Administrative costs to national public authorities	[€]		0.39	0.39	0.39		6.77
Administrative cost savings for **vessel operators**	[€]		0.06	0.06	0.07		1.11

Source: Elaboration of the contractor (2023)

[123] Ludden, V. et al., (2020): *Study supporting the evaluation of Directive 2005/44/EC on Harmonised River Information Services (RIS)*. Ramboll, University of Antwerp and DLA Piper. The average cost in the study is expressed in 2019 prices. For the purpose of this impact assessment, it has been transformed in 2022 prices using the harmonised consumer price index for Belgium from Eurostat because the two navigation software service providers that serve around 90% of the market are based in Belgium.

[124] The feedback has been provided by the two navigation software service providers, based in Belgium, that serve around 90% of the market.

[125] Part of these costs savings benefiting software provides may be passed through to the vessel operators, although it is not possible to assess the share of the costs savings passed through.

The following effects are expected from this measure:

Innovation impacts:

No innovation impacts are expected.

Economic impacts:

The **one-off adjustment cost to national public authorities** for this measure is estimated at EUR 5.0 million in IT-systems that would allow for data-exchange between countries. CEERIS could for instance be used, but also existing platforms such as BICS. The measure would ensure the exchange of cargo reports between RIS authorities. Currently, this is not yet successful on some borders (e.g. the borders between the Netherlands and Wallonia, between France and Wallonia, between France and Luxembourg between Austria and Germany, and all other borders in the Danube area except of the Austrian-Slovakian border). The measure would only ensure exchange between these countries, whilst qualitative inaccuracies or interoperability problems would not be solved.

This measure would allow to save on **administrative cost to national public authorities** in terms of staff at their borders. The estimate here is that this would involve savings equivalent to EUR 39,000 per year. The Net Present Value over the period 2025-2050 of the annual adjustment costs would amount to EUR 6.77 million.

For inland navigation, this measure would be important. The fact that skippers no longer have to re-register at a border crossing because the notification was not passed on, would also lead to savings in terms of administrative burdens on the private sector. The expectation here is that this amounts to **administrative cost savings for vessel operators of** EUR 70,000 on an annual basis which equals an estimated Net Present Value over the period 2025-2050 of EUR 1.11 million.

Measure 16: Specify more clearly the cases for exchange of personal data

This measure will specify more clearly the cases for exchange of personal data. The table below presents the expected impacts of this measure.

Table 26: Overview of costs and benefits of measure 16 ('specify more clearly the cases for exchange of personal data') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs to **national public authorities**	[€]	1.55				1.55
Administrative cost for **national public authorities**	[€]		0.39	0.39	0.39	6.74
Administrative cost savings for **vessel operators**	[€]		0.32	0.33	0.33	5.67

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Innovation impacts:

No innovation impacts are expected.

Economic impacts:

The **one-off adjustment costs to national public authorities** for this measure are estimated at EUR 1.55 million. It is hereby assumed that all 265 inland ports (as identified in DINA (2017)) would develop an application where handling of port-related matters, such as berth management and collection of port fees, are developed. The development costs are hereby estimated at EUR 5,839 per port (in 2022 prices).

The **administrative cost for national public authorities** resulting from this measure should be seen as management and maintenance costs of the data. These were assumed

to be 25% of the one-off investment cost in DINA (2017). This would result in EUR 1,460 per port, per year and thus a total of EUR 386,860 per year. This would amount to an estimated Net Present Value over the period of 2025-2050 of EUR 6.74 million.

The expectation is that making clear in which cases AIS data can and cannot be shared, the procedure for collecting port charges would become simpler and leading to **administrative cost savings for vessel operators.** Barges would no longer have to report in ports and authorities would have to make less effort to identify vessels. It is important to realise that there are 120 ports in Europe where port dues are levied. These ports are primarily located in the Netherlands. There are also some ports along the Rhine and Danube that levy harbour dues. It is estimated that if the cases for data-sharing would be better clarified, this would lead to annual benefits of EUR 320,000. The estimated Net Present Value of this would amount to EUR 5.67 million.

Measure 17: Develop templates and standards for the exchange of personal data

This measure will develop and mandate new standards and technical specifications for the exchange of information relating to IWT ports. The table below presents the expected impacts of this measure.

