Facilitators in IWT

Masterplan DIWA project, results activity 4 - Facilitators

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Executive summary

A successful digitalisation in Inland Waterway Transport (IWT) is facilitated by proactive standardisation, visionary rules and regulations, advanced cybersecurity and a high data quality.

Indeed, good (frameworks for) standards can facilitate a swift digitalisation, just as the lack thereof can be a serious impediment for digitalisation.
The same goes for rules and regulations as they can cause a significant hindrance for digital evolutions if written solely considering the paradigm of a skipper on a vessel carrying cargo and showing paper documents wherever needed. Even if most rules and regulations embrace the idea of digitalisation in all its aspects, a single 'analogue'-oriented rule or regulation can slow down or even block important evolutions.
Cybersecurity is essential for ensuring the safe and secure digitalization of inland waterway transport. By implementing appropriate cybersecurity measures, the sector can reap the benefits of digital technologies while minimizing the risks associated with cyber threats.
Last but not least, digital evolutions can only be successful if the received and provided data has sufficiently high quality and the necessary processes are implemented to safeguard this quality over time.

Four studies investigated the current state of play, possibilities and pitfalls for the future, and general ambition on these topics in light of the elaboration of a digitalisation masterplan for IWT in the period 2022 - 2032. A summary of these studies is included in this report, while more details can be found in the individual sub activity reports on Standardisation (SuAc 4.1), Rules and Regulations (SuAc 4.2), Cybersecurity (SuAc 4.3) and Data Quality (SuAc 4.4).

The main recommendations of the aforementioned studies are assessed, grouped into 5 overarching topics, and mapped on the general measures that were extracted from the other studies performed in the DIWA project. Where necessary new measures were added, or existing ones extended to ensure all recommendations concerning the facilitators were covered. The resulting measures are plotted on a 'road to the sun' (Figure 1), highlighting the time and roadmap component as a summarised output of this report.

As an overall conclusion, the main goal to reach in 10 years is a proactive stance of and a true, strong collaboration between the actors responsible for the different facilitators in IWT: standardisation, rules and regulations, cybersecurity, and data quality. If any of these facilitators fails to rise to the occasion this will seriously hamper, if not render impossible, the digitalisation goals in IWT for the upcoming decade.

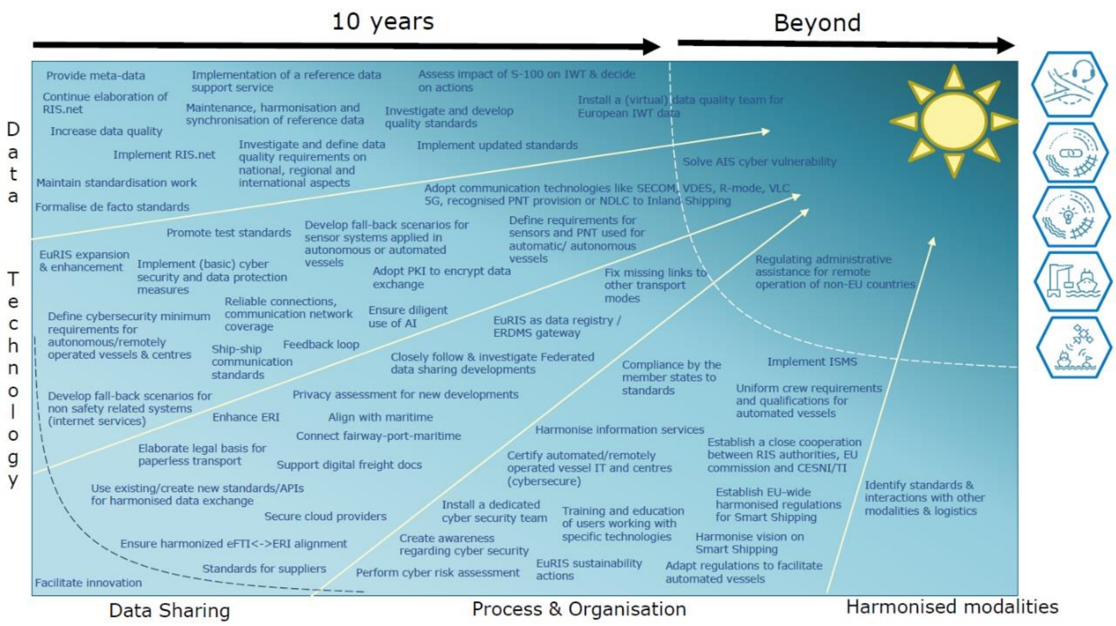

Figure 1: Assessment of main measures in the "road to the sun" approach. (larger version avaiblale at the end of the report)

1 Introduction

Inland Waterway Transport (IWT) is facing a digital evolution on many different levels. This report summarizes the results of the investigations made regarding four important facilitators for the modernisation and digitalisation of the IWT business processes and technologies:

- Standardisation
- Rules & regulations
- Cybersecurity
- Data quality

Indeed, good (frameworks for) standards can facilitate a swift digitalisation, just as the lack thereof can be a serious impediment for digitalisation.
The same goes for rules and regulations as they can cause a significant hindrance for digital evolutions if written solely considering the paradigm of a skipper on a vessel carrying cargo and showing paper documents wherever needed. Even if most rules and regulations embrace the idea of digitalisation in all its aspects, a single 'analogue'-oriented rule or regulation can slow down or even block important evolutions.
Cybersecurity is essential for ensuring the safe and secure digitalization of inland waterway transport. By implementing appropriate cybersecurity measures, the sector can reap the benefits of digital technologies while minimizing the risks associated with cyber threats.
Last but not least, digital evolutions can only be successful if the received and provided data has sufficiently high quality and the necessary processes are implemented to safeguard this quality over time.

2 Work approach

The four subjects under investigation in this report represent specific domains that each contribute to common goal of modernisation and digitalisation of IWT, but do so in a diverse way. At first sight, the coherence between the sub activities appears more limited.

However, despite the variation in subjects addressed in each sub activity, there is a clear common line in the work approach that was applied for the four sub activities. This implies that there was a shared methodology or process that was used for each sub activity, which helped to ensure consistency and cohesiveness in the overall project.

This is firstly due to the position of activity 4 within the overall DIWA Masterplan. As can be seen from Figure 2, activity 4 strongly builds on the output of activities in activity 2 (Business developments) and 3 (Technological developments). Activity 4 aims to provide valuable contributions on how to tackle important prerequisites arising from the future business and technological developments in IWT, thereby identifying important supportive measures to facilitate the overall digitalisation vision and roadmap for IWT in activity 5.
The interdependencies with other (sub)activities and the focus on providing clear answers on the issues identified in the prior activities is therefore a recurring element in each of the domains covered in activity 4, and a key step in the work approach was to carefully identify and collect all issues raised in activities 2 and 3.

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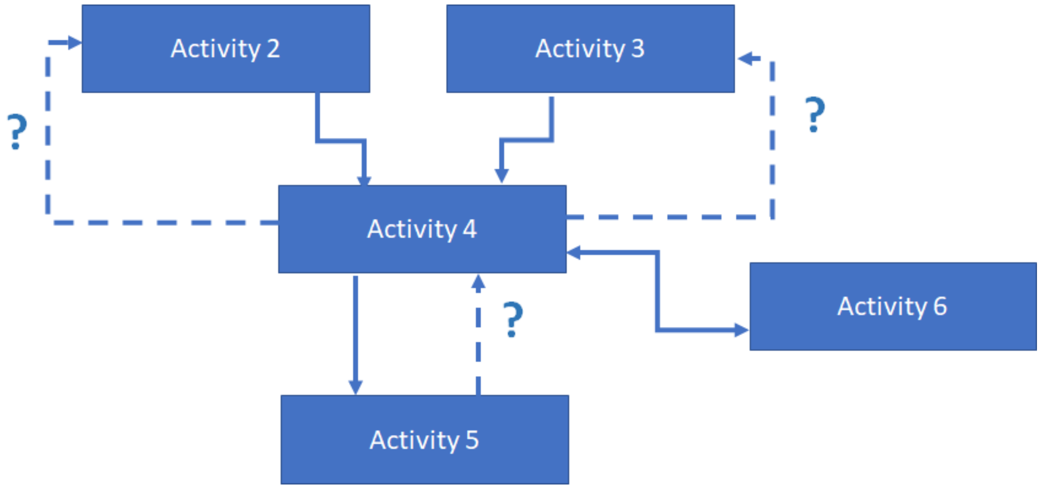

Figure 2: interdependencies of DIWA activities

Secondly each of the facilitators represents a particular independent field of knowledge where specialized expertise and a significant body of research, information, and other resources are available. The four facilitator sub activities therefore share an intensive phase of desk research, investigating the domain of the facilitator.

Thirdly, for each of the subjects it was important to combine business knowledge of IWT with functional knowledge in the domain of the facilitator. By combining both in a cross-functional team, it was possible to apply the general knowledge to the specific situation of Inland Waterway Transport and to address the challenges or opportunities that are specific to IWT.

Finally, each of the sub activities followed a similar approach by describing the current state of digitalisation in the respective domain, the foreseen future state in the next decade(s) and by identifying a set of recommendations and a roadmap making it possible to attain the foreseen future state.

