WATERBORNE TP has been set up as an industry-oriented Technology Platform to establish a continuous dialogue between all waterborne stakeholders, such as classification societies, energy companies, infrastructural companies, environmental non-profit organisations, manufacturers, research institutes, shipyards, ship-owners, waterway and port operators, universities, fisheries and citizen associations, as well as European institutions and Member States.
The ability of society and industry to address global and regional challenges, to meet the UN Sustainable Development Goals and the COP21 objectives (Paris Climate Conference, December 2015), to tackle societal needs and to adopt emerging technologies will determine the world of tomorrow and the life of future generations.

With more than 75% of the globe covered by water, 50% of Europe’s energy relies on the sea and the safety of the islands, the Waterborne sector will be pivotal in the coming decades, both in Europe and globally. Islands, sea islands, coastal areas and estuaries represent a significant share of the global population and serve as key transport areas, including the flow of international trade. The Waterborne sector is at the heart of the Blue Economy, which includes coastal and marine activities, such as aquaculture, tourism, energy and transport.

From the Mediterranean Sea to the freshwater bodies of the 15 largest rivers, the Waterborne sector2 (in particular inland waterways) is crucial in Europe and around the world. In Europe, Waterborne transport plays a key role in the European economy, creating more than 5.4 million jobs (about 2.25% of all European employment) and currently generating water and are becoming increasingly pivotal in the coming decades, both in Europe and globally. Islands, sea islands, coastal areas and estuaries represent a significant share of the global population and serve as key transport areas, including the flow of international trade. The Waterborne sector is at the heart of the Blue Economy, which includes coastal and marine activities, such as aquaculture, tourism, energy and transport.

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Keeping the Waterborne environment healthy and sustainable is a pre-condition for long–term European prosperity of all citizens at risk. A sustainable use and exploitation of natural resources, together with the sustainable is a pre-condition for long–term European prosperity of all citizens at risk. A sustainable use and exploitation of natural resources, together with the sustainable use and exploitation of natural resources, together with the sustainable use and exploitation of natural resources, together with the
efforts being made in the Waterborne sector.

Furthermore, the sector is already playing a crucial role in exploiting the promising potential of the new emerging markets in the Blue Economy, which includes maritime logistics, offshore wind and wave energy, and marine renewable energy, as well as an essential transport route for 40% of internal EU trade2. Waterborne tourism is a key industry, with more than 55 million passengers and nearly 400 million tons of freight transported annually. The Waterborne environment is becoming so important that the 21st

The Waterborne sector in Europe is determined to shoulder its responsibility to evolve along a green, safe, digital and efficient sustainable future. This will be central to the future of waterborne transport.

To implement its ambitious vision, the Waterborne sector in Europe is committed to making significant investments in research, development and innovation (RDI), as well as in education and training activities. These investments will have to be underpinned by an integrated, inclusive and coordinated policy and strategy across all parts of EU framework programmes and other relevant EU funding initiatives.
We should ensure that the development and introduction of new technologies and concepts goes hand in hand with education and training related to the knowledge, skills and competences needed.
To date, the Waterborne sector in Europe is well-developed, diversified and cross-cultural: it consists of three sectors with oceans, seas, lakes, canals and inland waterways as the common element.

Some of Europe’s Waterborne sectors are currently amongst the world leaders:

- shipowners control 40% of the world maritime fleet, shipyards build the world’s most complex civilian and naval ships, inland vessels or offshore platforms;
- manufacturers produce almost 50% of world maritime equipment, including sophisticated systems, equipment and technologies for civilian and naval purposes, including aquatic drones and automated systems;
- Maritime Research Centres and the inland waterway transport sector develop leading edge technology and dredging and construction companies build the most sophisticated maritime and inland waterways infrastructure in the world. Hence, the Waterborne sector in Europe has made a major contribution to Europe’s status as world maritime power and leading region in inland waterway transport.

The integration of digitalisation and automation in shipping services will be a dynamic process and will not affect the entire industry at the same time. The same applies to the introduction of alternative energy carriers and technologies designed to achieve zero-emissions. It is therefore important to acknowledge that since there are different levels of change, we should ensure that the development and introduction of new technologies and concepts goes hand in hand with education and training related to the knowledge, skills and competences needed. In this way, the developments will ensure the economically, socially and environmentally sustainable development of new technologies. The issues regarding safety, security and liability will require an environment where the highest standards prevail to create a robust, safe and secure regulatory framework.

The Waterborne sector in Europe is determined to assume its responsibility in facing the challenges, goals and needs mentioned in the Introduction. The sector has jointly developed an ambitious scenario for the future, underpinned by cross-sectoral visions and missions. In performing these missions, the Waterborne sector will be making a significant contribution to the wellbeing and prosperity of EU citizens, while continuing to be worldwide frontrunner.
The future will be characterized by a dramatic growth in population in urban areas, a major change in demography and an evolution of the international socio-economic balances. The need for global and local mobility and trade will increase dramatically, leading to more shipping which is well embedded in overall mobility and logistics systems. The effects of climate change will transform the sector and society and put them on a truly sustainable development path.

