Begonia

USE CASE 14:

Inland waterways multimodality

This project has received funding from the European Commission under grant agreement N°101133306.

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Use case 14: Inland waterways multimodality

Use case identification

Table 1. Identification of use case 14.

ID	Name of Use Case	Geographical scope	Cross-sector domains			Interoperability layers
			Electric	Mobility	Data	
BEG.14	Inland Waterways Multimodality 4.0	☒ Local ☒ Regional ☒ National ☒ Cross-border ☐ Outermost	☐ Customer ☐ DER ☐ Distribution ☐ Transmission ☐ Generation	☒ Customer information ☒ Vehicle ☐ Energy station ☒ Infrastructure ☒ Traffic and logistic	☒ Edge ☒ Fog ☒ Cloud	☒ Component ☒ Communication ☒ Information ☒ Function ☒ Business

The scope and objectives of the use case

Table 2. Scope and objectives of 14 use case.

Scope and Objectives of the Use Case	
Scope	The current context of decarbonization across sectors, guided by European legislation such as the European Green deal, sets an unprecedented need for the transport sector to drastically reduce green-house gas (GHG) emissions. This includes various perspectives, such as: • The shift towards transport modes that have lower emissions, such as railways and inland waterway transport. • The electrification of transport modes. • The use of lower emissions fuels. • The improvement of transport infrastructure asset management workflows. • The improvement of the connections among transport modes, fostering multimodality of both transport users and goods. In this scenario of changes in the transport sector, the Inland Waterways Multimodality 4.0 use case fosters the creation of an ODP to align the miscellaneous stakeholders and services that are required to operate inland waterway transport and their connection with other transport modes such as railways, roads and maritime transport. The aim of the use case is the interconnection of data from sources such as transport operators (across modes), inland waterways management authorities, logistics nodes operators (mainly ports) and other infrastructure managers. Thereby, Inland Waterways Multimodality 4.0 provides a framework to foster the use of inland waterways and their connection to greener transport modes such as railways. It also provides the means for enhanced operation of inland waterways (addressing both infrastructure management and water management) and traffic flows, addressing the need of the selection of lower emissions modes. In summary, the use case seeks to establish a robust platform for sharing and consuming goods and passenger data as well as infrastructure data, fostering low emissions and efficiency in the transportation sector.
Objective	The main objectives of the use case are as follows: 1. The provision of real-time traffic and logistics updates to inland waterways and port operators, facilitating informed decision-making and improving the connection across transport modes. 2. The seamless integration of platform services in order to support transport operators in decision-making processes when choosing among transport modes, with enhanced user experience and references to transport emissions.

	3. The enhancement in passenger and goods transport efficiency by offering route recommendations based on availability and carbon footprint. 4. The provision of alerts and warnings to transport operators so as to avoid bottlenecks in the logistics chain and ensuring the safety at all points. 5. The provision of integrated information for the dynamic interexchange between transport operators and infrastructure managers, so as to reduce the impact of maintenance in traffic flows (for instance, at logistics nodes such as ports) and to manage water resources optimally (for instance, at inland waterways locks). 6. The implementation of robust data privacy measures to safeguard passengers and goods information and ensure regulatory compliance.
Reference country(ies)	Belgium, Netherlands, Austria and Romania, apart from other countries across the Rhine-Danube CEF inland waterway corridor
Related Business Case	*Inland Waterway Transport, Traffic management, Infrastructure Maintenance, Logistics, Pollution Control*
Possible Stakeholders	Transport operators, Inland waterways management authorities, Logistics nodes operators (mainly ports), Infrastructure managers.

Narrative of the use case

The European Green deal and the related legislation establish clear goals for the decarbonization of the transport sector, as well as the adoption of clear goals to preserve the environment and the biodiversity of species in spaces affected by transport modes such as oceans and inland waterways. These guidelines include various perspectives, such as (a) The shift towards greener transport modes, such as railways and inland waterways; (b) The electrification of transport modes; (c) The use of lower emissions fuels; (d) The improvement of transport infrastructure asset management workflows; (e) The fostering of multimodality for both users and goods.