3 Summary of the 4 Sub Activities of the Facilitator studies

This chapter bundles the executive summaries of the sub activity reports on the Facilitators. More details on the individual topics can be found in the specific sub activity reports (in annex).

3.1 Standardisation

SuAc 4.1 of the Masterplan DIWA project identifies existing standards (and standardization frameworks) in the Road, Rail, Maritime as well as Inland Waterway sector. It was not the aim to make a complete inventory of all used standards, furthermore standards usually make use of / refer to other standards. The SuAc members concluded that such inventory would not provide a lot of added value. Therefore SuAc 4.1 takes-up questions and recommendations from other DIWA SuAc and tries to further elaborate on standardization perspectives and developments. The status-quo is analysed, standardization needs are further elaborated on in the chapter 'future situation'.

The following topics were identified that could contribute to improve RIS technical services:

- RIS.net: a proper technical specification of the digital RIS Inland Waterway Network is required for enhanced services like route- and voyage planning. It is recommended to finalize the specifications of RIS.net to provide the waterway sections and objects of relevance for inland navigation in a harmonized way.
- Uniform identification of locations: even though Electronic Reporting and Services based upon the RIS Index use the ISRS Location Code, the locations in the ERI Location Tables do not always have the same identifier as the RIS Index. Therefore, a certain location may have two

different ISRS Location Codes depending on which code list is used to fetch the data. Harmonization/Merger of location codes is recommended.

- Maintenance procedures: reference data used in RIS technical services originate from different sources requiring different procedures for maintenance. It is highly recommended to start the task CESNI TI-21 (maintenance procedures) as soon as possible to analyse, specify and improve these procedures.
- Compliance with RIS technical standards: Common European Services contribute to proper implementation of RIS technical services as this is a pre-requisite for interconnection and seamless integration of information. It is recommended to make use of Common European Services for further improvement of standard conformity of national services.
- Exchange of data for traffic management: so far there is no technical RIS standard for exchange of data for lock and bridge management. It is recommended to further specify such a service. New developments such as "intention sharing in inland navigation" in the domain of traffic management should be analysed and the need for new standards identified.
- Object status Information: a modified DATEX II standard was implemented in RIS COMEX for operational status of bridges. It is recommended to further standardize this interface in order to safeguard harmonized implementation across the European waterways.
- Interfaces between different transport modes (road, rail, and inland waterway): to calculate an optimal route for cargo, for each transhipment location it must be known for which type of goods a transhipment location is suitable and which modalities are supported. It is recommended to consider and provide this within RIS.net.
- Waterway status information: so far there is no commonly agreed format/service for the exchange of data on the actual status of the waterways combining information from the waterway network, lock- and bridge operation times, Notices to Skippers as well as additional Object status Information. It is recommended to further investigate and specify such a Waterway status information service (as part of the RIS operational services[1]).
- Reduce amount of code lists required by legislation: efforts have been made to harmonize code lists on technical level, e.g., for types of means of transport, but due to the complexity and different requirements (e.g., goods reporting, statistics), creating an unambiguous conversion table has been difficult. In order to unburden the inland shipping entrepreneur as much as possible in the sense that he/she should not provide the same kind of data several times, it is recommended to:
    - reuse existing code lists as much as possible and to harmonize code lists in the revision of standards,
    - establish conversion tables and keep in mind that 95% is sufficient,
    - elaborate a list of duplicate code lists and ask the national representatives to address this in the respective committees, e.g., IMDG.
- The European rail sector is going to develop a new single platform named 'DP-Rail' for (standardised) data exchange between all involved parties in a rail transport. Some services will be valuable for multimodal transport. IWT should (further) investigate what is the best way to exchange data with this data hub for seamless multimodal (or synchromodal) transport.
- Paper-based procedures: research on legal restrictions to use digital documents showed that there are several restrictions, mainly related to supervision and enforcement by the government. It is recommended to investigate digitization of procedures on an EU-wide basis in a transformation from paper to digitally available information for routines required by authorities (e.g. inspections). eFTI is an initiative of the European Commission to promote it to businesses and enforce it to authorities.
- At the time of writing, the European Commission decided to exclude all national legislation concerning ERI from eFTI, effectively ensuring that ERI does not fall under the scope of eFTI. This avoids a conflict between ERI and eFTI, as the eFTI Regulation states that all electronic reporting must use certified eFTI platforms, which is not possible for the RIS Technical Service Electronic Reporting. It is, however, foreseen that the revision of the RIS Directive will contain the obligation extract all (eFTI relevant) info in the ERI messages from a certified eFTI platform

[1] A RIS Operational Service (also referred to as 'RIS Services' before the 2019 PIANC RIS Guidelines) is an operational service that provides and uses information. See https://www.pianc.org/publications/inland-navigation-commission/wg125-1

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when creating an ERI message. As a consequence, this activity still recommends to keep a close eye on eFTI.
- Test standards: ensure high quality and correct standard conform implementation of products. It is recommended to develop test standards for products and services that are implemented by multiple parties to support uniform and harmonised implementation of services.
- Standard APIs of Common European Information Platforms such as EuRIS: The CEF funded project RIS COMEX introduced a Common European Information Platform for inland waterway transport, which is jointly governed and operated by fairway authorities and waterway managers of several EU Member States and non-EU countries. EuRIS makes extensive use of APIs for exchanging data on waterway infrastructure and traffic information. It is recommended to make the API specifications openly available, and to identify the APIs that could be subject for a broader standardisation. Furthermore, it is recommended to include the EuRIS APIs into the interface architecture of the emerging Common European Mobility Data Space, an initiative of the European Commission. Standard inland navigation APIs will facilitate the interconnectivity and interoperability with other information systems, e.g. Port Community Systems.
- CESNI and its permanent working group CESNI/TI operate under a formal mandate to standardise and harmonise developments in the field of information technology in European inland navigation. It is recommended to strengthen the cooperation with CESNI/TI and for the CESNI Member States to actively engage in the design and development of the CESNI/TI work programme.

Standards in the road sector (ITS)

The road sector has more than 200 standards for different services and applications, such as electronic fee collection, eCall, public transport, automatic vehicle and equipment identification, cooperative intelligent transport systems, traffic and travel information, and data exchange specifications for traffic management and information (DATEX). Cooperative intelligent transport systems consist of several standards, including those for contextual speeds, ITS station facilities for the transfer of information between ITS stations, and communication profiles for secure connections between trusted devices. DATEX II is a standard used for the exchange of traffic information and traffic data in Europe, and it can be considered the "RIS standards for the road." DATEX II has several parts covering different aspects of traffic management, and its exchange protocols are specified separately from the content specifications, allowing flexible use of the content specifications with any defined exchange protocols. There are elements which could be applied to IWT relatively easy, particularly for movable bridge status data (which has already been done in the Netherlands).

Standards in maritime sector (e-Navigation)

There is a long tradition of adopting standards from the maritime world for inland purposes (e.g. AIS, ENC) and certainly in mixed traffic areas it is important that both maritime and inland vessels use mutually comprehensible communication and data exchange via compatible standards.

The most significant development in maritime in the area of standards in the upcoming years is the introduction of the S-100 framework of standards. S-100 covers various products related to hydrography, navigation, and marine traffic management.

While the Masterplan DIWA project has identified S-100 as a topic of interest, an in-depth impact analysis of its various components on the IWT and/or RIS standards is not feasible within the project's timeframe. Therefore, it is recommended that impact analysis within relevant CESNI working groups continues, with special attention given to additional/new topics like S-421 Route Plan, SECure COmmunication (SECOM), and Maritime Autonomous Surface Ships (MASS). These topics are important to investigate as they could potentially have an impact on the development of RIS services and their cyber resilience.

Standards in the rail sector (ERTMS)

The ERI messages and the HERmes 30 message have some similarities in the general data and also some differences in the more specific information. Although both transport modes still can have their own messages, the incorporation of certain entries can also be useful in IWT.

Like the recent development of a central information platform in IWT, the rail sector as well decided to centralise the provision of relevant information about train composition and train (including waggon) movements. The new platform (DP-Rail) will use already established messages for gathering data. The more centralised approach of data provision will make it easier for IWT to exchange data in case of multimodal freight transport.

In the rail sector, the UIC has defined a V-cycle approach in order to follow a structured pathway for the development of new standards and specifications. This approach includes all relevant stakeholder and has a clearly defined sequence of processes. The Inland navigation sector could review its own approach of standardisation and try to learn from rail if optimisation is needed.

Standards in the RIS area

The European Committee for drawing-up standards in the field of Inland Navigation (CESNI) was set-up in order to adopt technical standards in various fields, in particular regarding vessels, crew and information technology. The respective regulations at the European and international level, including those of the European Union and the Central Commission for the Navigation of the Rhine (CCNR), may refer to these standards with a view to their application.

The RIS technical services are published by CESNI in ES-RIS (European Standard River Information Services). In 2019, four temporary working groups have been set-up to further develop the RIS technical services. The first edition of ES-RIS, ES-RIS 2021/1, was adopted by CESNI in April 2021. Meanwhile a second edition of ES-RIS (edition 2023/1) has been adopted and published by CESNI.

ES-TRIN (European Standard laying down Technical Requirements for Inland Navigation vessels) and ES-RIS are revised and published every two years.

An amendment of the RIS Directive is needed in order to refer to ES-RIS.

