

Strategic Research Agenda for the European waterborne sector

June 2025

Towards a resilient, competitive and sustainable
waterborne sector

The [Waterborne Technology Platform](#) (TP) has been set up as an industry-oriented Technology Platform to establish a continuous dialogue between all waterborne stakeholders, such as classification societies, shipbuilders, shipowners, equipment manufacturers, infrastructure and service providers, ports, universities or research institutes, and with the EU Institutions and EU Member States. Currently, Waterborne TP represents more than 120 members, originating from 19 EU Member States and four European countries associated with Horizon Europe. As one of our key activities, the Waterborne TP is coordinating the private side of the Co-Programmed Partnership on Zero-Emission Waterborne Transport (ZEWT).

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1. Preface

1.1 Context and drivers

The waterborne sector is a dynamic sector, featuring a diverse array of public and private stakeholders. These stakeholders include classification societies, shipbuilders, shipowners (both maritime and inland navigation), equipment manufacturers, ports, infrastructure and service providers (e.g. dredging), as well as universities and research institutes.

While large enterprises play a key role in development and innovation in the value chain, small and medium sized enterprises (SMEs) form the largest part of the EU waterborne sector and play a crucial role as well in the sector and the broader European economy. The sector encompasses various types of vessels and services, categorized based on power requirements and autonomy¹. These categories include **inland waterway transport vessels, ferries, short sea, cruise, intercontinental and offshore ships, as well as underwater and unmanned vehicles**. Distinctions also exist between liner and tramp shipping and their respective business models, as well as between retrofitting existing vessels and building new ones. Ports are equally important, functioning as multimodal hubs that facilitate the movement of goods and passengers and support a wide range of economic activities, including shipbuilding, maintenance, logistics, and energy production. Finally, the sector is a key solutions provider for the broader blue economy, like the development and production of offshore platform technologies, the design, production, maintenance and operation of specialised vessels and is a technology leader in the underwater domain, e.g. underwater unmanned vehicles.

The waterborne sector is **critical for Europe's trade and economy**, handling nearly 90% of international trade, with 81% of the EU's external trade and 40% of its internal trade carried by waterborne transport. Beyond trade, the sector is a significant employer in the EU, providing 4.2 million direct jobs and contributing approximately € 500 billion annually to the EU's Gross Domestic Product (GDP). The European fleet is one of the largest in the world, representing 35% of the global shipping fleet². Moreover, the European maritime technology sector³ is a global leader in high-technology shipbuilding (such as maritime and inland cruise ships, electric ships, offshore support vessels and platforms⁴ as well as underwater and unmanned vehicles) and in **green and smart port and shipping** technologies (such as battery electric solutions, clean engines, exhaust treatment systems, green equipment, smart technology for improved efficiency and operations and automation). European companies supply almost half of the world's maritime equipment and have played a leading role in designing and developing most of the global fleet's power systems.

The sector actively invests in research, development and innovation **to remain a frontrunner** in the global **green and digital** transformation. It plays a significant role in reinforcing the **EU's resilience in terms of trade, safety, security, defence, energy supply, and sustainability**, while enabling the transition towards sustainable energy and a more robust supply chain. Ports, in particular, serve as strategic hubs for enabling the energy transition, promoting modal shift, and advancing the decarbonisation of waterborne transport.

Due to its inherent international nature, the waterborne sector is subject to regulations at multiple levels: international, European, regional, national and local. This includes ambitious environmental objectives, like the **EU's target of a 90% reduction in net greenhouse gas emissions**, as well as sector-

¹ https://www.waterborne.eu/images/231229_SRIA_Zero_Emission_Waterborne_Transport_2.0_clean.pdf

² <https://ecsa.eu/european-shipping-key-for-europes-security-with-35-of-global-fleet-studies-find/>

³ https://www.waterborne.eu/images/documents/200527_Zero-Emission_Waterborne_Transport_Proposal_Final_Version_Spread.pdf

⁴

https://www.waterborne.eu/images/240910_Press_release_Draghi_report_calls_for_a_dedicated_waterborne_partnership.pdf

specific policy objectives outlined in the upcoming **comprehensive port strategy** and the **industrial waterborne strategy**. A **joint and coordinated approach** towards **research, development, innovation and the deployment of innovations** is critical to achieve policy objectives.