Table 27: Overview of costs and benefits of measure 17 ('mandate new standards and technical specifications for the exchange of information relating to IWT ports') in the period 2025-2050.

	Unit	2025	2030	2040	2050	NPV
One-off adjustment costs to **national public authorities**	[€]	2.71				2.71
Administrative cost for **national public authorities**	[€]		0.68	0.68	0.68	11.79
Administrative cost savings for **vessel operators**	[€]		0.49	0.49	0.50	8.51

Source: Elaboration of the contractor (2023)

The following effects are expected from this measure:

Economic impacts:

The **one-off adjustment costs to national public authorities** for this measure are estimated at EUR 2.7 million. It is hereby assumed that all 265 inland ports (as identified in DINA (2017)) develop an application where handling of port-related matters, such as berth management and collection of port fees would be developed. The development costs are hereby estimated at EUR 10,219 per port (2022 price level). An additional surcharge comes on top of this of 75% to accommodate the harmonisation of processes. This way, the administrative burden for inland skippers would be reduced and one single point of access would be created for all European ports.

The **administrative costs for national public authorities** resulting from this measure should be seen as management and maintenance costs of the data. These were assumed to be 25% of the one-off investment cost in DINA (2017). This would result in EUR 2,555 per port, per year and thus a total of EUR 677,005 per year with an estimated Net Present Value over the period of 2025-2050 amounting to EUR 11.79 million.

By clarifying instances when AIS data can and cannot be shared, the procedure for collecting port charges would become simpler and **administrative cost savings for vessel operators** would occur. In Europe, port dues are levied in 120 ports, which are primarily located in the Netherlands, but some also along the Rhine and Danube. It is estimated that if the cases for data-sharing would be better clarified the number of resubmitted reports to ports would decrease by 30% relative to the baseline from 2026 onwards. Considering the labour cost

per hour (EUR 26.7 per hour126), the administrative costs savings for vessels operators due to PM17 relative to the baseline are provided in Table 27. Expressed as present value over 2025-2050, they are estimated at EUR 8.51 million relative to the baseline.

Social impacts

The social impacts are assessed in terms of impacts on safety and fundamental rights.

6.2.1 Impacts on safety

Implementing new RIS standards under PM4 and increasing links with the systems of other modes in PM14, offer immense potential to improve safety as the induced modal shift also generates an indirect impact on road safety. This modal shift would result in fewer accidents on the road with Heavy Duty Vehicles. It is estimated that the safety gains on road transport because of this modal shift to water transport (reduction of accidents per tonnes-kilometre through modal shift) as the combined effect of PM4 and PM14 of a total of EUR 115.8 million in net present value over the period 2025-2050.

As the baseline showed, around 410 accidents are expected per year until 2050. Research by Intergo (2021) shows that accidents in inland navigation are due to human error in 70 to 80% of the cases. Statistics published by Eurostat and Rijkswaterstaat indicate that that most reported accidents involve grounding, collisions with infrastructure or collisions with other ships. No detailed breakdown was identified by the support study, nor any details on the magnitude and costs of these accidents. Measures that aim to improve the situational awareness of the vessel operators and the authorities (like PM4, PM5, PM6) should have a positive impact on avoiding accidents. The evaluation indicated that “water level messages concerning bridge passages can avoid collision with infrastructure, and messages related to traffic can help avoid collisions between ships. Given that current and accurate under keel clearance heights are only made available for a limited number of bridges, there is much to be gained here.” However, the evaluation did not succeed in quantifying the safety improvements. Neither did the information provided during the stakeholder consultation of the Impact Assessment allowed the estimation of a clear indicator that could be used the reflect the impact that these measures would have in avoiding accidents. As such, while it is understood that there is potential for a reduction of accidents, no further quantification of this impact is undertaken.

6.2.2 Impacts on fundamental rights

The policy options were assessed to determine if they have an impact on the fundamental rights and/or equal treatment of EU citizens. The starting point of the assessment of the fundamental rights is the Charter of Fundamental Rights of the European Union . All POs were assessed having regard to the relevant EU instrument and it was concluded that they maintain full respect for human and fundamental rights, and none will have any negative impact thereon. Furthermore, none of the options mandate the exchange of personal data, but only provide more clarity (through PM16 and PM17) on the conditions under which the handling of personal information by national authorities is allowed (PM16), or define the technical aspects of how such an exchange should be done through RIS if appropriate (PM17), fully in line with applicable legislation, thus increasing legal clarity for users of RIS services.