RIS Index:

The RIS Directive requires Member States to provide all relevant data concerning navigation and voyage planning on inland waterways to RIS users in an accessible electronic format. However, the electronic format is not further specified in a commission implementing regulation. The RIS Index was established as a first harmonized reference dataset for Notices to Skippers (NtS) over 20 years ago to refer to objects on waterways in NtS messages. The RIS Index makes use of the ISRS Location Code to identify objects, but there was no common agreement on the maintenance procedures for the ISRS Location Code, resulting in objects not being referred to with the same ID in different services and applications. The ISRS Location Codes are also maintained for electronic reporting in the ERI Location Tables, but these codes are not always in line with the ISRS Location Code assigned to a specific object in the RIS Index. It is strongly recommended to complete the merger of the ERI Location Codes with the RIS Index Location Codes to have a single code list with unique identifiers for specific objects. There are three types of locations to draw special attention to:

- Locations outside the area of competence of RIS authorities but within the RIS area (e.g. private ports)
- Locations outside of the RIS area (e.g. Oslo)
- Locations used and maintained by logistics (e.g. private terminals)

It is recommended to have a pragmatic approach first and a sustainable solution second. The need for further technical specifications and improvement was expressed by involved stakeholders, therefore CESNI defined task TI-15 to prepare technical specifications for data for navigation and voyage planning.

VisuRIS COMEX Reference Network Model

In the CoRISMa project first attempts were made to create a European Nautical Network Data Services (NNDS) based on the RIS Index. However, this network was derived from individual RIS Index points and did not provide parameters of specific links (Fairway sections) between objects. When EuRIS was implemented, the VisuRIS COMEX Reference Network Model was developed to provide all relevant objects with required attributes and their relations, including the parameters of the physical links. The VisuRIS COMEX Reference Network Model is a EuRIS application specific implementation and a general specification for future standardization is required and provided by the RIS.net concept.

RIS.net

The RIS Index lists objects of relevance for Inland Navigation, and the VisuRIS COMEX Reference Network Model was developed to add specifications for fairway links. The RIS.net concept combines

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information from the RIS Index and the VisuRIS COMEX Reference Network Model, adding also capabilities for services not yet included in EuRIS. The concept needs technical validation and defined maintenance procedures. The RIS.net concept needs to be implemented in a living lab environment to detect and fix issues and inconsistencies before standardization, and the RIS Index will be supported through legacy support. A new generic RIS_ID is included in the RIS.net concept to address issues with the ISRS Location Code as the primary ID of locations. The RIS.net concept is expected to be finalized in 2023, with a demonstrator to prove the concept by using selected test data sets. The rolling-out of the RIS.net concept could start in 2025, with national reference data to support the implementation. All steps could be carried out in a European project; thus, it is recommended to allocate sufficient funds in a European project for these tasks.

<u>New messages for voyage information</u>
The ERIINFO message shall be sent out by Vessel Traffic Management systems automatically or by an operator under special circumstances to inform the skipper that an update of the voyage plan (ERIVOY) is requested.
The Object Access message will be sent to the respective skippers to inform whether their vessels will be included in an upcoming locking cycle and where to position their vessel in the lock basin.
The Requested Time of Arrival (RTA) message provides the vessel with a preliminary lock cycle plan or bridge passage plan to give information needed to optimize their approach to an object, including RTA.

<u>Object status information:</u>
In the Netherlands a large number of bridges were equipped with sensors that transmit their operational status to the national access point for road data using the DATEX II standard.

The modified DATEX II standard was implemented in RIS COMEX for the provision of object status data both towards EuRIS and from EuRIS to third parties. The lock status data structure includes lock status, lock planning, and obstructions. These specifications are being used by Rijkswaterstaat (NL), VNF (FR), viadonau (AT), and Státní plavební správa (CZ) for providing object status data.
Expanding DATEX II with fairway specific elements like lock status was deemed not prudent since it would be an overkill for the IWT domain to use the entire DATEX II standard which contains many for IWT irrelevant items and it would be inefficient for the road domain to have to take IWT into account for a comparatively small part of the standard.
It would be advisable however to integrate the preliminary standard used in the COMEX project in the RIS technical services to safeguard harmonized implementation across the European waterways.

<u>Inventory of paper-based procedures</u>
The Dutch Ministry of Infrastructure conducted research on the legal and information needs of transport for all modalities, including inland water transport, resulting in a list of 170 information needs by different governmental organizations. The research aimed to determine whether there are legal restrictions to digitize documents, and it was found that there are a number of restrictions in legislation, mainly related to supervision and enforcement by the government. The upcoming eFTI regulation is an opportunity to support further digitalization, but it's not clear which information needs will be affected. Laws and regulations, procedures, organizational and supporting systems need to be adapted to support digital transformation. The Masterplan DIWA project aims to work towards paperless transport, but the digitalization of individual documents for transport needs further investigation on an EU-wide basis.

<u>eFTI</u>
In a broader sense, eFTI (electronic Freight Transport Information) is a set of data elements processed electronically for the purpose of exchanging regulatory information amongst economic operators (mainly companies involved in freight transport and logistics) and between operators and competent authorities. The eFTI approach enforces standardization and harmonization through an EU regulation, and it establishes a legal framework for road, rail, maritime, inland navigation, and air transport operators to share information with enforcement authorities in an electronic format. eFTI can bring data models for different transport modes together towards synchromodality, as it enables standard information interfaces. The eFTI data model (which is still under construction) is based mainly on the UN/CEFACT Multi-Modal Transport Reference Data Model. For inland navigation it is envisioned that eFTI and ERI will be partly overlapping. The development of a (partial) conversion service from ERI

information to eFTI information (and vice-versa) may be possible to support the transition/migration, although there are legal consequences which should be investigated. IWT has an advantageous position regarding the introduction of eFTI and could gain a competitive advantage via swift implementation. DIWA Ac 5 and any other follow-up projects should take further developments of eFTI into account.

Test Standards:
Test standards ensure the correct implementation of required functions, interoperability between different manufacturers, and a high level of quality of the product. They provide commonly agreed test procedures and are the basis for certification and type approval. The European committee for drawing up standards in the field of inland navigation (CESNI) has defined test standards for various equipment used in inland navigation, such as vessel tracking and tracing systems and electronic chart display and information systems, among others. It is recommended to develop test standards for international standards that have to be used by multiple parties in inland navigation to support a uniform and harmonised implementation of the appropriate technical services.

Harmonization of code lists:
Enumerations and code lists in standards are required to ensure clear and accurate interpretation of content. Code lists also help to reduce the size of data exchanges. Different IWT (Inland Waterway Transport) related standards have established various code lists based on their requirements, for example for types of means of transport or goods items. There are different requirements towards vessel types or goods items for statistics, cargo- and voyage reporting or vessel certification. Also, there are different categories of reference data, each with their own maintenance procedures. Efforts have been made to harmonize code lists, but due to the complexity and overlapping definitions, creating an unambiguous conversion table has been difficult, not only from a technical perspective, but also from an organisational point of view. It is recommended to reuse existing code lists and harmonize code lists in the revision of standards.

Connecting nodes between different modes:
The need for standard interfaces between different transport modes (road, rail, and inland waterway) is emphasized in the SuAc 2.2 report. To calculate an optimal route for cargo, there should be a link between locations, at least multimodal inland terminals in first step. To achieve this, a cross reference between different location code lists used by different transport modes is necessary, with standardized attributes for efficient and sustainable itinerary based on real-time information. This was investigated by Subgroup 1 of DTLF and could be important for the implementation of eFTI in a multimodal or synchromodal environment. Faulty or missing data on transhipment points should be reported by logistic service providers through a tool provided in RIS.

Compliance with the RIS technical standards
The RIS Directive and Commission Implementing Regulations aim to harmonize the implementation of RIS technical services across Europe. However, monitoring compliance with legal provisions has been difficult due to implementation on national level without interfaces. In addition, standards were not always unambiguous and left room for interpretation of the requirements. The EuRIS Portal, developed in the RIS COMEX project, revealed deficits in interconnecting and integrating national data sources into a common European service. Common European Services are necessary for proper implementation of RIS technical services and to put pressure on authorities to improve data and services by making visible faulty and missing information.

Waterway status information
In order to have an overall waterway status information, data from various sources needs to be combined to support voyage planning and overall infrastructure management. The digital inland waterway network serves as a baseline, with operating times and limitations for objects or sections, such as locks, published via NtS. Live status information can be fed into the system from local data sources, such as lock management systems. Sounding results can also complement the data available for specific sections, with a bottleneck service established on the Danube corridor to provide this information. To provide actual status information, data is aggregated from various sources, and a standardized interface is needed to exchange processed data.

Conclusions

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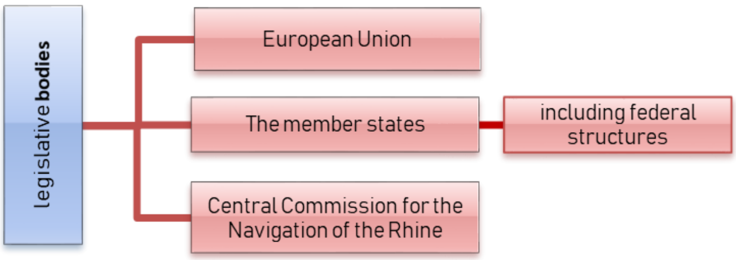
Overall, it can be concluded that in the field of standardization, works on the reference data and interfaces are required, both within the IWT/RIS domain, but also towards other modes of transport, to support multi-/synchro modality. In a fully connected, digitised world, processes and routines have to be re-thought to leave stamped paper documents behind. Legislation needs to regulate that the required information shall be accessible online to enforcement and inspection authorities.