The European Waterborne sector will meet the demand for transport and the sustainability challenge by being environmentally friendly, by providing a seamless connection between transport modalities and by full integration with green and smart multimodal ports. Air and water emissions will be negligible making coastal and waterfront areas healthier and more attractive. Maritime ships and inland vessels, with their large power generation network, will be integrated within the power generation and distribution systems, thereby contributing to energy production and network equalisation.

The share of Waterborne transport and other Waterborne activities at sea and inland waters has increased due to a growing efficiency of operations. The improvement in connectivity and automation of shipping has enabled the downscaling of units and has therefore facilitated access to smaller ports at sea and in the hinterland. Better accessibility and congestion-free solutions have stimulated the modal shift to
General Introduction

Scenario 2050 for the Waterborne Sector

Missions of the Waterborne Sector

Progress and Achievements

List of Definitions

Innovative technologies are being deployed to explore and explain the oceans and the climate, to protect marine, inland waterway and coastal areas and to monitor, preserve and regenerate Waterborne ecosystems.

Waterborne transport. New business models have emerged, and these have transformed the sector and supported the seamless integration with other modes of transport. European citizens benefit directly from the modal shift from road and rail transport to sea and inland waterway transport.

Civil society has become less willing to accept the negative environmental and social externalities of economic activities in the Waterborne environment. The scarcity of qualified personnel has led the sector to improve working conditions. European stakeholders have generated a positive environment of leading competence regarding safety and security and this has been further strengthened by knowledge, skills, know-how, components, systems, products and best practices. The European Waterborne community has introduced new technologies with continuously increasing levels of safety and security.

Key Enabling Technologies connected to Industry 4.0 have provided the shipyards and production sites with the encouragement required to competitively integrate the supply chain and the different processes within shipyards and production sites. Manufacturing has shifted to process automation, where staff members control and adapt production according to the newest insights. Human knowledge, assisted by big-data and the interpretation of key performance indicators (KPIs), has become the most important asset in any manufacturing phase, while productivity has improved steadily and some segments have seen increasing levels of employment.

Shipyards have a wide network of suppliers in the nearby shipbuilding ecosystem. The role of Waterborne clusters is of great importance since it represents the connection between major local actors: industry, academia, administrations, workers and citizens. Safer, cleaner, digitalized and robot assisted industrial processes have increased the social acceptance of large manufacturing sites in populated areas.

The growth of new activities at sea and on inland waters has created new perspectives for ports as bases for supporting offshore operations and has fostered cohesion and integration between ports and cities and between workers and citizens. Dynamic business models are capable of sharing self-organising logistics and mobility and coordinated Waterborne systems between sea and inland shipping and with other modes of transport. The waterfront is a shared space in urban areas where it is good to live, work, enjoy oneself and trade.

The increase in innovative Blue Growth activities and businesses has led to the water ecosystem being considered as a basis for the sustainable management and use of Waterborne resources. New knowledge regarding the exploration of resources has led to the development of the circular economy in which raw materials, the final product and its end of life are all managed within an integrated system. Economic gains have been maximized and environmental impact minimized. Innovative technologies are being deployed to explore and explain the oceans and the climate, to protect marine, inland waterway and coastal areas and to monitor, preserve and regenerate Waterborne ecosystems.

The changes in shipbuilding, shipping and Blue Growth regarding technologies and business models have led to new types of jobs, skills and competences. The European Waterborne sector is more flexible, integrated and technological. It is able to cope with the cyclical dynamics of demand; human capital is educated, trained and upskilled in a Europe where universities, higher education and vocational education and training have transformed knowledge into skills. Both ashore and on-board jobs are more specialized and generate more revenues, supporting growth of the European economy, including an increase in employment rates.
IMPACT ON THE ENVIRONMENT

The Waterborne community will have achieved the full decarbonisation of maritime and inland waterway transport and the elimination of pollutant emissions with non-emitting ships and offshore structures, thereby achieving and surpassing the strategy recently defined by the IMO and marine energy related organisations for the reduction of Green House Gas emissions by 2050, as well as the EU strategic long-term vision for a prosperous, modern, competitive and climate neutral economy by 2050 – A Clean Planet for All, including the Strategy of the CCNR and the Mannheim Ministerial Declaration calling for the further improvement of the ecological sustainability of inland navigation.

This transition has been supported by the development of innovative technologies on-board the existing fleet, through cost efficient refitting programmes targeting both the improvement of on-board energy efficiency and the transition towards cleaner sources of energy. Ships, vessels for cargo and freight and offshore structures operate in an eco-friendly way across nature areas and serve urban and industrial activities with long range and short distance transportation, whilst at the same time ensuring the green development of blue growth business.

The implementation of a full circular economy allows efficient use of resources during the design and manufacturing stages and optimises the use, reuse, recycle and regeneration of the ship, vessel or platform itself and its on-board systems. Indeed, the new focus on the ship’s lifecycle and environmental impact requires stronger action over the course of the ship’s life time, thereby promoting intensive repairing and refitting activities in order to ensure the product’s sustainability in the long term. The product’s loop is then closed with the integration of end-of-life activities within safe and environmentally friendly recycling facilities.