6.2.3 Impacts on digitalisation

All policy options will have a positive impact on the application of the ‘digital by default’ principle, as this is one of the main elements of the Directive. PO-A has the least impact as

[126] Weighted average of the tariff per hour for non-manual workers (ISCO 8 - Plant and machine operators and assemblers) in the 13 Member State in the scope of RIS. It is based on Eurostat Structure of earnings survey and expressed in 2022 prices.

while it will improve the quality of the underlying data for RIS (through PM6), it only encourages the use of eFTI for data exchange (PM7). PO-B introduces RIS COMEX as the main platform for exchange of RIS information (PM9), a platform upon which will also be the basis for the development of the digital applications of the other measures under consideration. Furthermore, by mandating the use of eFTI, by introducing better links with ports (PM12) and other modes (PM14) it improves the interoperability of IWT through digital solutions. PO-C goes a step further in particular as it requires electronic voyage reporting (PM5), and the exchange of cross-border data (PM15), and mandates electronic exchange with ports (PM13).

Environmental impacts

The environmental impacts are assessed in terms of climate change, air pollution, noise reduction and effects on habitats. These impacts are linked with developments in the modal split and are thus a direct result of their estimation (see section 6.1.5).

CO2 emissions

The modal shift from transport on road to inland waterways has an impact on CO2 emissions from both the IWT sector and transport on road. Due to the modal shift, more cargo is transported by energy-efficient inland shipping, instead of less efficient road transport. PM4 would help optimise navigation, while PM14 foresees the integration of RIS and information systems with other modes of transport. Calculated similarly to the above, CO2 emissions are expected to decrease by 389.1 Ktonnes over the period 2025-2050 as a result of this measure. Multiplied by future CO2 prices and discounted net, this corresponds to an estimated saving of EUR 48.6 million over the period 2025-2050 for PO-B. PO-C has a further impact in reducing CO2 emissions through the reduced energy use of IWT vessels (more efficient navigation). This is estimated to provide a further reduction in CO2 emissions compared with PO-B to the effect of 443 Ktonnes, for a total of 832.1 in 2050 Ktonnes, which translates in a total benefit of EUR 105.2 million NPV.

Air pollution

Several policy measures have an impact on the emitted air pollutants NOx and PM. As PM4 and PM14 have an impact on modal shift this is expected to have a further impact on the overall emissions due to the differences in engine performance between the modes. For PO-B, the effect of these measures is estimated to lead an increase of NOx emissions by 21.3 tonnes in 2050 compared to the baseline, and by 1.6 tonnes of PM emissions in the same year. For the whole period 2025-2050 this would lead to an increase of 603 tonnes in in NOx and 60.8 tonnes in PM emissions. This result is due to the fact that road engines are expected to increase their performance over this period more than those used in IWT. When estimating the net present value of these impacts in monetary terms we find a combined cost of EUR 13.1 million.

PO-C in addition to PM4 and PM14 also includes PM 5, which leads to energy savings due to better travel information and adaptation of i.e. travel speed, which reduces air pollution. Considering the projected number of vessels, the network size and use, PM5 is expected to reduce NOx emissions by 150.8 tonnes and PM by 7.9 tonnes compared to the baseline in 2025. In the period from 2025-2050, 7155,5 tonnes of NOx and 399.6 tonnes of PM are expected to be saved. Given the prices attached to those pollutants, this corresponds to a combined net present value of EUR 127.6 million in savings over the period 2025-2050.

Noise reduction

Modal shift would contribute greatly to reducing noise impacts along the European road network, from the implementation of PM4 and PM14, as less heavy-duty vehicles will be circulating in the roads. Estimating the reduction in noise by the modal shift will lead to a reduction of EUR 2.4 million in 2050 for both PO-C and PO-B. In total, this results to a NPV of EUR 36.6 million (2025-2050).

Habitats

Modal shift to IWT would make a limited contribution to improving habitat quality along the European road network by reducing the disturbance of road transport crossing fragile natural areas. With an increase in waterborne transport, more disturbance along rivers is expected, while still representing a net positive gain. Following the same calculation steps as the other environmental impacts, the weighted average externality of the modal shift relating to habitats is applied, which leads to an expected benefit of EUR 2.3 million for 2050 and a NPV of EUR 36.2 million.