3.2 Rules and Regulations

In the Sub Activity Rules & Regulation, an inventory of existing laws within the EU in the area of IWT was carried out and the new technologies or business models were checked for their compatibility with the existing rules.

A deliberate attempt was made to limit the work to technical and legal expertise and to distance itself from political will. Therefore, all proposals are either based on existing foundations or are inherent to the system.

3.2.1 Inventory – summary



Essentially, laws in IWT in the EU are created by the institutions listed above. Because DIWA is an international project within the EU, the following considerations are limited to the legal landscape of the EU. Moreover, a consideration of national laws would go beyond the scope and offer little added value.

At the EU level, the following topics are legally regulated in the IWT area:

eFTI regulation
Rules for promoting inland waterway transport in the EU
Qualifications of crew members
Inland transport of dangerous goods
Inland navigation: access to the market
Inland Waterways — Vessels
Inland waterways — river information services (RIS)
EU statistics of goods transport by inland waterways

In addition, there are also general rules at the EU level that are relevant for IWT:

- GDPR
- Open data directive

Looking at the overview above, it is noticeable that many areas are not regulated at the European level. For example:

- Traffic regulation

- Liability
- Crew requirements for vessels
- Smart shipping

There are also many different regulations for the exchange of data such as eFTI or RIS. In this respect, the legal structure is very confusing for the user.

3.2.2 Smart Shipping: recommendation

To enable Smart Shipping, existing rules have to be partially adapted and new rules have to be created. In order to understand the recommendations, the terminology is first explained in order to avoid misunderstandings. The following terms are used.

Assistance systems are systems that in some way facilitate or partially take over the work of the skipper. This includes, for example, the tracking pilot. Assistance systems are already in use today. They rarely cause legal problems as long as they are not intended to establish privileges. Therefore, they are only mentioned when they are expected to cause legal implications.

Remote operation allows the skipper to navigate the vessel by remote control. Accordingly, basically "only" the skipper's workplace is decoupled from the vessel.

Platooning involves a convoy. However, the convoy is not physically connected. Rather, one ship sails ahead and the ships behind automatically steer to the positions of the first ship. In contrast to a physically connected convoy, all ships are motorized.

In **autonomous sailing**, the ship can drive and move without human intervention. Human intervention is only required in case of malfunctions or similar.

Smart Shipping is a generic term and covers all the concepts above.

In the area of smart shipping, the legislature will not be able to avoid the decision to either introduce new rules to enable it or to counter smart shipping. In the overview below, it can be seen which areas would need to be changed for which smart shipping technology.

Adaptation or supplementation of the existing legal situation necessary?				
Topic	**autonomous shipping**	**platooning**	**remote control**	**assistance systems**
Technical requirements ship	yes	?	yes	partial
Crew requirements	yes	yes	yes	partial
Liability	yes	yes	yes	no
Qualification of crew	no	yes	yes	no
Traffic rules	?	yes	no	no
Police actions	yes	yes	yes	no
Responsibility	yes	yes	yes	no
Documents	yes	yes	yes	no

From the listed overview, the scope of the legislative challenge is presented. If the legislature is committed to enabling smart shipping, which is exclusively a political decision, then the following recommendations are proposed:

- General framework conditions must be established in a timely manner that are binding for smart shipping entities. No false incentives should be created here. Criteria for testing new technologies must also be created. These must illuminate the critical points of a technology.

- If a technology fulfils the legal requirements, entities in smart shipping should have a clear perspective, Therefore, a clear procedure must be created, e.g., test phase, evaluation and final technical approval.

- New technologies are developing rapidly. Legislators should find a way to address these as quickly as possible. The new technologies will always represent a potential on the one hand and a possible security risk on the other. Therefore, the legislator will predictably and regularly be confronted with a certain degree of uncertainty. General procedural structures should be developed to speed up the process. International cooperation should also be regulated to enable cross-border testing.

- Because inland navigation very often takes place across borders, the member states should at least agree on certain definitions in order to ensure easily comprehensible rules for shipping.

3.2.3 Privacy of employees

Ships are increasingly monitored with sensors. As a result, a vessel's employees are also monitored or can be monitored. The legislator is called upon to enable sufficient monitoring of vessels. However, the legislator must also intervene if employees are monitored to an inadmissible extent.

3.2.4 Documents in IWT

In IWT, the skipper must carry many documents on the vessel. The legislator is challenged to decide whether an online platform can be created on which the documents can be deposited and thus made available to the competent authorities. In this way, police checks could be made easier and more efficient. In addition, smart shipping technologies will increasingly be used to separate the skipper from the ship or to physically separate the skipper from the ship. However, this development is not legally mandatory. The decision is purely political.

3.3 Cybersecurity

3.3.1 Introduction

The transport and logistics sector depends more and more on information for the day-to-day running of business. Information systems are a fundamental part of transport and logistics, and therefore also the inherent cybersecurity threats.

The current study provides a **cyber risk and vulnerability assessment** based on the business developments and technological developments as specified in activities 2 and 3, taking into account the requirements of the NIS(2) and GDPR directives. The study defines the effects on the digital transition in the period 2022-2032.
It is the objective to provide **advice on measures for prevention, detection, and reaction** to secure the information and measures to be taken to avoid or limit the consequences of cyberattacks on the processes in the transport and logistic chain.

The information and knowledge required for this study was primarily gathered through an extensive desk research and through collection of the input from other DIWA Sub-Activities. Subsequently, a stepwise approach was used to establish an inventory of cyber risks in IWT and to define recommendations and a roadmap on how to address those risks.

The study concludes that the negative side effect of digitalisation is an increased probability and impact of cyber incidents and hence it is important that **organisations need to be prepared to address cyber risks**. Also, there are vulnerabilities in certain systems, such as AIS that relies on VHF radio transmissions which can easily be falsified. However, **there are some measures that can be taken** to improve the cybersecurity of these IWT systems. Finally, although there is clearly a growing awareness of cyber risks and their potential business impact, it is key to **keep awareness at a high level and**

organisations must continuously adapt their security measures to evolving cyber threats and vulnerabilities.

This study was conducted over a period of 10 months from May 2022 to March 2023. Five fairway authorities participated in the project: via donau (Austria), De Vlaamse Waterweg (Belgium), Voies navigables de France (France), Bundesministerium für Verkehr und digitale Infrastruktur (Germany) and Rijkswaterstaat (The Netherlands).

3.3.2 Frameworks for cybersecurity

There is an extensive body of existing standards, guidelines, and studies available regarding cybersecurity in general, but also more specifically on cybersecurity in the maritime sector. A lot of this well documented knowledge is also largely applicable within IWT. These frameworks provide a structured approach to identifying, assessing, and mitigating cyber risks. They can help the IWT sector develop and implement a comprehensive cybersecurity strategy.

The main standards and regulations that provide guidance in this matter are:

- the EU cybersecurity strategy, a comprehensive cybersecurity strategy that aims to improve the protection of citizens, businesses, and critical infrastructure from cyber threats.
- the NIS (Network and Information Systems) Directive, a EU legislation that aims to improve the security of network and information systems across the EU for operators of essential services and for digital service providers.
- the Cyber Resilience Act, a proposed EU legislation which will implement minimum requirements regarding cybersecurity on all devices sold in the EU.

There are multiple organisations that play a key role in the definition and implementation of the frameworks aimed at improving cybersecurity at the national and international level.

Finally, there are several frameworks and guidelines related to risk management, business continuity management, and information security management that provide organisations with a comprehensive approach to managing their cybersecurity and allow them to assess, control and monitor the effectiveness of their security controls:

- Risk management frameworks provide a structured approach to identifying, assessing, and mitigating cyber risks. They can help organisations to understand the threats they face and the measures they need to take to protect themselves.
- Business continuity management (BCM) frameworks provide a structured approach to planning, preparing, responding, and recovering from disruptive incidents, including cyber incidents.
- Information security management (ISM) frameworks provide a comprehensive approach for protecting information assets and include guidelines for incident management, access controls, cryptography, and physical security.

3.3.3 Generic measures for cybersecurity

Cyber resilience is the ability of organisations to protect themselves against cyberattacks and to recover from them (quickly) in the event of an attack, thus resuming normal business operations.

Organisations can achieve or improve their cyber resilience by

- Identifying vulnerabilities and risks
- Protecting the infrastructure, systems, applications, data, etc.
- Detecting cyber threats and attacks
- Responding to cyberattacks
- Recovering from cyberattacks

The security measures organisations can put in place consist of administrative, technical, and physical controls. Often a simultaneous application of several security measures is applied in what is called a layered defence approach.

3.3.4 Cyber risks in IWT

Identification of Cyber Risks in IWT was mainly realised through reports and through the input of other DIWA activities.

Summarised conclusions from other DIWA sub activities show:

- Cybersecurity is valued as a very important element of digitalisation, but few specific cybersecurity risks are recognised. This limited and mainly technical coverage of cybersecurity is cause for concern.
- It is recommended to raise awareness of the broader scope (beyond purely technical) of cybersecurity and provide actionable advice to reduce cyber vulnerability of IWT across this broader scope.
- Fairway authority mandate might need to be extended beyond the technical equipment requirements of a vessel to the cyber resilience of the vessel and the vessel operator.