A safe-and-secure policy is in place to prevent pollution from accidents. Automation and connectivity boost the Waterborne sector’s dynamism and seamless integration, as well as efficiency in the transport chain. The increased flexibility in the transport and supply chains redirects cargo flows from road to water and consequently reduces emissions per cargo unit moved and relieves congestion.

As hubs for multimodal transport and clean industries, ports are becoming green energy hubs by ensuring the carbon neutrality of their operations, the availability of infrastructure enabling the production of renewable energy and providing storage and supply to vehicles, ports machinery, vessels and ships, as well as full integration into an efficient energy grid.

Global warming has caused rising sea levels on the one hand, and changes in rainfall and river flow patterns resulting in more frequent water level variations, on the other. Flood and drought warning and emergency relief programmes have been put in place, together with the application of flood and drought tolerant design and construction standards. Risk mapping, as well as real-time, in-advance information and seasonal forecasts, advise transport users and waterfront residents and users. Water resources are protected with preventive and structural action taking into account the needs of reliable and fluid transport by water in combination with other water functions. The Waterborne sector participates in setting up an integrated system to obtain a holistic view of the environmental impact for any related waterborne operation or meteorological high-intensity event. This will enable the sector to take actions for the conservation of biodiversity, waterfront protection and depolluting operations. The assistance of continuous monitoring systems immediately recognizes any new pollution (also including air and water pollutants, noise and invasive species). Water biodiversity is fully understood and properly maintained, Waterborne resources are sustainably explored and exploited.
IMPROVING PRODUCTIVITY AND COMPETITIVENESS

Research, development and innovation (RD&I) are a cornerstone of the European Waterborne technology sector, with almost 10% of the industry’s sales being invested in research, development and innovation. RD&I is essential for European business to gain access to new markets and to develop new economic possibilities, in order to improve overall competitiveness.

RD&I has been the decisive factor for Europe to strengthen its leadership in the Waterborne sector. The European Union encourages further investment in research and development through an open innovation approach. A solid network of diverse stakeholders is a crucial catalyst for RD&I and promotes shared knowledge among Waterborne players, as well as enhancing their competitive advantage. Close cooperation between academia, research institutes and private and public players in the sector delivers a continuous stream of innovations that are swiftly implemented in the sector.

European applied research centres within the Waterborne sector are on the frontline of Europe’s Waterborne sector. They capitalize on scientific investments in several technology intensive areas, such as testing and numerical simulation, and benefit from an outstanding infrastructure of facilities. They spur competitive innovation, develop their strategic assets and consolidate Europe’s scientific and technical leadership.

REGULATORY AND POLITICAL FRAMEWORK

The unprecedented technological acceleration and the corresponding potential advances in organizational and process innovations have led to a timely and effective evolution of rules and regulations. The regulatory framework and technological innovation are complementary to each other, and the mutual interaction between all relevant stakeholders makes it possible to foster the understanding of what is technically and economically feasible.

The result of the cooperation between all relevant stakeholders represents the most valuable source of information to be provided either to the regulatory or the legislative framework and allows the definition of rules and regulations that are coherent with the development of new technologies.

A flexible European regulatory framework for innovative ships sailing under European flag and for platforms has been implemented, assuring harmonization of rules for all member states. The seamless integration of the Waterborne sector in the entire logistics and mobility chain is fostered by avoiding regional fragmentation of regulations.

The interaction of highly automated ships, vessels or platforms, aquatic drones and smart buoys with traditional ships and vessels is taken into account in traffic control and regulations at sea, on inland waterways and in ports. Similarly, full development and deployment of ICT and AI (Artificial Intelligence) technologies, digitization of data process flows and integration/standardization of tools for design disciplines with a fast and global pace, is facilitated.

The industry 4.0 evolution has determined the role of port infrastructures, which is supported by appropriate regulation, especially for interactions between man and machines or for the management of innovative and disruptive technologies. Building a sustainable and inclusive transport system goes hand in hand with policies providing guidelines and support for the initial move towards clean, sustainable and automated technologies.

Initiatives have been taken and implemented to re-skill and redeploy people working in the waterborne sector, as a result of the impact of innovation and digitalization on skills, competences and jobs. A pro-active attitude, stimulating R&D and supporting test infrastructures and facilities, boosts the economy as long as it is integrated in an overall strategy for economic development.

While undergoing the unprecedented transition of greening and digitalisation, it is essential for the waterborne sector to have access to an open and fair international level playing field, as well as a multimodal playing field within Europe. Therefore, European policy ensures that innovation is not stifled, but rather is stimulated at all international fora.
The Waterborne sector in Europe is determined to assume its responsibility, considering the major role that oceans, seas, inland waterways and lakes will play in the coming decades in addressing global and local challenges, in meeting the UN Sustainable Development Goals and in fulfilling societal needs.

To that end, the Waterborne sector has developed ambitious visions based on a series of cross-sectoral missions and focused on the transformation of Waterborne transport, blue growth activities and the integration of shipping and inland navigation into seamless port and logistics operations.