Table 28: Impact on external costs of CO2 emissions, air pollution emissions, noise and habitats relative to the baseline in 2030, 2040 and 2050 (in million EUR, 2022 prices)

	Difference to the Baseline								
	PO-A			PO-B			PO-C		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
CO2 emissions	0.0	0.0	0.0	-2.7	-3.1	-1.8	-5.4	-7.1	-4.6
PM5							-2.7	-3.9	-2.9
PM4&PM14				-2.7	-3.1	-1.8	-2.7	-3.1	-1.8
Air pollution	0.0	0.0	0.0	0.7	0.9	0.6	-9.4	-6.0	-3.3
PM5							-10.2	-6.8	-4.0
PM4&PM14				0.7	0.9	0.6	0.7	0.9	0.6
Noise	0.0	0.0	0.0	-2.0	-2.2	-2.4	-2.0	-2.2	-2.4
PM4&PM14				-2.0	-2.2	-2.4	-2.0	-2.2	-2.4
Habitats	0.0	0.0	0.0	-2.0	-2.1	-2.3	-2.0	-2.1	-2.3
PM4&PM14				-2.0	-2.1	-2.3	-2.0	-2.1	-2.3
Total impact on external costs	0.0	0.0	0.0	-5.9	-6.6	-5.9	-18.7	-17.4	-12.7

Source: Elaboration of the contractor (2023)

Impacts per policy option

To present an overview at a higher level of the expected impacts, the sections below summarise these per Policy Option, grouping the impacts from all of the measures included in each of those. For the grouping of measures per option, see Table 5. To recall, the three options are:

Option A: Providing guidelines to clarify key issues

Option B: Updating key parts of the RIS Directive

Option C: Providing for increased data exchange

More details on each of these and the measures these contain can be found in Section 0.

The table below presents the consolidated impacts for Policy Option A grouping together the impacts for all of the individual measures (see Table 5) it covers.

Table 29: Expected overall impacts for each option, per stakeholder category

	Difference to the Baseline		
	PO-A	**PO-B**	**PO-C**
Vessel operators			
Administrative costs	0.0	0.0	367.5
Adjustment costs savings	29.6	72.1	324.0
Administrative costs savings	10.7	28.5	51.9
Software providers			
Adjustment costs savings	4.4	8.1	8.4
National authorities			
Adjustment costs	5.6	18.3	28.2
Administrative costs	34.9	75.3	104.3
Administrative cost savings	11.4	30.6	37.4
European Commission			
Adjustment costs	0.5	0.0	0.0
External costs savings			
Reduction in external costs of air pollution emissions		-13.1	127.6
Reduction in external costs of accidents		115.8	115.8
Total costs	41.0	93.6	499.9
Total benefits	56.1	450.4	930.0
Net benefits	15.1	356.7	430.1
Benefits to costs ratio	1.4	4.8	1.9

Source: Elaboration of the contractor (2023)

Policy Option A

Policy Option A has the lowest overall cost among all options. While the investment costs for RIS authorities remain limited, the total benefits exceed the costs on the private sector. Nevertheless, the administrative cost savings for vessel operators and the adjustment cost savings for vessel operators are limited

However, the measures of Policy Option A do not touch the broader goals set in the revision of the Directive. It does not make inland navigation more energy-efficient and does not bring about a modal shift

Finally, Policy Option A provides a limited improvement in safety in the inland navigation sector and is expected to reduce the number of accidents

Policy Option B

In terms of overall impacts, Policy Option B is attractive from a European perspective. The benefits greatly exceed the costs and exhibits the highest benefit-cost ratio. Reflecting this, the estimated Net Present Value over the period 2025-2050 totals EUR 356.7 million

Policy Option B contributes strongly to achieving the European Green Deal targets. Especially, the expected modal shift to inland shipping would make transport more energy efficient. The reduction of CO2 emissions corresponds to savings in external costs of EUR 48.6 million (NPV 2025-2050)