It is noted that within the RIS COMEX project a lot of work was done by privacy related and legal experts to draft the core arrangements 1 and 2 (CA1 and CA2) regulating the information exchange between COMEX Partners and the users.
Also, in order to mitigate several cyber risks within EuRIS a lot of actions were taken including the use of scanning functionality (i.e., functionality that scans for the application of recommendations from different security related standards), a high-performance firewall to improve network security, components with a high availability (SLA 99.9% or higher), a modern anti-malware and a best practice central authentication platform.

The cyber risks within IWT that were identified can be grouped in 4 categories (Vessel related risks, infrastructure related risks, information/data platform related risks and RIS technology related) where the key risks are:

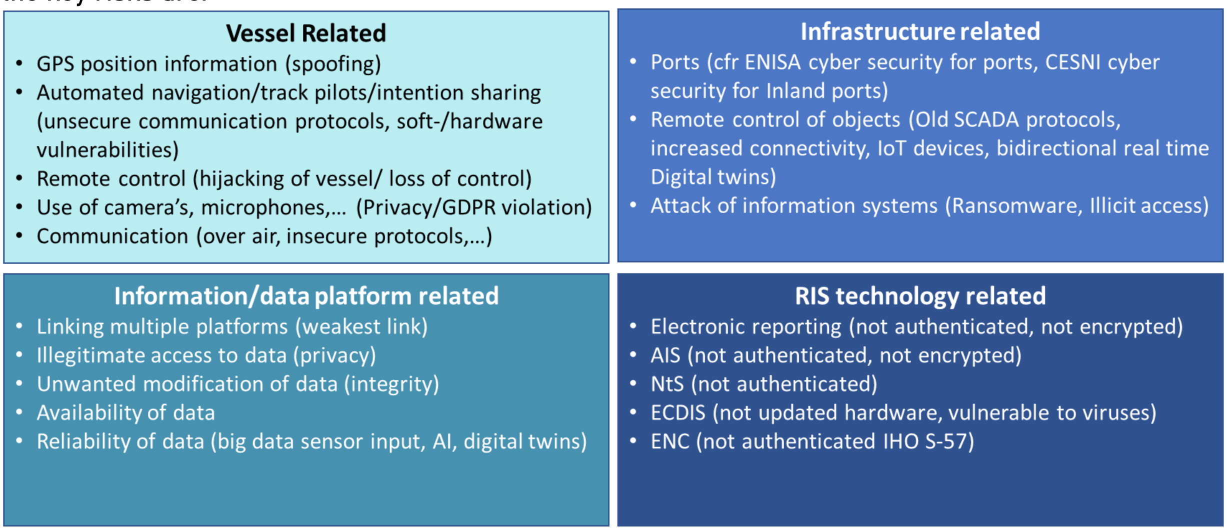


Figure 3: Cyber risks in IWT

3.3.5 Countermeasures & Recommendations

By applying the known frameworks for cybersecurity and generic measures for cyber resilience on the specific cyber risks in IWT, a set of countermeasures and recommendations is identified. For the in depth discussion of the conclusions, we refer to the recommendations that provide specific and actionable steps that can be taken to address the issues outlined in the study. They are the tangible outcome of the analysis and research conducted, and serve as a guide for future decision making and implementation.
However, in order to highlight the key findings of this study, the main conclusions for this report can be summarised as follows:

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- As digitalisation and the use of more connected systems increase, the surface of attack for cybersecurity risks also increases. On top of that, as the reliance on digital solutions to actively intervene in the system (e.g., in smart shipping) increases, the probability and potential impact of cyber incidents also increases. Hence it is increasingly important that **organisations need to be prepared to address cyber risks**.

- It is noted that IWT is not currently the most cyber resilient transport mode, through vulnerabilities in certain systems, such as AIS. While AIS has been implemented as a safety measure to improve vessel navigation and reduce the risk of collisions, it relies heavily on VHF radio transmissions which are prone to spoofing, which is the act of transmitting false AIS data to deceive other vessels or systems. However, **there are some measures that can be taken** to improve the cybersecurity of these IWT systems.

- Developments such as initiatives by organisations like PIANC and CESNI demonstrate a growing awareness of cybersecurity risks in the transport industry. This is a positive development, but efforts should continue to be made to keep **awareness** at a high level, as it is difficult to maintain this level of awareness over time. Also, cybersecurity is not a goal that can be achieved, but rather an ongoing process. Cyber threats and vulnerabilities are constantly evolving, and **organisations must continuously adapt** their security measures to keep pace.

3.3.6 Roadmap

In a last step, all recommendations were categorised using a high-level assessment of legal, technical, financial, and organisational impact and assigned to a basic, intermediate or advanced scenario. They are grouped according to the risk categories defined above (+ one category covering the common and organisational recommendations) and represented in the roadmap below (Figure 4).

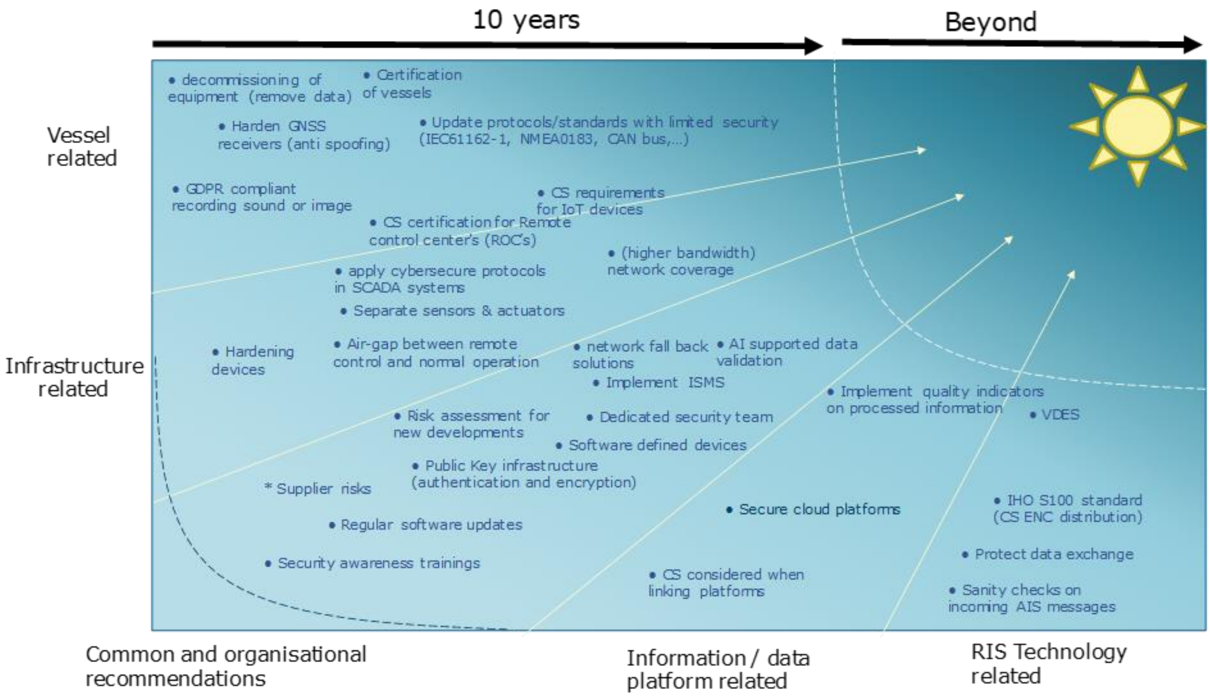

Figure 4: Roadmap for cybersecurity

3.4 Data Quality

Sub-Activity 4.4 of the Masterplan DIWA project identifies existing frameworks, tries to link data quality to existing standards, projects and guidelines and provides pre-conditions and requirements on data quality management related to IWT services, systems, information, and data.