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

- The transformation of Waterborne transport;
- Developing European leadership and new business models for blue growth sectors;
- Integrating shipping and inland navigation into seamless port and logistics operations.

**Green and clean Waterborne transport**

**VISION**

Waterborne Transport will be the most sustainable mode of transport. To achieve this aim, all harmful environmental emissions (including pollutant and greenhouse gas emissions), as well as water pollution, waste and noise, will be eliminated. Shipping and inland navigation are also shifting their power generation towards sustainable options, including renewable energies. The sector's targets are two-fold: first of all, to tackle new-build short sea ships and new-build inland vessels (by 2030), to decrease emissions during navigation by 50% for other ship types (by 2030), and...
secondly, to address all ship types operating deep-sea trades (by 2050). To achieve these targets, cross-sectoral cooperation with other modes of transport and even other related sectors, embracing the overall logistics and mobility chain, will be essential. The identification of innovative business models will be crucial in reaching such targets.

**MISSION**

The Waterborne sector will build and operate economically competitive ships that completely eliminate harmful emissions to air (including pollution and greenhouse gas emissions), water and noise from shipping by 2050 and will exceed the IMO GHG emission reduction goals and 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.

**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 2030, new technologies and new methodologies will radically improve the management of the safety of ships (both maritime and inland waterways) 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. It will include 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 ships, vessels and equipment that will become more complex, larger, with more freight and more passengers and increased payload, year after year. 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.

The position of EU shipyards and technology suppliers shall be strengthened by delivering safe and secure ships and vessels, primarily for complex or critical ships and vessels and for new business models. The European community will represent the forefront of innovation in safety defining standards, enabling the application of new materials and ensuring a safe “marinization” of innovative technologies. On the basis of a solid safety culture and by leveraging European technical excellence, technical contributions shall be provided to the process of regulatory definition at IMO, CESNI, CCNR, UN-ECE and other competent bodies.

**Connected and automated Waterborne transport**

**VISION**

Digitisation will connect smart ships and vessels as well as smart ports and smart infrastructure. It will enhance data flows. It will also lead 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 2030. Future ships and vessels will be designed so that they can be continuously updated with the digital technologies throughout their lifecycle. Connectivity and automation 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 smart and connected ships and vessels, with a focus on improving efficiency in Waterborne logistics.

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.

Safe, competitive and eco-friendly shipyards and production sites

VISION
By 2030, digitisation and automation will also lead to the use of advanced design and production technologies, which will deliver flexible and cost-effective ships, vessels and offshore structures with competitive production costs and increased productivity by 50%. They will, furthermore, contribute to the establishment of an entire production chain of safe, competitive and eco-friendly shipyards and production sites. They will enable European shipyards to master the increasing complexity of ships and vessels, maintaining their leadership in the area of specialized ships and vessels and increasing their market share of new ships and vessels of other types.

MISSION
The Waterborne sector will be the world leader in design, engineering, construction and maintenance of ships, vessels, equipment, infrastructure and integrated complex systems in high value ships, equipment and infrastructure throughout their lifecycle.
DEVELOPING EUROPEAN LEADERSHIP AND NEW BUSINESS MODELS FOR BLUE GROWTH SECTORS

The Waterborne sector is determined to enhance the understanding of the Waterborne environment through more efficient dissemination of a European water science model, which is capable of providing a holistic view of the environmental impact for any Waterborne operation and enabling the EU to carry out large scale depollution and climate change resilience actions.

Simultaneously, the Waterborne sector will produce technologies and systems to facilitate the exploration and exploitation of the oceans, seas and inland waters as a source for energy, food and minerals. It will therefore promote innovative technologies to facilitate and transform human life and activity in the Waterborne environment.

Understanding and protecting the oceans, seas and inland waters

VISION

The Waterborne sector will enhance Europe’s capability in ocean, sea and inland water observations, protection and sustainable exploitation, promoting the development of blue technologies, giving technical support to inland waters, coastal and maritime planning and management, and trying to connect the waterborne sector with the challenges of the coming decades, namely:

- good environmental status enforcement;
- seabed and water depollution;
- ocean acidification reduction and carbon transformation;
- deep sea understanding and exploration.

By 2030, a fully integrated ocean, seas (including deep sea) and inland waters monitoring system will be implemented. This system will provide a holistic view of the environmental impact of any waterborne operations.

MISSION

A sound management of the oceans, seas and inland waters, combined with the sustainable use of water resources, are the key factors for the long-term protection of the water environment. In cooperation...
with marine research, the Waterborne sector will develop a deeper understanding of the structure and the functioning of water ecosystems, including both biotic and abiotic processes. This clear understanding will represent the "license to exploit" for all waterborne activities in a changing climate (including carbon transformation and deep sea monitoring).