The Inland Waterways Multimodality 4.0 use case tackles the changes towards a greener transport infrastructure sector by creating an Operational Data Platform to connect the variety of stakeholders and services that are required to operate multimodal transport services in inland waterways, including transport modes such as railways, roads and maritime transport; transport and logistics operators; and logistic nodes authorities, among others. The platform has the following objectives and services:

1. Real-time provision of traffic and logistics information.

The Operational Data Platform aims to provide transport authorities and transport operators with the necessary real-time information to manage traffic and logistics information, especially at key points such as the interfaces in locks and ports, in order to foster multi-modality, improve efficiency and reduce related carbon emissions.

2. Seamless integration of information for the decision-making when selecting particular transport modes.

The provision of information on transport routes including inland waterways will make this mode of transport more efficient and competitive against other transport modes

such as roadways. Furthermore, the provision of information related to carbon emissions should provide extra parameters to be taken into account in the decision-making process for transport and logistics operators.

3. Provision of alerts and warnings to transport operators to avoid bottlenecks in the logistics chain.

The platform aims to integrate an alarm system, providing information related to potential problems with infrastructure, accidents or weather conditions, among others. The aim is to avoid bottlenecks in particular points such as locks or port entrances.

4. Coordination of transport infrastructure maintenance with traffic flows in inland waterways.

The coordination of transport infrastructure maintenance (especially at critical points such as ports and locks) with the planning of logistics and passenger flows is critical to improve transport flows in linear infrastructures such as inland waterways. The Operational Data Platform aims to improve this exchange of information to allow a better planning.

5. Coordination of traffic flows at key navigation points and logistics nodes for green navigation.

The coordination within the inland waterway between the infrastructure operators (such as locks, doors, etc.) and the ships operators is to reduce waiting times and, thereby, reduce carbon emissions, by connecting more efficiently the decisions on water levels, barge speeds and opening and close times of gates.

6. Development of robust data management and security measures.

The platform is to provide a seamless exchange of data with no security implications for the different owners of the data.

7. Integration with environment-related sources of information and stakeholders for the preservation of biodiversity.

The EU 2030 Biodiversity Strategy sets the target to build a coherent Trans-Europe Nature Network [20]. This must be coordinated with critical ecosystems such as inland waterways and heavily pollutant nodes such as ports. Thereby, information on pollution is to be shared in the platform, so as to study and limit its effect on protected species.

The use case has a relevant cross-border component, given the main inland waterways in Europe cross several countries. Thereby, the use case is of clear application to the Rhine-Danube CEF corridor, connecting several countries across central and east Europe.

Figure 1. The framework of the use case 14.

Diagram of the use case

The diagram of the use case 14 is presented in Figure 2. Actors' actions and scenarios' descriptions are presented in Table 3 and Table 4, respectively.