Finally, there is a sizeable reduction in other environmental and social costs

Policy Option C

In terms of overall impacts, Policy Option C brings the highest benefits but also by far the highest costs, leading to a benefit-cost ratio of 1.8.Thus, the expected Net Present Value of net benefits over the period 2025-2050 totals EUR 430.1 million

Policy Option C contributes strongly to achieving the European Green Deal targets. Modal shift to inland shipping would lead to external cost savings of CO2 emissions of EUR 105.2 million (NPV 2025-2050), significantly higher than in policy option B

Comparison of policy options

This chapter presents a comparison of each of the identified policy options. The elements and analysis presented in the previous chapters are taken together and presented alongside one another to allow for an analysis of each of the policy options and the degree to which they address the specific objectives (see section 0) effectively, efficiently and with coherence to other EU policy objectives.

Effectiveness

The assessment of effectiveness looks at the extent to which the general and specific objectives (SO) of the intervention are met.

Overall, each of the policy options would contribute to meeting the **general objective**. **PO-A** focuses on providing guidelines to clarify key issues, contributes significantly to effectively meeting the general objective and specific objectives of the directive. By developing guidelines in collaboration with CESNI or the European Commission, a universal interpretation of key concepts of the RIS Directive could be brought about. This universal interpretation could have the potential to promote harmonisation, ensuring an effective framework for the deployment and use of harmonised RIS in the EU, as stated in the general objective. **PO-B** would update key parts of the RIS Directive. By partially updating elements of the Directive, this option would aim to ensure that the RIS framework remains relevant and aligned with evolving needs, technological advancements, and policy requirements, thus contributing to the general objective. **PO-C** would mandate the increased data exchange beyond the current scope of the RIS Directive. By imposing an obligation on Member States to enhance data exchange, this option would strengthen the framework for the deployment and use of harmonized RIS in the EU, as specified in the general objective.

With regards to **Specific Objective 1** (SO1), each of the policy options would directly address the objective. Under **PO-A,** SO1 would be directly addressed through facilitating improved RIS data availability, access, and harmonisation of standards. The guidelines would clarify key issues such as data standards, access requirements, and reporting protocols, leading to enhanced data availability and facilitating efficient data exchange within the inland waterways transport sector and with other transport modes. **PO-B** would also directly address SO1. The updates would introduce new data standards, reporting obligations, or performance indicators, enhancing the quality and availability of information exchange within the IWT sector and with other transport modes. This would help to facilitate efficient data exchange and contributes to improved data accessibility and harmonisation. Similarly, **PO-C** would also directly address SO1 through mandating increased data exchange. This option would enhance the availability and accessibility of data within the IWT sector and with other transport modes which in turn could facilitate the efficient exchange and use of data, leading to better-informed decision-making, optimised operations, and improved overall transport efficiency.

Under **Specific Objective 2** (SO2), each of the policy options would contribute to ensuring a higher uptake and interoperability of digital solutions, as well as addressing data protection concerns. Under **PO-A**, the inclusion of guidelines (e.g. on data standards, access requirements), could have a positive impact on improving efficiency and interoperability, aligning with SO2, which aims to ensure higher uptake and interoperability of digital solutions. Furthermore, the provision of guidelines could help to address data protection concerns, in part, through the provision of best practices and recommendations for handling and protecting sensitive data, thereby ensuring that privacy and data protection standards are met.

PO-B would also support the higher uptake and interoperability of digital solutions, through incorporating updates that align with emerging technologies and practices, such as artificial intelligence and automation. This would help to promote interoperability, enhance efficiency,

and enable the IWT sector to leverage digital advancements effectively. Additionally, PO-B would contribute to addressing data protection concerns by reviewing and updating the requirements imposed on RIS users and Member States. The updates would ensure that privacy and data protection standards are adequately addressed, protecting sensitive information and addressing the specific objective of data protection concerns.

PO-C would mandate the sharing a broader range of data, thus, stakeholders would have the potential to leverage advanced technologies, such as data analytics and predictive modelling, to optimise routes, improve vessel performance, and enhance overall transport operations. This, in turn, could increase the sector's competitiveness and contributes to SO2. In terms of addressing data protection concerns under SO2, PO-C would only have an in-direct impact, through the increase in the exchange of data which could prompt measures at the Member State level to ensure the secure and responsible handling of data.