The oceans, seas and inland waters as a source/font of natural resources

VISION

The Waterborne sector will produce technologies, systems and processes to facilitate further exploration and exploitation of the oceans, seas and inland waters as a source for energy, food and minerals, and to ease their provisional storage and, in time, transport. By 2030, floating wind turbines, tidal turbines and other energy sources (e.g. waves, thermal and salinity) will become technically viable for large scale applications, cost effective for remote areas and will be installed in many European coastal and inland regions or offshore areas. Fixed and floating installations will produce fresh water, while aqua-farming and related bio-technologies will satisfy the demand of the European market. By 2030, the Waterborne sector will have the first deep-sea mining pilot installations available as a basis for future sustainable and reliable industrial operations.

MISSION

The Waterborne sector will pursue the sustainable utilisation of oceans, seas and rivers that represent vast, but limited, resources. Attentive environmental impact monitoring and priority given to renewable resources will guarantee the “rules of engagement” for further exploitation of natural resources. The concurrent use of oceans, seas and inland waters for traditional maritime activities (e.g. shipping, fisheries, oil & gas and tourism coastal activities) and new large-scale activities (e.g. offshore marine renewable energy, aquaculture, nautical leisure, etc.) will be enabled through Maritime Spatial Planning and Maritime integrated strategies. The Waterborne sector has identified six key areas as main drivers to unlock sustainable jobs and growth: green Oil & Gas exploration and decommissioning, ocean energy, marine biotechnology, mariculture, waterborne leisure and selected seabed mining.

The knowledge and experience gained in the development of oil and gas activities should be transferred to the ocean energy and/or to deep sea mining sector; innovative technological solutions should be sought to enhance energy conversion, whilst storage, transport and distribution efficiency should be integrated in the emerging marine renewable energy facilities; substructures and/or integrated floating systems need to be developed for installation in deeper waters and harsh marine environmental conditions, etc. Synergies will be developed with solutions for connected and automated Waterborne transport, as well as for connected and automated Waterborne offshore structures.
Efforts to facilitate more permanent and longer stays offshore will be combined with rural and coastal expansion into the sea.

Working and living at sea

VISION

Population density in coastal areas is increasing due to the numerous employment opportunities related to waterborne activities. Many coastal areas are running out of space for cities and the expansion of industries and ports. At the same time, they are threatened by the consequences of climate change, notably rising sea levels. The development of mass tourism is placing additional pressure on the use of land space and the population growth in coastal areas is also increasing the need for sustainable sources of water, food and energy. In the traditional Oil & Gas industry, offshore workers stay offshore for a number of weeks, after which they return to land where they spend a period of time. As part of the mission related to living and working at sea, efforts to facilitate more permanent and longer stays offshore will be combined with rural and coastal expansion into the sea. This will include the workforce for offshore (renewable) energy production, storage and distribution of goods, carbon transformation, aquaculture and maritime leisure. It is expected that with an increased quality of life offshore, workers will stay offshore for longer periods of time and even take their families with them. Therefore, communities will gradually become established offshore, meaning that this expansion will require support facilities such as schools, shops and other facilities.

As offshore installations of this type are no longer a dream, the Waterborne sector is taking advantage of offshore coastal protection developments to provide a safe marine environment to artificial islands and is promoting the appropriate multi-use of space and multi-use offshore combinations, in keeping with the Marine Spatial Planning, Connecting Europe Facilities planning and Strategic Energy Technology Plan (SET-Plan).

The waterborne sector will develop multi-purpose modular systems to support and protect offshore workers, to allow good living conditions at sea and to provide offshore recreational facilities by 2030. With multi-use offshore platform combinations, the waterborne sector’s ambition is to produce, in Europe, the first floating islands for large-scale industrial or recreational activities and inhabitation by 2050.

MISSION

Working and living at sea will change over the next few decades, with increasing offshore activities following the main drivers discussed above. Traditional maritime working patterns of weeks offshore followed by weeks at home may not be feasible or desirable for the workforce of the future. Due consideration should be given to technological and business models for fostering maritime activities. Digital communication and remote relations are becoming more and more common, enabling offshore working and living, while at the same time opening new possibilities for people to live in a waterborne environment. The Waterborne sector will foster increased automation and robotics, supported by an adjustment of expertise and an increase in diversity in the workforce. The current workforce will be faced with a shift of employment requiring education and training. Cost-effective benefits will be achieved by integrating different systems on the same platform, e.g. multipurpose offshore platforms might be designed to host marine renewable energy devices, aquaculture installations, monitoring systems, fresh water production, etc. However, design and manufacturing, as well as installation, operation, maintenance and decommissioning present several technological challenges to be overcome through the development and extensive use of efficient design and production paradigms for complex structures, as well as the development of innovative materials for modular structures and rapid prototyping. Finally, the concurrent development and integration of fully autonomous and smart ships and vessels, is essential to increase connectivity and ease maintenance controls. Both the working activities and the offshore territorial expansion require a durable, affordable and safe solution in creating space at sea. To achieve this, questions regarding classification, insurance, regulations and governance will need to be properly addressed.
The increase in global trade will impact Waterborne transport, since there is no real alternative for the large-scale movement of goods. Seaports are key infrastructures for the economies of the (surrounding) countries, regions and cities, but they face congestion and other challenges limiting their flexibility and potential growth. At the same time, inland ports could be better integrated in transport and logistics supply chains. The need to respond to the continued increase in maritime and hinterland traffic, to the new challenges raised by environmental, safety and security issues and to the emergence of new business models for waterborne transport and offshore activities, will require new solutions and scalable alternatives, including new near shore and offshore infrastructures.