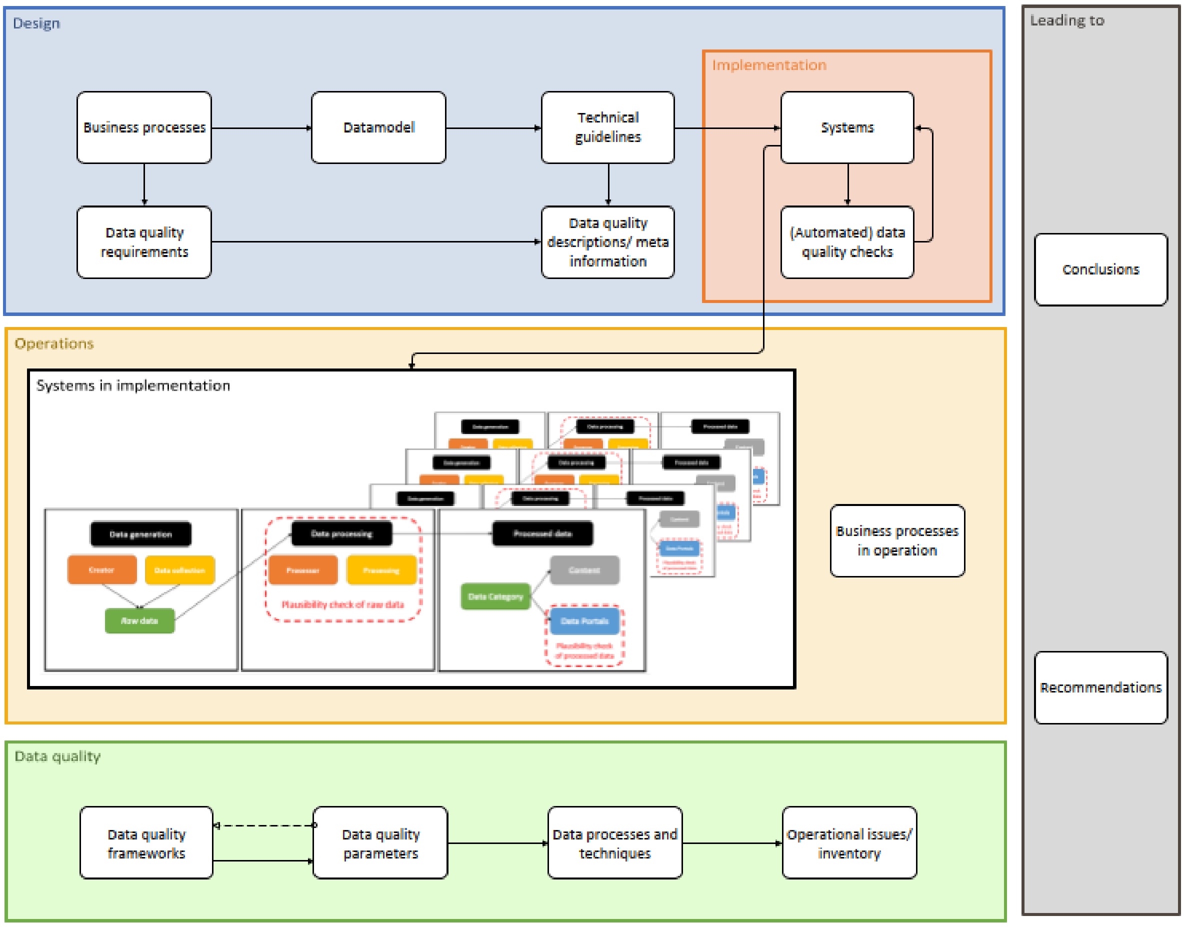

Figure 5 Reading guide for the Data Quality report.

3.4.1 Definitions

There is a very thin line between 'data' and 'information'. While 'data' is defined as facts/figures without any meaning, 'information' is giving meaning to the data so it can be interpreted by e.g., humans.

Data quality is the extent to which data is suitable for the purpose for which it is used. Therefore, data should pursue all or some of the data quality parameters. Data quality will have an impact on the level of quality of services.

Data quality management is about checking whether data is correct, complete, and compatible with data provided by other systems while information quality is described as the quality of the information that is produced by systems and therefore the quality of the content of information systems.

Information management is the process of acquiring, organising, storing, and using information. The goal is to provide the right information based on high quality data. People and systems cannot make effective business decisions with faulty, incomplete, or misleading information because it is based on incorrect data.

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3.4.2 Data source types and processing concepts

Data generation summarises the generation of new raw data generated by a creator. Data collection describes the tools used to generate the raw data.
The newly generated raw data is then processed in a further step. Here the term processor refers to the organisation that processes the data. Data processing refers to the tools or software used to process the data. During the processing of the raw data, an initial check or plausibility check of the data can take place.

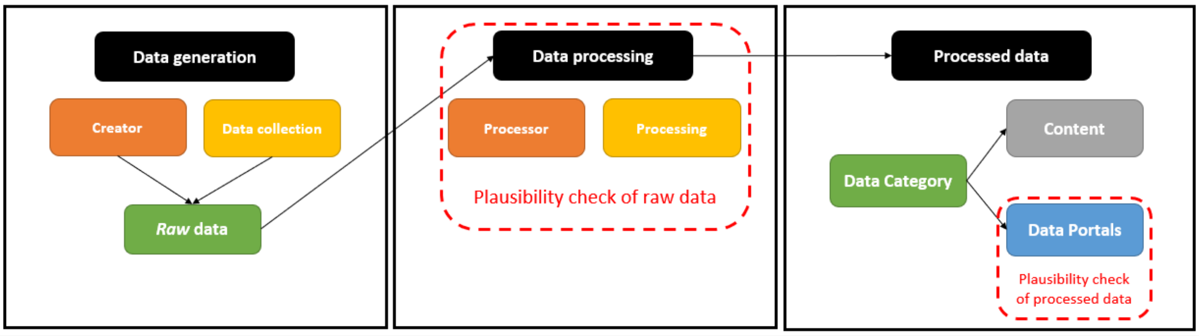

Figure 6 From Data generation towards processed data

The data source is usually included in the metadata of the data and can be found there. Metadata contains important information about the data itself. It plays a vital role in data quality, as it can be used to pass on information about various quality parameters to the data user.

3.4.3 Quality parameters

There are several parameters (or dimensions) to describe the level of quality of data. A subset of these parameters was identified and defined by Accuracy, Completeness, Consistency, Currency, Timeliness, Uniqueness and Validity. This list is not exhaustive.

3.4.4 Quality frameworks

Describing the quality of data with these parameters is a first indication but how are you going to interpret the values? A data quality framework is a tool that you can use to not only measure the data quality within your organisation but also to define data quality goals and standards as well as the activities that must be taken to meet those goals.

All examined frameworks have their own way of dealing with parameters and processes. After comparing the different frameworks on the used parameters with the selected set, two frameworks were identified:

- **Cost-effect Of Low Data Quality**: In this framework, the following parameters were consistent with those selected for IWT: accuracy, completeness, consistency, currency, timeliness.
- **A Data Quality Practical Approach**: The data quality parameters that occur in this data quality framework are: accuracy, completeness, consistency, currency, timeliness, uniqueness. Only validity is missing this framework.

3.4.5 Desk research

New techniques and data processes which could support the monitoring of data quality were examined through desk research.

1. Aggregation and anonymization:
   Aggregation and anonymization do not lead directly to increasing data quality but is closer linked to privacy instead. There is a trade-off between the protection of privacy and not losing too much information when anonymizing (or aggregating) the dataset. In case of poor quality, back tracing to the root cause is even more difficult than with pure data.

2. Management of big data:
   Overlooking errors within the data is much easier when working with big data. It is no longer possible to check data by hand, so you need to have the metadata of a dataset.

3. Process mining:
   Process mining can support in the improving of the quality of data by detecting flaws and outliers in the data. On the other hand, the principle "Garbage in, garbage out" is also applicable to process mining and can lead to misleading decisions.

4. Artificial intelligence:
   AI can be used to monitor and correct data in a reliable way, but a machine learning algorithm that uses irrelevant or faulty data as input, will not be able to solve tasks that become more and more complex. Therefore, it is critical to pre-process datasets before using them to train a machine learning model.

5. Semantic modelling[2]:
   Especially when data has to be shared amongst different transport modes (road, rail, inland waterways, maritime transport, air, hyperloop, ...) it is difficult to establish dedicated syntactical mappings from one format to another. It is there that semantics can be of use. Care should be taken on the influence on the data quality. Namely the quality of the resulting data and the derived information is strongly dependent on the mapping algorithms between the different domains. The governance on the definitions on an atomic data level used within the different domains, where the automated mappings are based on, is of utmost importance to get satisfactory and trustworthy results.

6. Data sharing versus data exchange:
   Instead of sharing data by copying it, is also possible to share the link to the source of the data. Since the data is maintained at the source, one could expect that the quality is better when using this method. However, availability of the different parts of the data puzzle that can be scattered over multiple data bases and networks becomes more crucial than ever.

[2] According to Klas and Schrefl (1995), the "overall goal of semantic data models is to capture more meaning of data by integrating relational concepts with more powerful abstraction concepts known from the Artificial Intelligence field. The idea is to provide high level modeling primitives as an integral part of a data model in order to facilitate the representation of real world situations" source : Wolfgang Klas, Michael Schrefl (1995). "Semantic data modeling" In: *Metaclasses and Their Application*. Book Series Lecture Notes in Computer Science. Publisher Springer Berlin / Heidelberg. Volume Volume 943/1995.

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3.4.6 IWT related topics

IWT is working with a set of different topics, platforms, standards, … which are all using and depending on data. During the desk research these commonly known topics are examined on the quality aspect. *Are the requirements on the level of data quality described and if so, how is this described?*
The topics that are examined are:

- RIS COMEX (EuRIS, CEERIS)
- eRIBA
- Inland ECDIS
- RIS Guidelines 2019

There are many differences between the IWT related topics. Quality of data is described in different wordings and in most cases on a very general level. Requirements on e.g., accuracy are not described in units and/or values, so further investigation is needed for each operational process.

3.4.7 Results and conclusions

The most important conclusion of this research is that data quality is and remains most important for inland navigation and data exchange / data sharing. If the data quality is poor, analyses based on the data are unusable. For further digitalisation in inland navigation, data quality will play a key role for the necessary further technological developments and e.g., Smart Shipping. Therefore, to check the data quality, it is important to make use of the data quality parameters in IWT as researched to ensure that the used data, meet the associated parameters.