Efficiency

Efficiency concerns "the extent to which objectives can be achieved for a given level of resource/at least cost". In all policy measures, the benefits outweigh by far the increase in costs, relative to the baseline. The costs and benefits are summarised in the table below.

Table 30: Overview of costs and benefits in NPC (in millions)

	Difference to the Baseline		
	PO-A	PO-B	PO-C
Vessel operators			
Administrative costs	0.0	0.0	367.5
Adjustment costs savings	29.6	72.1	324.0
Administrative costs savings	10.7	28.5	51.9
Software providers			
Adjustment costs savings	4.4	8.1	8.4
National authorities			
Adjustment costs	5.6	18.3	28.2
Administrative costs	34.9	75.3	104.3
Administrative cost savings	11.4	30.6	37.4
European Commission			
Adjustment costs	0.5	0.0	0.0
External costs savings			
Reduction in external costs of CO2 emissions		48.6	105.2
Reduction in external costs of air pollution emissions		-13.1	127.6
Reduction in external costs of noise emissions		36.6	36.6
Reduction in external costs of habitats		36.2	36.2
Reduction in external costs of congestion		86.8	86.8
Reduction in external costs of accidents		115.8	115.8
Total costs	41.0	93.6	499.9
Total benefits	56.1	450.4	930.0
Net benefits	15.1	356.7	430.1
Benefits to costs ratio	1.4	4.8	1.9

Source: elaboration on the contractor (2023)

When comparing the costs and benefits against each other, it becomes clear that Policy Option A is clearly less efficient whilst Policy Options B and C are close to each other.

SMEs

As discussed in Section 0, the European IWT sector consists largely of (i.e. for up to 90%) of SEMs. Whilst the collected data does not allow to filter out expected impacts for SMEs specifically, nor to split these according to the size of the economic operator, it becomes clear that most of the impacts that are expected will have to be borne by SMEs. This has been confirmed during the Workshops with representatives of the IWT sector and the various expert groups where particular concerns regarding impacts on SMEs were raised. This is especially the case for the measures where economic impacts on the private sector operators are expected (i.e. in terms of adjustment costs, investments, administrative burden, etc.). policy options A and B are estimated to result in net savings of EUR 40.24 million and EUR 100.59 million respectively in net present value over the period 2025-2050. On the other hand PO-C is expected to have a net benefit of only EUR 8.37 million in present value over the same period, stemming primarily from the comparatively large administrative costs linked with the electronic voyage reporting requirements. Software providers on the other hand have net cost savings in all policy options (EUR 4.38 million for PO-A, EUR 8.13 million for PO-B, and EUR 8.44 million for PO-C in present value for 2025-2050).

Competitiveness

For this study, competitiveness is understood to mainly refer to the position of the IWT sector vis-à-vis other modes of transport (i.e. sectoral competitiveness and, especially, the inter-modal aspect of this). The quantitative assessment shows that Policy Option B will bring modest improvements in the operational efficiency of inland waterway operations, including the efficiency of vessel operators. These efficiencies result mainly from the measures enabling to better plan operations and to reduce resubmissions as well as through better exchange of cargo information and with inland ports. Additionally, administrative cost savings come from measure streamlining the administrative procedures related to the use of a one-shop-platform for all exchanges and the exchanges with inland ports. Administrative costs savings are estimated at EUR 15.57 million in PO-B for vessel operators, expressed as present value over 2025-2050, relative to the baseline.

Conclusion

Policy Options B and C are much more effective and efficient than Policy Option A as well as more tailored to SME needs and to foster the competitiveness of the European IWT sector. Both options are rather close to each other in terms of expected effects they will bring about. The main differences between the two is that for certain topics, alternative solutions are chosen:

- Policy Option B introduces a complaint mechanism (in Member States) to ensure a higher degree of harmonisation for RIS, whilst Policy Option C introduces a new Performance Measurement Framework
- Policy Option B develops new standards and technical specifications for the exchange of information relating to IWT ports, whilst Policy Option C mandates new standards and technical specifications for the exchange of information relating to IWT ports
- Policy Option B specifies more clearly the cases for exchange of personal data, whilst Policy Option C develops templates and standards for the exchange of personal data
- Policy Option C requires electronic voyage plan reporting, whilst Policy Option B does not go that far
- Policy Option C obliges Member States to share all necessary data cross-border that are required for traffic management and transport management, whilst Policy Option B does not go that far

Comparing these differences against each other, it becomes clear that Policy Option C always includes more far-reaching and ambitious interventions which would also put significant more (administrative) burden on the European IWT sector. This is especially the case for making electronic voyage reporting mandatory. From the perspective of subsidiarity and proportionality and considering that the eventual impacts are roughly the same, Policy Option B has been selected as the preferred option in this study.