By 2050, 80% of the EU population will live in urban areas, which will lead to an increase in freight and passenger traffic. While expansion of the existing land infrastructure is often challenging and expensive, in order to meet the increasing demand for public transport and city logistics, EU cities located along uncongested waters will fully seize the potential of transporting goods and people by smart, clean and modular ships and embed these services in multimodal solutions. People and goods will reach their destination in a reliable, affordable, healthy and safe way. Better use of uncongested transport by water in multimodal logistics and mobility will drastically 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.

**Port operations**

**VISION**

By 2050, ports will offer the fastest, most reliable service with zero-waste and zero emissions in a safe and secure environment at the lowest cost. Therefore, ports will be able to achieve zero-emissions in their own port operations and to adapt to the new demands following the energy transition. Driven by automation and cyber-physical systems, blockchain, artificial intelligence (AI) and other new technologies, Industry 4.0 will allow new digital and automated port environments to assist nautical operations, ship-port communication, cargo handling and other port operations. This dynamic will improve efficiency and increase the capacity to accommodate changing cargo and passenger flows. Moreover, the evolution of new socio-economic trends (blue growth, waterborne tourism, cruisers, automated transport, etc.) will lead to new port services and operations and to the enhancement of societal responsibility (employability, accountability, etc.) of port activities.

**MISSION**

Port operations serve both the ship/vessel and the cargo and passengers that pass through the ports. Port operations add value to the port infrastructures to provide easy navigation and give shelter to ships and
vessels with nautical services (signalling, dredging, traffic management, locks management, piloting, mooring, towing, etc.) and other complementary services (dredging, bunkering, waste management, inspection, maintenance, etc.).

Furthermore, port operations add value to the port infrastructures to provide a smooth cargo and passenger flow in their transition to the next node in the transport chain, providing efficient cargo handling services and connections between transport modes. Finally, port operations should be adapted to meet the future challenges of the Waterborne sector, characterized by capacity, efficiency, environmental, social and security concerns, in which energy transition, the circular economy, digitalisation, robotization, inter-modality and collaboration, amongst others, will play a crucial role.

**Integrating maritime and hinterland logistics**

**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. In this regard, ports will be able to achieve zero-emission in port-hinterland logistics. Inland waterways and inland ports will evolve rapidly and play a crucial role in achieving these objectives, offering integrated multimodal solutions. Technological and logistical developments will allow real-time information (digital corridors) to flow throughout the entire supply chain, providing the opportunity to transfer the cargo in a seamless way and offering customer-tailored solutions (synchronisation, cost/time trade-off, new cargo handling solutions, etc.). This dynamic will enable an innovative business environment and will foster the smart collaborative planning of ship/vessel to hinterland logistics (capacity sharing, self-organising logistics, physical internet, coordinated inland navigation, etc.). The increasingly changing demands from the logistics sector (sustainable procurement, real-time cargo status visibility, etc.) will enable the adoption of new concepts like modularisation of cargo to achieve secure inter-modality in transport (last-mile integration, Internet of Things for Customs and security, etc.). The integration of maritime and hinterland logistics will also provide expanding services to waterborne tourism and mobility, cruises and ferries, waterbuses and water taxis.

**MISSION**

Maritime transport is part of complex logistics chains and transport networks where ports are key multimodal nodes linking maritime and hinterland logistics. Therefore, waterborne transport seaports and inland ports are not isolated, and their challenges are those of the logistics and transport system. The Waterborne sector should play a key role in the integration of maritime and hinterland logistics, paying special attention to inland waterways and multimodality. The multimodal transport container is an example of previous developments which have taken this integration to a higher level through standardisation in an intermodal transport chain. Port community systems (PCS) and River Information Services (RIS) are other examples related to the integrated management of information. The logistics sector is facing the new challenges of the global/local – or so-called “glocal” – logistics and transport system (characterised by capacity, efficiency, environmental, social and security concerns) through the development of new concepts such as the physical internet, which involves innovations in modularisation, collaboration schemes, robotization, artificial intelligence and other IT technologies. This requires a further step forward in terms of the integration of maritime and hinterland logistics, in which the Waterborne sector, seaports and inland waterways and ports should retain a leading position and develop new versatile concepts for integrated door-to-door transport solutions.

**Port infrastructure**

**VISION**

Port infrastructures will increasingly support and become integrated with port operations and waterborne and hinterland logistics by adapting near-shore extensions and offshore ports and by establishing flexible and resilient solutions for future ship and vessel types, hinterland logistics, new port activities and climate change. In this respect, new
facilities for the (re)generation of zero emissions energy and green supply for ships, vessels, port activities and society will be developed. Cutting-edge adaptive secure communication and IT architecture (real time information, etc.) will be introduced to the benefit of strategic traffic and port management and ship-assist infrastructure (smart berths, towage, mooring, MARPOL, bunkering, etc.). Furthermore, city-port-nature oriented planning (building with nature, smart industry, coastal recreation, etc.) will promote leisure and business integrated hubs for passenger transport, closely linked to public transport, the cities and the local tourism sector.