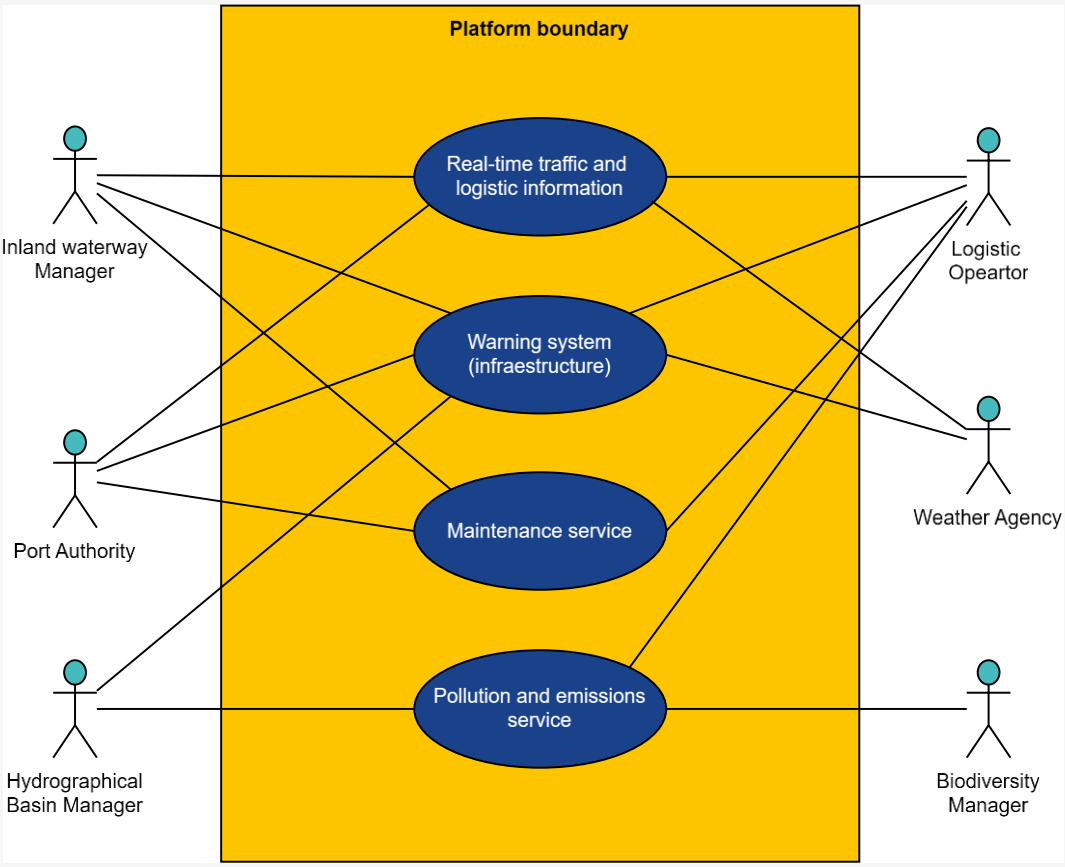

Figure 2. The diagram of the use case 14.

Actors of the use case

Table 3. Description of the actions of use case 14 actors.

Actor Name	Actor Type	Actor description	Actions	Standards
Inland Waterway Manager	Role	Government agencies or departments responsible for planning, maintenance, and regulation of inland waterway networks.	Develop and implement traffic management policies, maintain infrastructure, deploy traffic control systems, conduct safety assessments, and coordinate with other stakeholders.	No
Port Authority	Role	Public and/or private companies in charge of the management of port infrastructures.	Coordinate the different stakeholders in a port area, including infrastructure managers, transport operators, government agencies or passengers.	No
Hydrographical Basin Manager	Role	Government agencies responsible for preserving the group of rivers and water sources in a particular area or basin.	Manage and preserve the rivers and underground water in a particular area or region.	No
Transport and logistics operator	Role	(Private) organizations responsible for managing and operating the transport of passengers and goods.	Manage the movement, storage, and distribution of goods and/or passengers across various transportation modes and supply chain networks.	No
Weather Agency	Role and System	Agencies responsible for the prediction of weather in a particular area.	Monitor and forecast meteorological conditions to provide accurate weather information and warnings.	No
Biodiversity Manager	Role	Government agency responsible for preserving the ecosystem of a particular area or region.	Oversee conservation efforts, habitat restoration, and species protection to maintain ecological diversity.	No

Scenarios

Table 4. Description of use case 14 scenarios.