2. Technology Leadership in Waterborne

Research, Development and Innovation (RD&I) are key to retain or increase the competitiveness of the European waterborne sector. **Technology Leadership**⁵ will be essential to remain a worldwide frontrunner in the design, production, development and implementation, including on-board and onshore integration, of innovative technologies and solutions.

Competitiveness implies that the results of RD&I provide the European waterborne sector with a frontrunners position regarding the technology developed. In addition, it implies a competitive advantage of the waterborne transport sector in comparison with other modes of transport.

The development of technological and operational solutions is often closely guided by policy objectives. Policies are defined, for example, to address major societal and environmental challenges, such as to protect the climate, mitigate climate change, stimulate economic development, improve the quality of life for citizens, and ensure the strategic autonomy of the EU. **Technology leadership implies being a frontrunner in enabling the transformation, which entails developing and deploying competitive solutions that mitigate climate change, provide the capability to become climate resilient, eliminate all harmful pollutants, improve working conditions or create new jobs, and stimulate economic prosperity**, all while ensuring safety and security.

For the coming years, **digitalization, circularity (sustainability in the broad sense of the word) and competitiveness** will be the key hooks for research, development and innovation activities. Europe's waterborne value chain is a frontrunner in the development of innovative technological solutions and is engaged in implementing technologies to reduce and ultimately eliminate Greenhouse Gas (GHG) and air and water pollutant emissions from waterborne transport. Furthermore, the value chain is a leader in the digitalization of the waterborne sector. A competitive value chain also heavily depends on a **resilient supply chain** that can source the entire product from raw materials to finished high-tech parts. **Reliable delivery** equally requires a well-connected and innovative trans-European network.

As technologies evolve, it is vital that innovation in the waterborne sector remains human-centred, supporting reskilling, inclusivity, and collaboration across industry, academia, and policymakers to align progress with workforce needs and societal value. Furthermore, the development of technologies should hand in hand with regulatory developments, to be able to deploy innovations.

⁵ https://www.waterborne.eu/images/24_01_15_Annex_5_Waterborne_Long_Term_Strategy.pdf



Stimulating the **systematic** deployment of economically viable innovations, will provide the European waterborne sector with a **frontrunners position** and **stimulate the transition towards a resilient, competitive and sustainable** European maritime technology sector. At the same time, this presents opportunities to **export European solutions and products to the global market**.

(Complex) vessels are typically one-off orders built in very short series, meaning that a significant amount of engineering work must be performed for each new project. To ensure the frontrunners role of the European waterborne sector, and the stimulation of demand at the European maritime technology sector, a systematic approach towards deployment of innovations is required. This could be further analysed per product type as in table 1.

This requires that all key players team up, including classification societies, shipbuilders, shipowners (both maritime and inland navigation), equipment manufacturers, ports, infrastructure and service providers (e.g. dredging), energy suppliers, as well as universities and research institutes. In addition, financial institutions, and in case of electrification, utility companies, should be involved. As regards digitalization, there is for example a need to ensure adequate 5G coverage, and relevant organisations should be involved. On a case-by-case basis, additional stakeholders need to be identified. The systematic approach would solve the “chicken and egg” dilemma as regards sustainable alternative energy carriers. In addition, green corridors (for liner traffic or traffic in certain regions, could be established). This will have a spin-off effect for other segments of the waterborne sector (e.g. in ports) or for other modes of transport or industries (e.g. in the hinterland).