MISSION

The port infrastructure is the base for port operations to serve the vessel, cargo and passengers which pass through ports. The development of port infrastructures requires capital-intensive investments, a long lead-time and therefore long-term planning. This means that the design of port infrastructures should anticipate the needs of the Waterborne, logistics and transport sector. This is an especially difficult task at a time when the transport and logistic sector is immersed in a deep transformation, as is currently the case, affecting both maritime and inland aspects (new fuels, autonomous transport and cargo handling, self-organising logistics, new business models, etc.). Furthermore, port infrastructures should also anticipate and adapt to the development of new waterborne activities (blue growth) and to other external factors, such as new extreme weather conditions resulting from climate change. There is a need to design more flexible, intelligent and resilient port infrastructures which are able to adapt to future requirements. The European Waterborne sector should identify and develop different lines of research and innovation in order to adapt port infrastructures to this vision of the future.

The Waterborne sector wishes to lead a long-term business transition; port infrastructures will become adaptive to new ships, vessels, inland waterways and offshore activities supporting blue growth, which are suited to further scalability. Connectivity and integration will be developed to ensure continuity among different transport modalities and different ships, vessels and vehicles. Infrastructure must be resilient to environmental challenges. To accommodate the fast implementation of the energy transition, clarity is needed on the most likely transition path. Furthermore, the development of new, more flexible solutions for bunkering and energy storage is required to enhance the resilience of investments in alternative fuels. Infrastructure should also integrate intelligent technologies and efforts should be made to allow infrastructures to be able to collect data in order to meet all requirements from the point of view of the market and the maintenance of the infrastructures themselves. Within European ports, infrastructure will be developed following the paradigm of city-port-nature oriented planning, cohesively linking shipping to the territory in a sustainable manner. The social, political and regulatory elements are fundamental to future changes in the sector. The workers and the inhabitants of the cities annexed to the ports, etc. are the sector’s main assets as both customers and suppliers of labour to ensure the sustainability and viability of the infrastructures through which the cargo and the associated information move.
This approach will ensure that effective mechanisms are developed to enable adequate research coordination and cooperation between the relevant stakeholders at EU level.

had a considerable and long term innovative impact, stimulating ground-breaking technologies which have undoubtedly made a significant contribution to the development of the Waterborne community research agenda. The Waterborne community has made essential contributions to the sector and the overall welfare of European citizens through the implementation of several innovative projects, at the national, European and international level. Research has played a crucial role in proposing solutions supporting the implementation of environmental policies in order to drastically reduce emissions, to improve energy-efficiency and to develop production techniques and ground-breaking technologies.

The EU framework programmes for research and innovation have stimulated these developments, for example, through research focusing on business models, processes and products. The design of energy saving devices and solutions has considerably enhanced the overall efficiency of vessels (both inland and maritime). Similarly, the effectiveness and reliability of a holistic energy saving approach and emission reduction technologies at full scale have improved, in line with end users’ needs and requirements.

“The ship itself progressively improved thanks to innovative propulsion concepts developed with a large range of novel, alternative and optimized conventional devices. The hybrid propulsion and power have been demonstrated as an effective means to reduce energy consumption on small vessels. More recently, studies on alternative fuels and fuel cells have been conducted leading to a better assessment of the feasibility of new technologies and the design of new components.”

Ship and offshore structure design has contributed to the efforts to reduce emissions and to increase energy efficiency: research activities are succeeding in introducing innovative methodologies, integrating operational requirements (performance indicators, life-cycle cost, environmental impact) at an early design stage within a circular economy approach.

The technological development of production sites has also been supported since 1992 and has significantly improved vessel-building techniques along the whole supply chain, addressing the challenging task of systematically introducing innovative welding techniques, increasing automation levels while ensuring the highest safety. Most recently, new progress has been made in innovative materials and their wider use as a mean to improve the life cycle performance of European built ships and maritime structures.
Moreover, European action has also been focused on the improvement of port logistics (especially as far as container terminals are concerned) and sea traffic management within an efficient and environmentally sustainable framework. Considerable attention has therefore been given to inter-modality, with the purpose of integrating the Waterborne transport mode and infrastructures with the hinterland network, through the support of disruptive technologies and innovative concepts.

The regulatory framework has been addressed from an R&D perspective in order to define clear and sustainable standards in terms of technical and environmental requirements for the sector. Successful cooperation has been put in place among regulatory institutions, academic partners and Waterborne stakeholders in order to meet the sector’s needs and the increasingly compelling political and societal demands, while addressing the regulatory process at EU and international level (such as IMO).

Conversely, as far as Blue Growth is concerned, significant efforts have been made to capitalise the European Commission’s funding on marine and maritime research by ensuring accessibility and uptake of research Knowledge Outputs by end-users: policy, industry, science and wider society. The understanding of oceans, seas and inland waters and related advanced technology is, indeed, crucial in order to grow Waterborne economic potential in a sustainable manner.