The preferred option

Overall, considering the assessment of effectiveness, efficiency, coherence, subsidiarity and proportionality of the four options (see chapter 7), the analysis points at PO-B as the preferred policy option, since it brings the best balance between the objectives which must be achieved, the degree of proportionality of the intervention, the costs and benefits incurred, as well as ease of implementation. PO-B is more effective in in addressing all specific objectives than PO-A, with slightly increased costs for national authorities. PO-B is less effective than PO-C, in particular with regard to environmental benefits, but with higher administrative costs both for vessel operators and national authorities. However, PO-B appears more politically feasible and easier to implement than PO-C as it does not involve important costs for vessel operators (in particular with regard to efforts spent in electronic voyage plan reporting).

Following the comparison outlined in the previous chapter, **Policy Option B should be considered as the preferred Policy Option**. Policy Option B is more effective in in addressing all specific objectives than Policy Option A, with slightly increased costs for national authorities. Policy Option B is less effective than Policy Option C, in particular with regard to environmental benefits, but with higher administrative costs both for vessel operators and national authorities.

Details on stakeholder views per measure are presented in the accompanying technical annexes.

Overview of impacts

The following tables provide an overview of the combined costs and benefits of the preferred option.

Table 31: Overview of costs – preferred option

	Difference to the Baseline
	PO-B
Vessel operators	
Administrative costs	0.0
National authorities	
Adjustment costs	18.3
Administrative costs	75.3
European Commission	
Adjustment costs	0.0
External costs savings	
Total costs	93.6

Source: elaboration of the contractor (2023)

Table 32: Overview of benefits (total for all provisions) – preferred option

	Difference to the Baseline
	PO-B
Vessel operators	
Adjustment costs savings	72.1
Administrative costs savings	28.5
Software providers	
Adjustment costs savings	8.1
National authorities	
Administrative cost savings	30.6
External costs savings	
Reduction in external costs of CO2 emissions	48.6
Reduction in external costs of air pollution emissions	-13.1
Reduction in external costs of noise emissions	36.6
Reduction in external costs of habitats	36.2
Reduction in external costs of congestion	86.8
Reduction in external costs of accidents	115.8
Total benefits	450.4

Source: elaboration of the contractor (2023)

Stakeholder views

Concerning the views from stakeholders, while they did not express specific views on the policy options, they did provide input through the consultation process on the draft policy measures. A small number of RIS experts expressed the view during the stakeholder process that the Directive was sufficiently broad, and that focus should be placed more on implementation and in the introduction of guidelines. The majority of stakeholders across all groups, though, envisaged the need for further adaptations in the Directive.

In terms of improving the monitoring and enforcement of the Directive, Member State authorities expressed more scepticism on the costs of the complaint mechanism than, vessel operators, who were more receptive, as this measure would allow them to signal problems to the authorities.

As a way to improve efficiency and safety of navigation, stakeholders across all categories were in favour of increased requirements to supply data to the ERDMS, as well as on the strengthening of the RIS requirements and adding new standards on data for navigation and voyage planning. Software providers in particular were in favour of measures that improve the quality of data.

On the other hand, electronic voyage reporting was considered as the most contentious measure as vessel operators consider it would introduce little benefits for them, highlighting that authorities should not be involved in voyage planning and that current requirements are enough, while Member State authorities saw benefits in terms of navigation planning and safety, vessel operators were less supportive, due to the expected overall burden this would impose on their operations.

There was also a general agreement across the board that the development of standards by CESNI would bring benefits in terms of timely development and introduction of standards. All stakeholders agreed that RIS COMEX provides an important basis (even though the current situation can still be improved according to some vessel operators and Member State authorities). Some stakeholders from across all the categories saw benefits in RIS COMEX becoming mandatory. In terms of interest from the side of the Member States, the most

important indication is the fact that they decided to continue and upgrade the project, being selected on 22 June 2023 for CEF funding for this purpose.