The quality framework includes the definition of the overall set of parameters and their values, mechanisms and guidelines aligned to the implementation of new business and technical services and their intended quality.

Because of the wide range of IWT related applications, a broad range of data quality frameworks can be used. It is impossible to assign one particular framework as 'the data quality framework for IWT'. However, using one is needed for good data quality in business processes.

Not knowing whether the used data is correct, accurate and complete leads to specific high-risk issues that IWT is facing today. This is a high risk because incorrect data can lead to human, material and/or infrastructure damage. Therefore, it is important to always take a look at the data quality parameters that are expanded in this report and to implement them.

Smart shipping and autonomous navigation will require a higher or different data quality than is currently possible. To complete the above list, synchro modality and digital twins will also require a more robust data quality (framework).

Depending on the purpose of the data for the user or for other systems, other quality requirements can be in place. By consequence, when the purpose of a certain data element changes, also the requirements on that data element must be checked whether they have to change too.

Recommended actions for improving data quality were identified in six areas:

1. Additional study; covering topics requiring further investigation
2. Data Governance; covering cooperation and guidance proposals aimed at increasing understanding and harmonisation between all elements of the data provision chain
3. Data quality checks; covering proposals to increase the amount and thoroughness of quality checks
4. Metadata; covering the inclusion and completeness of metadata when providing data
5. Requirements; covering proposals to come up with clear and harmonised requirements
6. Standards; covering the need for data quality standards.

4 Main conclusions and recommendations

The main conclusions and recommendations from the Facilitators sub activities are summarized in this chapter. Given the heterogeneous nature of the different sub activities, it is not possible to provide overall conclusions. Nevertheless, any complementarities in the conclusions and recommendations of the different sub activities were identified where possible.

The conclusions and recommendations in this chapter are on a, very, high level and intend to provide a general overview and a link towards interesting (parts of) sub activity reports for the reader. More details can be found in the sub activity summaries (see Chapter 3) and of course in the sub activity reports themselves.

4.1 Assessment of recommendations

The recommendations from the Facilitators sub activities have been assessed by seeking similarities and complementarities with the recommendations from the other DIWA activities. As the recommendations from the other sub activities were already grouped into general measures in Activity 5, the recommendations were mapped to those measures, updating the scope of certain measures, and creating new measures where necessary.

The assessment showed that many of the Activity 4 recommendations confirm the relevance of Activity 2 & 3 recommendations and extend the scope of others. Furthermore, new measures that were added during this exercise are frequently based on a combination of several sub activity recommendations. This shows that, despite the heterogeneity of the activity 4 sub activities, the high-level goals in the digitalisation of IWT are shared among the different facilitators.

4.2 Grouping recommendations

The recommendations from the Facilitators sub activities have been grouped based on the measures defined in Activity 5. As such, there are five groups: Data, Data Sharing, Harmonised Modalities, Process & Organisation, and Technology, As the measures from Activity 5 were already available when this report was drafted, the recommendations from the Facilitators sub activities have also been mapped to the Activity 5 measures, resulting in Table 1 below.

4.3 Mapping of Recommendations to Measures

Below all recommendations from the Facilitators sub activities are mapped to the general measures drafted in Activity 5. The first column provides a reference to the identifier used in Activity 5 for that measure.

Table 1: Mapping of SuAc 4.x recommendations to Activity 5 Measures.

ID	Category	Title	SuAc 4.x recommendation
M1	Data Sharing	Ensure harmonised eFTI<->ERI alignment	4.1-REC28
M2	Data Sharing	Enhance ERI	4.1-REC14, 4.1-REC18, 4.2-REC25, 4.2-REC27
M4	Data Sharing	Elaborate legal basis for paperless transport	4.2-REC17, 4.2-REC25, 4.2-REC27
M5	Data Sharing	Use existing / create new standards/API for harmonised data exchange	4.1-REC32
M6	Data Sharing	EuRIS as data registry / ERDMS gateway	4.1-REC30, 4.4-REC10, 4.4-REC17
M9	Data Sharing	Support digital freight docs	4.1-REC23
M10	Data Sharing	Closely follow & investigate Federated data sharing developments	4.1-REC2
M12	Data Sharing	Secure Cloud providers	4.3-REC10
M13	Data Sharing	Fix missing links to other transport modes	4.1-REC5
M15	Data Sharing	Align with maritime	4.1-REC34, 4.1-REC35
M16	Data Sharing	Connect fairway-port-maritime	4.1-REC19
M17	Data Sharing	Privacy assessment for new developments	4.2-REC26, 4.3-REC20
M18	Data Sharing	Standards for suppliers	4.3-REC13b
M20	Harmonised modalities	Identify standards & interactions with other modalities & logistics	4.1-REC6, 4.1-REC22
M24	Process & Organisation	Create awareness regarding cyber security (material & training)	4.3-REC5
M26	Process & Organisation	EuRIS sustainment actions	4.1-REC1
M33	Process & Organisation	Harmonise information services	4.4-REC13

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M35	Process & Organisation	Establish a close cooperation between RIS authorities, EU commission and CESNI/TI when upgrading, replacing, designing, operating, maintaining, …. registries for IWT	4.1-REC3, 4.1-REC9, 4.1-REC11, 4.1-REC26, 4.4-REC7
M36	Process & Organisation	Establish EU-wide harmonised regulations for Smart Shipping	4.2-REC1, 4.2-REC17, 4.2-REC18, 4.2-REC19, 4.2-REC20, 4.2-REC21, 4.2-REC22, 4.2-REC23
M37	Process & Organisation	Adapt regulations to facilitate automated[3] vessels	4.2-REC14, 4.2-REC22
M38	Process & Organisation	Harmonise the vision on Smart Shipping	4.1-REC17, 4.1-REC27
M40	Process & Organisation	Uniform crew requirements and qualifications for automated vessels	4.1-REC34, 4.2-REC7, 4.2-REC8, 4.2-REC9, 4.2-REC10, 4.2-REC11, 4.2-REC12, 4.2-REC13, 4.2-REC14, 4.2-REC15, 4.2-REC16, 4.2-REC24
M41	Process & Organisation	Resolve liability issues for automated vessels / introduce strict liability	4.2-REC2, 4.2-REC3, 4.2-REC4, 4.2-REC5, 4.2-REC6
M42	Process & Organisation	Certify automated/remotely operated vessel IT and centres (cybersecure)	4.3-REC1
M43	Process & Organisation	Perform cyber risk assessment	4.3-REC15
M44	Process & Organisation	Implement ISMS	4.3-REC3
M45	Process & Organisation	Install a dedicated cyber security team	4.3-REC4
M47	Process & Organisation	Facilitate innovation	4.2-REC1
M48	Process & Organisation	Training and education of users working with specific technologies	4.4-REC2
M50	Technology	EuRIS expansion & enhancement	4.4-REC11
M51	Technology	Develop fall-back scenarios for non safety-related systems (internet services)	4.3-REC12a
M52	Technology	Adopt PKI to encrypt data exchange	4.3-REC2

[3] Automated as used in the international definition of inland navigation automation levels published by the CCNR (https://www.ccr-zkr.org/files/documents/AutomatisationNav/DefinitionAutomatisation_en.pdf and https://www.ccr-zkr.org/files/documents/AutomatisationNav/Note_explicative_en.pdf)

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M53	Technology	Implement (basic) cyber security and data protection measures	4.2-REC24, 4.3-REC16, 4.3-REC17, 4.3-REC18, 4.3-REC19, 4.3-REC20
M56	Technology	Ensure diligent use of AI	4.3-REC11
M64	Technology	Develop fall-back scenarios for sensor systems applied in autonomous or automated vessels	4.2-REC12
M65	Technology	Define cybersecurity minimum requirements for autonomous/remotely operated vessels & centres	4.3-REC1
M66	Technology	Reduce AIS cyber vulnerability	4.3-REC6, 4.3-REC14
M68	Technology	Define requirements for sensors and PNT used for automatic/ autonomous vessels	4.3-REC7, 4.3-REC8, 4.3-REC9
M70	Technology	Reliable connections, communication network coverage	4.3-REC12a, 4.3-REC12b, 4.3-REC13a
M71	Technology	Ship-ship communication standards	4.1-REC15
M75	Technology	Adopt communication technologies like SECOM, VDES, R-mode, 5G, VLC, Recognised PNT Provision or NDLC to Inland Shipping	4.1-REC37
M78	Technology	Promote test standards	4.1-REC12, 4.1-REC13
M79	Technology	Feedback loop	4.1-REC33, 4.4-REC6
M80	Data	Maintain standardisation work	4.1-REC6, 4.1-REC7, 4.1-REC24, 4.4-REC33
M81	Data	Formalise de facto standards	4.1-REC8, 4.1-REC16
M82	Data	Implement updated standards	4.3-REC6
M83	Data	Increase data quality	4.4-REC1, 4.4-REC3, 4.4-REC18, 4.4-REC19, 4.4-REC20
M84	Data	Provide meta-data	4.4-REC14, 4.4-REC22, 4.4-REC23, 4.4-REC24
M85	Data	Install a (virtual) data quality team for European IWT data	4.4-REC15, 4.4-REC16, 4.4-REC21
M86	Data	Continue elaboration of RIS.net	4.1-REC4, 4.1-REC20
M87	Data	Implement RIS.net	4.1-REC25
M88	Data	Assess impact of S-100 on IWT & decide on actions	4.1-REC36, 4.4-REC25
M89	Data	Implementation of a reference data support service	4.4-REC5, 4.4-REC17
M92	Data	Maintenance, harmonisation, and synchronisation of reference data	4.1-REC10, 4.1-REC29, 4.4-REC8, 4.4-REC12, 4.4-REC17
M93	Process & Organisation	Compliance by the member states to standards	4.1-REC21, 4.1-REC31, 4.4-REC9