S.No	Scenario Name	Triggering Event	Scenario Description	Primary Actor
BEG.14.S1	Accident Notification	Information systems on (e.g.) a lock detect a failure in infrastructure or an accident.	The sensors in a port/lock detect an incident and automatically send notifications to the federated platform. The platform validates the incident, cross-referencing it with the information provided by transport operators. Once confirmed, the platform sends alerts to other transport operators and actors to shift	Port authority or inland waterway manager systems.

			traffic in the inland waterway or port area.	
BEG.14.S2	Notification of port infrastructure intervention	Maintenance begins in a particular infrastructure asset such as a quay wall.	The maintenance operator reports the state of works to the infrastructure asset manager via the platform. The platform provides real-time notifications, which are transmitted to transport operators. Transport operators receive valuable insights that allow them to adjust routes or schedules.	Port authority or inland waterway manager.
BEG.14.S3	Weather Hazard Detection	Extreme weather conditions arise, for instance, low water levels, waves, heavy rain, extreme wind, etc.	Adverse weather conditions affect the integrity of certain infrastructure assets and, most importantly, navigability in port areas, where interexchange occur. This information is received in the platform and it is transmitted to the transport operators and infrastructure managers to adapt depending on risk levels.	Infrastructure managers. Weather agencies.
BEG.14.S4	Oil Spill	Commercial barge spills oil in a port environment.	A barge in a port area spills oil due to an accident or mechanical problem. This problem is reported to the platform. Port authorities establish a safety procedure due to the spill and the potential problem on the barge. Governmental entities in charge of biodiversity analyse the situation. Transport and logistics operators follow procedures, avoiding the area.	Port authority. Transport operator.

Policy and digitalisation needs

Table 5. Description of use case 14 policy and digitalisation needs.

Policy needs	**Minimum Regulatory Framework** • **Data Privacy and Security Regulations:** Implement robust measures to ensure the protection of personal data, adhering to GDPR and other relevant privacy laws. • **Liability and Insurance Regulations:** Clarify liability issues related to incidents and accidents involving connected systems, defining the responsibilities of operators, service providers, and infrastructure authorities. **Current Barriers** • **Fragmented Regulatory Landscape:** Inconsistent regulations across countries hinder the seamless deployment of an Operational Data Platform for inland waterways across Europe, requiring harmonization efforts and cross-border cooperation. • **Infrastructure Investment:** The implementation of the Platform, including infrastructure sensors and communication networks, requires significant investment and collaboration between public and private stakeholders. **Legal and Social Factors**

	• **End-user Acceptance:** Addressing end-user perceptions and attitudes towards connected inland waterway transport is crucial to fostering its use, highlighting the benefits in terms of safety, efficiency, and carbon emissions. **Regulatory Compliance:** • Compliance with evolving regulatory requirements, including emission standards, is essential to ensure the legal operation of an Operational Data Platform connecting several stakeholders across the inland waterway transport domain.
Digitalisation needs	**Data Integration and Management** • Data Volume and Variety: Managing the large volume and variety of data required in logistics processes across transport modes and countries. • Real-Time Processing: Ensuring the capability to process and analyze data in real-time to provide timely and accurate information for transport operators and other stakeholders. **Connectivity and Network Infrastructure** • Network Coverage: Ensuring comprehensive network coverage, especially in rural and remote areas, to support all points within inland waterways. **Security and Privacy** • Cybersecurity Threats: Implementing advanced cybersecurity measures to protect the network and user data from cyber-attacks. • Data Encryption: Ensuring end-to-end encryption of data to maintain confidentiality and integrity during transmission and storage. **Cross-Border Data Exchange** • Harmonized Standards: Establishing harmonized standards for data exchange across different countries and stakeholders to ensure seamless cross-border interoperability. • Regulatory Alignment: Aligning regulations related to data privacy, security, and insurance across different jurisdictions to facilitate cross-border operations. **Multi-Stakeholder Collaboration:** • Stakeholder Coordination: Coordinating among various stakeholders, including transport operators, infrastructure authorities, infrastructure managers or river managers, to ensure smooth collaboration and data sharing. **Data Sharing Agreements** • Developing clear data sharing agreements and frameworks to facilitate collaboration while protecting proprietary and sensitive information.