The Stakeholder consultation process showed that there is a general discussion in the IWT as to the potential role of RIS and its potential for development of business-to-business applications. Several stakeholders considered that there can be benefits in logistics and business applications if RIS is connected with applications with other modes. On the other hand, other stakeholders considered that there are significant differences in scope and objectives (information on movement of vessels vs information on movement of goods), and that these should not be mixed. This split of views was across the stakeholders and did not reflect any particular group. The links with eFTI in particular drew some discussions, with some Member State authorities considering though that it is important to become mandatory. On the other hand, some vessel operators were sceptical of such an approach, while others saw this as a potential opening for business-to-business applications on a voluntary basis.

Last but not least, there was a clear concern from the side of vessel operators (and in particular those representing SMEs) about the use of personal data (thought there did not appear to be a clear understanding of what would qualify as “personal data"). Some vessel operators went beyond the issue of personal data, expressing the view that they need to be in clear control of what information is shared, including business information. Member State authorities saw potential in exchanging personal data (in fact some of them have signed, but it became apparent that some clarity on the conditions under which exchange is possible is required, as some of them pointed to potential conflicts with national legislation.

Overall, and considering the input through the whole stakeholder consultation process, there appears to be an underlying element between stakeholders which has to do with the provision and reception of information and the associated costs. In particular, vessel operators, mindful of operation and business considerations, were generally in favour of measures that increase the flow and quality of information to them, thus providing with better awareness and options. On the other hand, they expressed the need of keeping control of the information they share and to limit the cost of providing this information. On the other side, Member State authorities were more in favour of exchange of information in particular for aspects like traffic planning, while being conscious of the costs of implementing measures (in particular the complaint mechanism).

REFIT

Under the BRG, the REFIT approach considers the regulatory fitness and performance of EU legislation. Regulatory fitness assesses whether the legislation is achieving its objectives effectively and efficiently. In addition, the One-in-One-out approach is a principle that requires new regulations to be offset by the removal of existing regulations that impose equivalent burdens on businesses or citizens.

In the case of the RIS Directive, the IA has identified one specific measure (#5, Require electronic voyage plan reporting) that is expected to increase administrative burden slightly. This means that the implementation of this measure would require the removal of an existing regulation that imposes an equivalent burden to ensure that the overall regulatory burden does not increase. It is important to note that the One-in-One-out approach does not necessarily mean that the measure will not be implemented. Instead, it means that the measure must be balanced by removing an existing regulation that imposes an equivalent burden, so that the overall regulatory burden does not increase. Thus, the implementation of measure #5 (Require electronic voyage plan reporting) as part of the preferred option would need to be balanced with the removal of an existing regulation that imposes an equivalent burden to ensure that the overall regulatory burden does not increase.

Subsidiarity

Subsidiarity is the principle that decisions should be taken at the lowest level possible, in order to ensure that they are made as close as possible to the people who are affected by them. This principle is enshrined in the EU treaties and reflected as such as a key element of analysis in the BRG. It is designed to ensure that EU actions are taken only when they are necessary and when they add value. In the case of the preferred policy option (Option B), no measures were identified that could *potentially* impact subsidiarity.

Monitoring and evaluation

The progress and outputs of policy elements must be monitored through relevant arrangements. As Policy Option B has been selected as the preferred one in Section 0, the monitoring and evaluation arrangements should focus on this option.

As specified as part of the evaluation of the RIS Directive; *no fixed common provisions for monitoring performance towards the achievement of the RIS Directive's objectives are currently in place.* Thus, having a common approach to the measurement and provision of data would allow for a more robust monitoring and assessment of the RIS Directive's effectiveness in the future.

As per the BRG[127], the IA should examine potential indicators and/or regulatory reporting requirements that will be required to monitor and evaluate the preferred option. Indeed, as part of the IA process, numerous measures were put forward that could support either the collection of information or monitoring requirements. This includes, for example, measures on the encouragement/ enforcement of RIS-information through eFTI mechanisms, new guidelines/ technical specifications/ reporting templates or the obligation for Member States to share all necessary data cross-border that are required for traffic management and transport management (not selected as it formed part only of Policy Option C which has not been selected as the preferred one).

[127] BRG Toolbox, pg. 356

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