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M94	Process & Organisation	Regulation of administrative assistance for remote operation of non EU countries	4.2-REC4, 4.2-REC17, 4.2-REC18, 4.2-REC19, 4.2-REC20, 4.2-REC21
M95	Data	Investigate and develop quality standards	4.4-REC4, 4.4-REC31
M96	Data	Investigate and define data quality requirements on national, regional and international aspects	4.4-REC26, 4.4-REC27, 4.4-REC28, 4.4-REC29, 4.4-REC30, 4.4-REC32

5 Future state of digitalisation in IWT

Within the sub activities of activity 4 a description was made of the most optimal desired situation (long term) of the sub activity topic, based on existing studies, investigations and business interviews. To limit the scope somewhat a timeline of approximately 10 years was used for the designation “long term”. Taking a greenfield perspective (lacking the constraints of today) was encouraged.
Of course, it is fully recognised that the voyage towards this desired future state will encounter known and unknown constraints. With these constraints in mind, there is a definite probability that where we can be in ten years does not equal where we want to be in ten years.

5.1 Where do we want to be in 10 years?

The results of the Facilitators sub activities show that there is a challenging time ahead. Through a close collaboration between all involved parties and beyond the borders of a single facilitator’s point of view, however, the envisioned path for the coming decade will be difficult but not impossible. Indeed, if the facilitators wait for evolutions and changes in other domains, a standstill situation will emerge, seriously hampering the growth potential of IWT. If, on the other hand, the facilitators choose to take the lead in their respective domains, an opportunity for a quantum leap may occur when other facilitators, technologies, and businesses catch up! One of many examples are the developments in automated vessels. If actors from ‘rules and regulations’, ‘data quality’ and ‘standardization’ wait for fully functional and time-tested automated vessels before changing related legislation and regulations, improving the quality of provided data, and providing standardised ways of providing said data, the technological and business changes in this domain will be hampered to a degree where advanced testing and building a (future) business case become impossible. If, on the other hand, these facilitators decide to cooperate and take the lead, advanced testing can be facilitated, clear timelines can be provided, enabling automated vessels to become an advantage of IWT in the multimodal transport chain.

Indeed, one could conclude that the main goal to reach in 10 years is a proactive stance of and a true, strong collaboration between the actors responsible for the different facilitators in IWT: standardisation, rules and regulations, cybersecurity, and data quality.

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6 Roadmap

Below is an overview of the different measures related to Activity 4 and their high-level categories on a road to the sun graph. This is the result of the assessment of the different sub activity recommendations and their mapping onto and extension of the Activity 5 overall measures. More detailed information for each measure will be available in the Activity 5 reports, while more information on the underlying recommendations is provided in Chapter 3 and in the individual sub activity reports.

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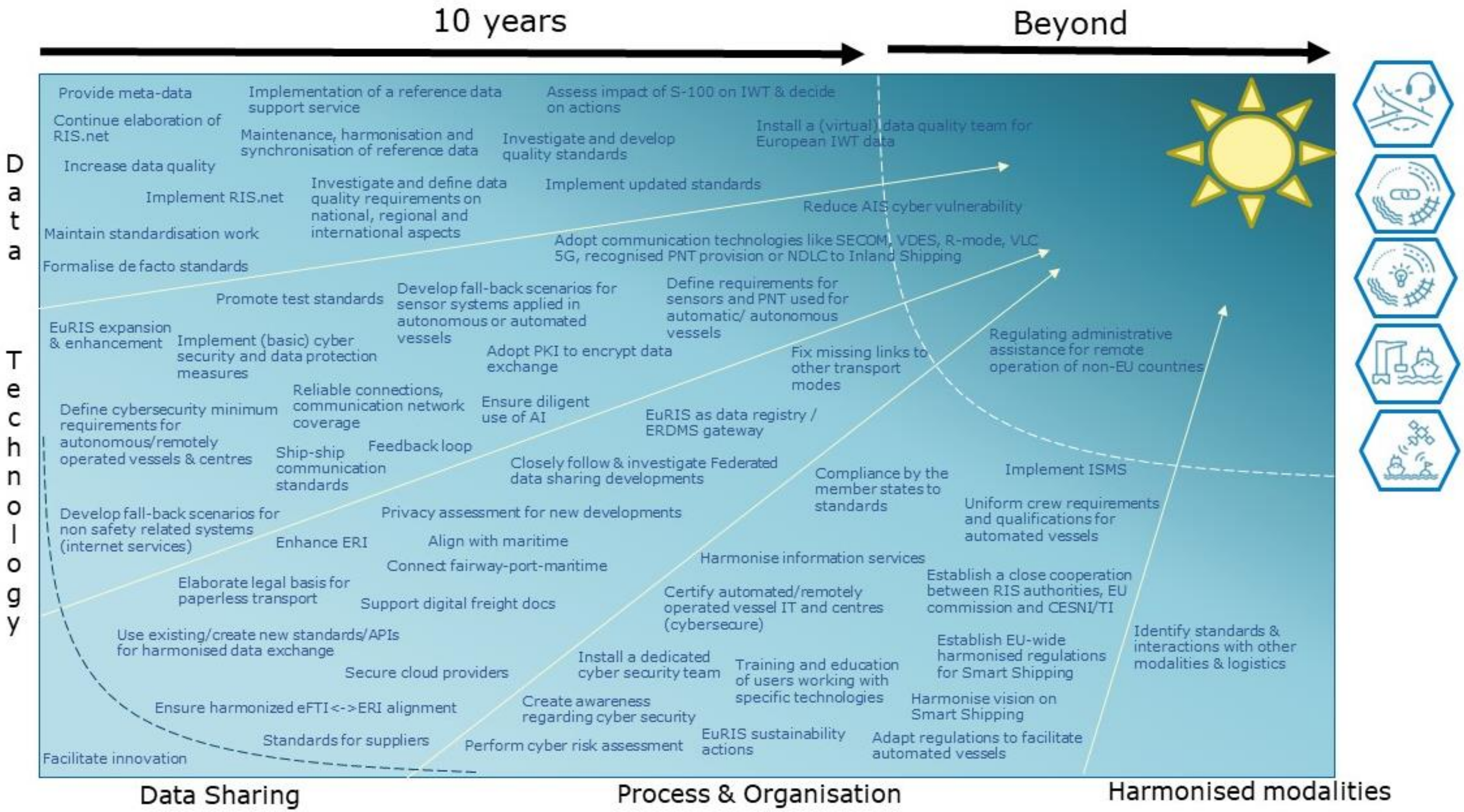

Figure 7: Assessment of main measures in the "road to the sun" approach.

7 List of figures

8 List of tables

9 Glossary

AI	Artificial Intelligence
AIS	Automatic Identification System
API	Application Programming Interface
BCM	Business Continuity Management
CCNR	Central Commission for the Navigation of the Rhine
CEERIS	Central & Eastern European Reporting Information System
CESNI	European committee for drawing up standards in the field of inland navigation
COMEX	RIS Corridor Management Execution
CoRISMa	RIS Corridor Management
DATEX	DATa Exchange
DIWA	Masterplan Digitalization Inland Waterways
DTLF	Digital Transport and Logistics Forum
ECDIS	Electronic Chart Display Information System
eFTI	Regulation (EU) 2020/1056 on electronic freight transport information
ENC	Electronic Navigational Chart
ERDMS	European Reference Data Management System
ERI	Electronic Reporting International
eRIBa	Electronic reporting for inland barges
ERIINFO	ERI Information Message
ERIVOY	ERI Voyage plan notification Message
ERTMS	European Rail Traffic Management System
ES-RIS	European Standard for River Information Services
ES-TRIN	European Standard laying down Technical Requirements for Inland Navigation vessels
GDPR	EU General Data Protection Regulation
IMDG	International Maritime Dangerous Goods
ISM	Information Security Management
ISMS	Information Security Management System
ISRS	International Ship Reporting Standard

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ITS	Intelligent Transport System(s)
IWT	Inland Waterway Transport
MASS	Maritime Autonomous Surface Ships
NDLC	Nautical Datalink Communications
NIS	EU Directive on the Security of Network and Information Security
NNDS	Nautical Network Data Services
NtS	Notices to Skippers
PIANC	World Association for Waterborne Transport Infrastructure
PKI	Public Key Infrastructure
PNT	Position, Navigation, Timing
RIS	River Information Services
RTA	Requested Time of Arrival
SECOM	SECure Communication
SLA	Service Level Agreement
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
VDES	VHF Data Exchange System
VHF	Very High Frequency
VLC	Visual Light Communications
VNF	Voies navigables de France

11 Appendices

1. Report Facilitators Sub Activity 4.1 Standardisation
2. Report Facilitators Sub Activity 4.2 Rules & Regulations
3. Report Facilitators Sub Activity 4.3 Cybersecurity
4. Report Facilitators Sub Activity 4.4 Data quality

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