The European waterborne sector is committed to mobilizing significant investments in research, development and innovation (RD&I), education, training and skills development, and deployment across the full value and supply chain, including SMEs, start-ups, and regional actors. These efforts must be supported by coordinated, forward-looking EU policies and funding instruments, from Horizon Europe to the Innovation Fund, the Connecting Europe Facility, and their successors in the Multiannual Financial Framework 2028 - 2035.

Table 1: Involvement of the European waterborne sector in different products and services

	IWT	Short Sea Shipping	Ferries	Cruise	Intercontinental	Offshore	Blue Economy
Shipowners	X	X	X	X	X	X	X
Shipyards	X	X	X	X	(X)	X	X
Equipment manufacturers	X	X	X	X	X	X	X
Ship designers	X	X	X	X	X	X	X
Ports	X	X	X	X	X	X	X
Infrastructure and service providers	X	X	X	X	X	X	X
Classification societies	X	X	X	X	X	X	X
Research	X	X	X	X	X	X	X
Financial institutes	X	X	X	X	X	X	X
Energy suppliers	X	X	X	X	X	X	X
EU/MS	X	X	X	X	X	X	X

(x) = retrofitting

3. Missions of the waterborne sector

The European waterborne sector is committed to contribute to a competitive, resilient and sustainable future of Europe. To that end, the sector has developed ambitious visions based on a series of cross-sectoral missions and focused on the transformation of waterborne transport, the ports and leadership in related sectors in the blue economy.

Accordingly, waterborne stakeholders have set out three main priorities and developed ambitious visions around them:

- The transformation of waterborne transport.
- Technology leadership in blue economy sectors; and
- Optimising the link of waterborne transport with ports and logistics operations.

3.1. The transformation of waterborne transport

Waterborne transport will be the most resilient, competitive and sustainable mode of transport by 2050. To achieve this, all harmful emissions to air and water, as well as noise pollution will be eliminated. Zero accident and zero-fatality goals will also be realized. In parallel, digitalization will unlock the value of data, enhancing flows and enabling higher levels of automation and autonomy. These developments will improve operational efficiency, energy performance, safety, and overall sustainability and reliability across the logistics and mobility chain, as well as the fuel and energy value chain. This transition will be facilitated by a resilient, competitive and sustainable maritime technology sector along the entire value chain. Finally, the transformation of waterborne transport has the potential for spin-offs, transferring cutting-edge innovations to the defence sector.

3.1.1. Zero-emission waterborne transport

Vision

By 2050, the European waterborne transport sector will eliminate any negative influence on the environment, enabling customers to choose the most sustainable form of transport. The European waterborne sector will extend its global leading position in zero-emission waterborne technology and expertise to increase the global market share of the European waterborne sector, providing new highly qualified jobs and stimulating overall growth.

Mission

In order for European waterborne transport to reach the zero-emission aim, all harmful environmental emissions (including greenhouse gas emissions and other harmful pollution to air), as well as water pollution, waste and noise, will be eliminated. This will be achieved by utilizing sustainable alternative energy carriers with highest possible efficiency and optimized use of hybrid power systems whilst also capitalizing on other forms of renewable energy such as wind, solar and wave. Cross-sectoral cooperation with other modes of transport and even other related sectors, embracing the overall logistics, mobility and fuel and energy value chains, will be essential. Embracing circular economy principles will further support environmental objectives and unlock added value.

The identification of innovative business models will be crucial in reaching such targets.

3.1.2. Safe and secure waterborne transport

Vision

The European waterborne sector will strengthen Europe's lead in waterborne safety and security in two ways. First, by 2040, new technologies and new methodologies will radically improve the management of the safety of vessels and of their operations and will contribute to zero fatalities. Then, by 2050, the waterborne sector will build and operate its fleet with a radically improved safety culture – applied onboard as well as on-shore – and characterized by zero accidents, zero loss-of-life and zero pollution, while ensuring secure data exchange and cybersecurity.