Building on these achievements, the Waterborne sector is looking ahead to the new opportunities and challenges of a competitive green economy leading to a flourishing society to which it will contribute with decarbonized and climate resilient ships, equipment and infrastructure to offer cutting edge services in Europe and the world.
LIST OF DEFINITIONS

BLUE ECONOMY
In the 2018 Annual Economic Report on EU Blue Economy, the European Commission defines the Blue Economy as “All economic activities related to oceans, seas and coasts. It covers a wide range of interlinked established and emerging sectors.” In this agenda, activities related to inland waterways and lakes are also considered to be part of the Blue Economy.

BLUE GROWTH
According to the European Commission (DG MARE), Blue Growth is “the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole.” In the Strategic Research Agenda, activities related to inland waterways and lakes are also considered to be part of Blue Growth.

WATERBORNE SECTOR
consists of deep and short sea shipping, inland navigation, port and logistics and blue growth, including classification societies, energy companies, infrastructural companies, environmental non-profit organisations, manufacturers, research institutes, shipyards, shipowners, waterway and port operators, universitites, fisheries and citizen associations, as well as European Institutions and Member States.

GREEN PORTS
A green port is a port that manages to balance environmental challenges with economic demands (www.greenport.com)

AUTOMATED SHIPPING
automated shipping may refer to various levels of automation, ranging from steering assistance to full automation of navigation.

1 The Waterborne Sector consists of waterborne transport, blue growth and ports, including their manufacturing value chain, research communities and related industries, including representatives of public authorities.
4 http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGfinalstrategy.aspx
5 https://ec.europa.eu/transport/modes/inland/promotion/naiades2_en
6 Strategy adopted in December 2017: “The CCNR also continues to support national, regional and global sustainability goals and initiatives, in particular by adopting the vision of zero emissions from inland navigation vessels by 2050”;
8 e.g. GRIP project (Green Retrofitting through Improved Propulsion), FP7 contract n. 284905; HERCULES project (High efficiency engine R&D on combustion with ultra-low emissions for ships), FP8 contract n. 506676; HERCULES-B project (Higher-Efficiency Engine With Ultra - Low Emissions For Ships), FP7 contract n. 217878; HERCULES-C project (Higher Efficiency, Reduced Emissions, Increased Reliability And Lifetime, Engines For Ships), FP7 contract n. 284354; HERCULES-2 project (Fuel Flexible, Near -Zero Emissions, Adaptive Performance Marine Engine), H2020 contract n. 834535; NEWS (Development of a Next generation European Inland Waterway Ships and logistics system), FP7 contract n. 316055; INBAT (Returning Back to Nature - Inland Water Transportation), FP5 n. 00458
9 e.g. LeanShip project (Low Energy And Near to zero emissions Ships), H2020 contract n. 636146; MOVE IT! (Modernisation of vessels for Inland waterway freight Transport), FP7 contract n. 285405.
10 e.g. MC-WAP project (Molten-carbonate fuel Cells for Waterborne Application), FP6 contract n. 19973; STREAMLINE project (Strategic Research for Innovative Marine Propulsions Concepts), H2020 contract n. 688191; JULES project (Joint Operation for Ultra Low Emission Shipping), FP7 contract n. 805960.
11 e.g. INTERSHIP project (Integrated collaborative design and production of cruise vessels, passenger ships and RoPax), FP6 contract n. 506127; BESST project (Breakthrough in European Ship and Shipbuilding Technologies), FP7 contract n. 233980.
12 e.g. RAMSSES project (Realisation and Demonstration of Advanced Material Solutions for Sustainable and Efficient Ships), H2020 contract n. 723246; MOSAIC project (Materials Onboard: Steel Advancements and Integrated Composites), FP7 contract n. 314037.
13 e.g. GREENCRANES project (Green Technologies And Eco-Efficient Alternatives For Cranes And Operations At Port Container Terminals), TEN-T contract n. 2011-EU-92058-S; MGNALISA 2.0 project (Motorways And Electronic Navigation By Intelligence At Sea), TEN-T contract: STM Validation Project (Sea Traffic Management), CEF contract: SAURON project (Scalable Multidimensional Situation Awareness Solution For Protecting European Ports), H2020 contract n. 740477; TT project (Transforming Transport), H2020 contract n. 731932; INTER IoT project (Interoperability Of Heterogeneous Iot Platforms), H2020 contract n. 687283; COREALIS project (Capacity with a pOSitive enviRonmental and societAL footprInt: portS in the future era), H2020 contract n. 768994.
14 e.g. FLAISHIP project (European Framework for safe, efficient and environmentally-friendly ship operations), FP6 contract n. 31406; SAFEDOR project (Design, Operation and Regulation for Safety), FP6 contract n. 516278; GOALDS project (GOAL Based Damage Stability), FP7 contract n. 233876.
15 e.g. COLUMBUS project (Monitoring, Managing and Transferring Marine and Maritime Knowledge for Sustainable Blue Growth), H2020 contract n. 652690.