Mission

The European waterborne sector will preserve safety as a cultural value in all its activities, its products and its infrastructure. It is essential to protect the life and preserve the health of the waterborne workforce, passengers, and citizens living in coastal areas, near waterways and lakes, because we care about people. Sufficient consideration must therefore be given to social sustainability. The waterborne sector pursues a zero accident, zero fatalities, zero pollution policy and has an avowed policy to protect ships, vessels and infrastructures from perils, cyber-attacks, piracy and terrorism. Safety shall be ensured in developing new types of vessels and equipment that will become more complex. The sector shall safely enable new operating conditions and business models by developing new products and supporting the safe introduction of new technologies, materials and fuels. To support this, the sector will invest in digital autonomy and resilient cyber-physical systems capable of making safe decisions and responding to emerging threats in real time.

The position of the European maritime technology sector will be strengthened by delivering safe and secure vessels. Europe will represent the forefront of innovation in safety defining standards, enabling the application of new materials and ensuring a safe “marinization” of innovative technologies, including ones coming from defence sector. On the basis of a solid safety culture and by leveraging European technical excellence, technical contributions shall be provided to the regulatory development process at IMO, European Commission, CCNR, UN-ECE and other competent bodies.

3.1.3. Connected and automated waterborne transport

Vision

Digitalization will connect smart vessels as well as smart ports and smart infrastructure and maintenance. It will enhance data flows leading to a higher degree of automation and autonomy, automated and autonomous systems, ship operations (both maritime and inland navigation) and remote control from the shore by 2040. Future ships and vessels will be designed so that they can be continuously updated with the digital technologies throughout their lifecycle. Digitalization will not only improve nautical operations, safety or the energy-efficiency of waterborne transport, but will also improve logistics and mobility flows.

Mission

The European waterborne sector will increase efficiency, flexibility and safety by means of the transformation of business models and automation of operations, thereby increasing the share of waterborne transport in the worldwide and regional logistics and mobility chain. It will develop, implement and maintain automated and interconnected work processes in waterborne integrated systems and infrastructures, enabled by digital vessels⁶, with a focus on improving efficiency in waterborne logistics. The digital capabilities throughout the whole value chain from the waterborne fleet to ports and equipment providers will be developed to support efficient and resilient operation. The sector will aim at the largescale introduction of resilient and secure autonomous operations in 2050 and will extend its global leading position regarding the integration and automation of waterborne systems, utilizing its strengths in developing creative solutions and cooperation with all stakeholders. Europe will keep its leading position in terms of the deployment of integrated automated systems and will set the standard in data exchange and communications.

⁶ Vessels equipped with advanced digital technologies

3.1.4. A resilient, competitive and sustainable maritime technology sector

Vision

By 2040, digitalization will also lead to the use of advanced design and production technologies, which will deliver flexible and cost-effective vessels and offshore structures with competitive production costs and increased productivity by 30% compared to current levels. Digitalization will furthermore contribute to the establishment of an entire production chain of safe, competitive and eco-friendly maritime technology companies. It will enable European shipyards to master the increasing complexity of ships and vessels, maintaining their leadership in high complex, high added value vessels and increasing their market share of vessels of other types.

Mission

The waterborne sector will be the world leader in design, engineering, construction and maintenance of vessels, equipment, infrastructure and integrated complex systems throughout their lifecycle.

The European waterborne sector will provide ship-owners with zero-emission and digital vessels in accordance with the highest technical standards. The sector will also provide a safe working environment with a zero-accident target, foster continuous skills development, and contribute to long-term job creation by strengthening local industrial networks. The maritime technology companies will ensure green operation with zero emissions into the environment. This will be achieved by enhancing energy efficiency, integrating digital technologies, driving innovation in clean and material-efficient industrial processes, adopting sustainable materials and lightweight structures, and leveraging circular solutions across all value chains and product life cycles. Aiming for 100% recycling and upcycling of production waste and decommissioned assets will further support environmental sustainability.

The complexity of the construction of a vessel or other floating structures requires excellence in design, engineering and construction. The various segments of the blue economy offer potential for the further growth of the sector, as long as it maintains the capability to manufacture a large range of products, thereby maintaining and diversifying specifically tailored production.

3.2. Technology leadership in blue economy sectors

The European waterborne sector possesses the key know-how, skills and expertise to support emerging markets in the blue economy. This includes capitalising on new integrated and circular business models, for example sharing services and/or infrastructure in so called multi-use cases.

The waterborne sector is a key enabler for many of the related blue economy sectors, such as fisheries, aquaculture, renewable offshore energy and critical infrastructure at sea, in rivers and underwater. The waterborne sector will be the worldwide leader with regard to the design and manufacturing of offshore infrastructure, pipelines, cables, blue economy vessels, underwater unmanned vehicles, etc. and in the support of their maintenance, operation and protection. Furthermore, the waterborne sector will be the frontrunner in the development of artificial islands for different purposes such as floating piers, ports, energy island or for living at sea. In addition, the sector will play a key role in environmental monitoring of the underwater domain. And finally, enhancing the technology leadership in emerging blue economy sectors has the potential for spin-offs to the defence sector.

3.2.1. A leader in the design, production, operation and maintenance of specialised blue economy vessels

Vision

By 2040, the European waterborne sector unlocks the full potential of building, equipping, maintaining, operating and dismantling specialised vessels for the different segments of the blue economy. Developments of technology for zero-emission and digitalization as well as the principles of integrated and circular business models will be fully exploited by 2050.

Mission

The waterborne sector will be the world leader in design, engineering, construction and maintenance and operation of specialised blue economy vessels, inter alia fishing vessels, leisure boats, supporting vessels for the European aquaculture and tourism sector, and vessels for advanced environmental monitoring as well as carbon capture and storage (CCS).

The European waterborne sector will provide the blue economy sector with safe, secure and stable vessels in accordance with new rules, regulations and policies. The potential of digitalization will be fully unlocked, to contribute to a resilient, competitive, safe, secure and sustainable blue economy. Finally, the development of relevant skills will be essential to unlocking this potential.

With an increasing focus on security in Europe, the waterborne sector is in the centre of keeping our borders safe. This requires highly specialized vessels and equipment onboard. The interaction between security operations and other waterborne operations is in many ways new, especially considering the emerging infrastructure offshore. In a heightened security situation, rapid response and repair capabilities are very important. Finally, in the light of environmental sustainability, the waterborne sector will operate with vessels equipped with advanced sensor technology to collect data about the marine environment. This type of data will assist the development of the European Ocean Observatory and Digital Twin of the Ocean, as well as other environmentally important databases. Vessels will collect and analyse data on their own operations as well, for the purpose of energy-efficiency or safety. Reliability and integration of technology, including sharing data will be among the key factors in the transition to a zero-emission and resilient waterborne sector.

3.2.2. Resilient, sustainable and interconnected infrastructure

Vision

By 2040, the European waterborne sector will design, build, maintain and operate resilient, sustainable and interconnected infrastructure for the benefit of the waterborne and blue economy sectors. By 2050, the full utilization of digitalization will be integrated in the operation and maintenance of infrastructure, as well as the concept of working with nature and nature-based solutions. The effects of regional differences and land-sea interactions will be fully included in concept designs for infrastructure.

Mission

Resilient, sustainable and interconnected infrastructure is critical for the functioning of the European waterborne sector and the blue economy. This concerns emerging permanent and semi-permanent infrastructure at sea, as well as more permanent constructions like offshore wind platforms. Offshore ports and floating offshore substations will provide a new opportunity for a sustainable use of oceans. Smaller ports may find new business opportunities in serving small scale macro-algae or shellfish farming or other boating operations. In addition, the support to building, maintaining and operating critical undersea infrastructure will be key for the security of Europe. The growing population in coastal areas and the expansion of cities, ports and industries creates challenges. At the same time, coastal communities are threatened by the consequences of climate change, notably rising sea levels and more extreme weather conditions. The development of tourism is placing additional pressure on the use of land space and together with population growth in coastal areas, there is an increasing need for sustainable sources of water, food and energy. Infrastructure and transport coupled with tourism such as marinas and waterborne leisure crafts, are also in need for sustainable solutions. Finally, resilient and interconnected waterways are critical to the functioning of the inland waterway transport sector in Europe, as well as for supply of water to the population, industries, energy companies and agriculture around these waterways. Hence, developing and deploying infrastructure at sea, inland or in coastal regions will be critical to the functioning of Europe, specifically with climate change effecting current infrastructure and living areas. Europe will remain a frontrunner in working with nature and nature-based solutions, including its unique dredging sector.

The waterborne sector will provide solutions for design, building and maintenance of marine infrastructure, inland, coastal and more offshore, including dredging solutions. This new infrastructure will create new business opportunities and will serve the marine environment and mitigate climate change by for example so called Nature Based Solutions, smart materials, and by enabling an effective and efficient waterborne sector.

Finally, regional differences may affect the development and implementation of new technology. In the most northern parts of Europe, winter navigation is faced with new safety concerns as emerging infrastructure starts taking place at sea. The knowledge of how ice behaves and interacts with new permanent infrastructure, and how that in turn affects navigational risks, needs to be further investigated. In southern Europe, heat waves may cause extreme conditions for the crew onboard and calls for new technical solutions. The waterborne sector will ensure regional differences are taken fully into account when developing new solutions.

3.2.3. Excellence in the underwater domain

Vision

By 2040 the European waterborne sector will autonomously and safely navigate and operate below the surface with the aim to monitor, survey and protect the underwater domain. By 2050 the domain will have been has developed to enable seamless interchange of data and information above and below the surface as well as a greater connectivity amongst the blue economy sectors and the aquatic environment.

Mission

The European waterborne sector will be a key solution provider for building, equipping, maintaining, operating and dismantling the underwater domain, e.g. underwater drones and underwater and unmanned vehicles and infrastructure. Underwater manned and unmanned vehicles will be further developed to meet the demands of all blue economy and waterborne sectors, including defence. The waterborne sector will provide technological solutions and cooperate with other disciplines in order to sustain safe, viable and resilient underwater operations and infrastructure. Some of the devices require deployment from a surface ship and hence the interactions between surface and subsurface is pivotal to enable an innovative and developing underwater domain. The underwater domain can be a harsh environment and the skills and know-how from the waterborne sector are, again, crucial. The European waterborne sector will be a leader in the development of underwater vehicles and infrastructure. This means developing vehicles, sensors and other equipment as well as data handling devices.

In a heightened security situation, it is necessary to address the vulnerability of underwater infrastructure, requiring technological development and European cooperation. This includes utilizing drones, satellite images, underwater drones, and remote-controlled vessels for monitoring and data collection.

3.3. Optimising the link of waterborne transport with port and logistics operations

Changes in global trade will impact waterborne transport. Seaports are key ecosystems for the economies of the (surrounding) countries, regions and cities, but they face congestion and other challenges limiting their flexibility and potential growth. Inland ports also have a role as a logistics node, alleviating road congestion and strengthening the local and regional economies. Ports need to respond to the continued increase in maritime and hinterland traffic, to new challenges raised by environmental, safety and security issues and to the emergence of new business models for waterborne transport and offshore activities.

By 2050, due to demographic, technologic and societal changes, the demand for trade of freight and passenger traffic will be significantly different than it is today. Better use of uncongested transport by water in multimodal logistics and mobility will reduce the impact on the living environment, safeguarding air quality, safety and living and working conditions in cities, while increasing their competitiveness through effective and reliable transport, as well as sustainable jobs.

Ports are integrated in the urban fabric. The location of ports in urban environments has created opportunities for seamless multimodal logistics and mobility. Land use planning schemes have replaced the mono-function management of space with a shared use of the waterfront for housing, distribution, leisure, alternative energy, multimodal mobility and logistics. Besides the physical environment, ports evolve into digital nodes enabling real-time data sharing and smart operations. The multifunctional environment also supports transition toward a circular economy by promoting the efficient use and reuse of resources, and fostering synergies between maritime, industrial and urban activities.

In addition, ports have become hubs of clean energy, serving multiple modes of transport, as well as surrounding villages, cities and industries.

Finally, ports play a facilitating role in military mobility.

3.3.1. Port operations

Vision

By 2050, ports will offer fast, reliable and resilient services with zero-waste and zero-emissions in a safe and secure environment. Ports will be able to achieve zero-emissions in their own port operations to adapt to the new demands following the energy transition. Digitalization and other new technologies will allow the development of new digital and automated port environments to facilitate more efficient and competitive port operations. This dynamic will increase the capacity to accommodate changing cargo and passenger flows and to adapt to new energy demands.

Mission

Port operations serve both the vessel and the cargo and passengers that pass through the ports. Port operations add value to the port infrastructures by providing nautical services (signalling, traffic management, locks management, piloting, mooring, towage, etc.) and other complementary services (dredging, bunkering, waste management, inspection, maintenance, etc.). Port operations add value to the port ecosystem by providing a smooth cargo and passenger flow in their transition to the next node in the transport chain, providing efficient cargo handling services and seamless connections between transport modes. Port operations furthermore serve an important role in Europe's security facilitating military mobility and safeguarding geo-political and geo-economic resilience, for instance by serving as an energy hub.

Our mission is to develop solutions for port operations to meet the future challenges of the waterborne sector, focusing on capacity, efficiency and environmental, social and security concerns. Energy transition, the circular economy, digitalization, automation, cyber security and inter-modality, will play crucial roles. Specific attention should be given to how to deal with the transition from the current

situation to a new state. An example of this is how to ensure safe traffic management in a situation with mixed traffic of autonomous and manned vessels.

3.3.2. Towards digital and green maritime and hinterland corridors

Vision

By 2050, port actors will connect and integrate maritime and hinterland logistics to a point where they offer the lowest costs and the fastest, most reliable service with zero waste and emissions in a safe and secure environment. Inland waterways and railways corridors will evolve rapidly and play a crucial role in achieving these objectives, offering integrated multimodal solutions. Technological and logistical developments will allow not only real time information (digital corridors) but also predictive insights and advance information to flow throughout the entire supply chain, providing the opportunity to transfer the cargo in a seamless way and offering customer-tailored solutions. This dynamic will enable an innovative business environment and will foster the smart collaborative planning of ship/vessel to hinterland logistics. The integration of maritime and hinterland logistics will also provide expanding services to waterborne tourism and mobility.

Mission

Ports are key multimodal nodes linking maritime and hinterland logistics. Therefore, seaports and inland ports are not isolated, and their challenges are those of the logistics and transport system. The waterborne sector plays a key role in the integration of maritime and hinterland logistics, paying special attention to inland waterways and multimodality. The logistics sector is facing the new challenges of the logistics and transport system (characterised by capacity, efficiency, environmental, social and security concerns) through the development of new digitalization concepts such as the physical internet, which involves innovations in modularisation, intelligent cargo units, the setting of standards, collaboration schemes, robotization and artificial intelligence. This requires a further step forward in terms of the integration of maritime and hinterland logistics, in which the waterborne sector, including seaports and inland ports and waterways should retain a leading position and develop new versatile concepts for integrated door-to-door transport solutions. In developing these innovations, special attention needs to be given to cybersecurity and resilience of the network. The concept of Autonomous Cargo Transport is also a key opportunity to boost more efficient solutions to move cargo by means of autonomous ships and logistics. To successfully adapt to changing global trade and societal expectations, the optimisation of port-logistics connections must consider human factors and social resilience. The integration of digital technologies needs to be paired with programs aimed at workforce development to ensure a fair and inclusive transition.

Besides the field of digitalization, collaboration of logistics networks also has an important role in the adoption of new energy carriers through the setup of green corridors. Collaboration between different public and private stakeholders on specific maritime or hinterland trade lanes can assist in alleviating technical, operational and financial barriers for adopting sustainable alternative fuels. Numerous initiatives worldwide have started, with a great variety in goals and scope of the collaboration. Current experiences show that roll out of the concept of green corridors requires innovations in business models (such as risk sharing models) and digital decision support tools.

3.3.3. Port infrastructure

Vision

By 2050, port infrastructures will increasingly support and become integrated with port operations and maritime and hinterland logistics by establishing flexible and resilient solutions for future vessel types, hinterland logistics, new port activities and climate change. In this respect, new facilities for the bunkering and supply of sustainable energy carriers and supply of shore power for vessels, port activities and society will be developed. Cutting-edge adaptive secure communication (5G-6G, Satellite solutions, etc.) and IT architecture (real time and advanced information, etc.) will be introduced to the benefit of traffic and port management (Smart Port concept). In addition, ports will function as hubs of sustainable alternative energy, with the required infrastructure in place. City-port-nature oriented planning (building with nature, smart industry, coastal recreation, space and time sharing, etc.) will promote leisure and business integrated hubs for passenger transport, closely linked to public transport, the cities and the local tourism sector.

Mission

Port infrastructure is the base of operations for serving vessels, cargo and passengers. Given its capital-intensive nature and long lead-times, infrastructure must be planned with foresight, anticipating the evolving needs of the waterborne, logistics and transport sectors. This includes major transformations, such as the adoption of sustainable energy carriers, shore power, autonomous systems, self-organising logistics, and offshore infrastructures.

Flexible, intelligent and resilient port infrastructures are needed to support new waterborne activities, adapt to climate change, and integrate digital systems and decision-support tools. Connectivity and integration across modes will ensure seamless operations and scalability, particularly for blue economy activities.

To enable the energy transition, clear pathways, standardised procedures, and sufficient energy infrastructure, must be developed. Important topics are the provision of flexible and adaptive solutions for bunkering alternative energy carriers and onshore power supply. This should take into account local port conditions, such as the link with local industry. Clean Power Supply Plans should align with port stakeholder strategies, supported by training and workforce development across all levels.

Port infrastructure development will follow a city-port-nature oriented planning, linking waterborne transport to the territory in a sustainable manner. Social, regulatory and education elements, along with local citizens and workers, are essential to ensuring infrastructure sustainability, viability and resilience.

4. Annex I

4.1. List of definitions

The purpose of this list is to clarify the meaning of some of the terms in the document to facilitate the reader's understanding.

Blue Economy: In the 2024 EU Blue Economy Report⁷, the European Commission defines the Blue Economy as activities that are marine-based and marine-related activities which use products and/or produce products and services for the ocean and marine-based activities."

Waterborne Sector⁸: The European waterborne sector includes all relevant actors of the sector, including, inter alia, shipyards and equipment manufacturers, shipowners (both maritime and inland navigation), ports, classification societies, blue economy, infrastructure and service providers and the academic and research communities. It includes, inter alia, all main ship types, included in the cPP Zero-emission waterborne transport, and has been extended with underwater vehicles: inland waterway transport vessels, ferries, short sea shipping, offshore, cruise ships, long-distance shipping, underwater and unmanned vehicles.

Digitalization⁹: Digitalization is the broad transformation of societal and business models through the adoption and strategic integration of digital technologies. Research, development and implementation will focus on programs to improve efficiencies, enhance customer experience, provide new opportunities, enable automation, drive innovation and results in a more agile and competitive organization.

⁷ https://oceans-and-fisheries.ec.europa.eu/news/eu-blue-economy-report-2024-innovation-and-sustainability-drive-growth-2024-05-30_en

⁸ https://www.waterborne.eu/images/250123_Waterborne-Digitalization_Paper_Digital_Version_Final.pdf

⁹ https://www.waterborne.eu/images/250123_Waterborne-Digitalization_Paper_Digital_Version_Final.pdf