

GLOBAL TRENDS

GLOBAL TRENDS
DRIVING
MARITIME
INNOVATION



WATERBORNETM

Maritime Europe Strategy Action

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GLOBAL TRENDS AND DRIVERS

The world in 2030 will be shaped by powerful and relatively certain global trends that we observe today. Societal trends are a continued population growth and increasing urbanisation, increasing difficulties in providing adequate amounts and quality of food and water and continuously increasing expectations with regard to health, safety, security and our impact on the environment. Significant economic trends are the increasing GDP share of developing countries; a continued growth of energy consumption, and a growing volume of trade with changing patterns. The two possibly biggest drivers are climate disruption and digitalisation. Both are accelerating and their impact might be larger than currently expected.

The following key trends have been observed and are considered to be influential for the future of the Waterborne industries:

- The **world population** is predicted to increase to 8.5 billion in 2030 from 7.3 billion in 2015. At the same time, the share of people living in urban agglomerations will increase to about 60% in 2030.
- **Water demand** will grow to 5500 km³ in 2050 from 3500 km³ in 2000. The rapidly growing water demand from cities, industry and electricity suppliers will challenge water available for irrigation which in turn challenges **food production**.
- Society's increasing expectations of adequate **health, safety, security** and the greater awareness of the impact of industries on the **environment** will lead to stricter regulations and will require the Waterborne industries to improve in these areas.
- While in many OECD countries GDP development is predicted to grow steadily by a low single digit number, developing countries will have **higher growth rates**, e.g. China and India are predicted to at least double their GDP from 2015 to 2030.
- World primary **energy production** grows at 1.5% p.a. from 2012 to 2030. The Asia Pacific region is responsible for 47% of the increase in global energy production. There will be a similar share of fossil energy consumption between oil, gas and coal, these continuing to be the main energy sources. While energy consumption will grow marginally for OECD countries, developing countries will increase their energy consumption by approximately 75%.
- **Waterborne trade growth** will be driven by the economic growth of developing countries and global growth in demand for food, water and technological products.
- It is expected that climate will change dramatically, causing an increase in temperature extremes, more severe rainfall and flooding, higher frequency of storms and continuous and increasing polar ice melting, all leading to possibly severe operational disruptions.
- With massive growth in computational capacity and data storage capabilities, globally accessible networks and cloud infrastructure with increasing bandwidth, availability of smart devices (Internet of Things) and smart and cheap sensors, a significant increase of **digitalisation in all Waterborne sectors** is expected.

GLOBAL MARITIME TRENDS AND DRIVERS

Continued population growth and urbanisation will increase demand for focused Waterborne services and for the upgrading of infrastructure.

With continued population growth in Africa, Asia and South America during the coming decade and the continuing trend towards urbanisation, demand for Waterborne services will increase between these growth regions and will in particular need to focus on serving future mega-cities. This also requires an upgrade of the respective infrastructure.



Population growth leads to:

- Increasing urbanisation will lead to new and upgraded port infrastructure
- Increased Waterborne transport in general
- Increased use of ferries, cruise ship and leisure craft in particular

Food and water demand is increasing with supply becoming challenged which will result in an increased need for water transport and aquatic food production.



Population growth, increasing urbanisation and industrialisation will lead to increased food and water demand. At the same time, the availability of food and water will be reduced, principally because of deteriorating conditions to grow food and access to clean water due to climate change effects. This will lead to an increasing demand for Waterborne transport of food and water and a commensurate growth in the related infrastructure. Aquatic food production is also expected to rise.

Food and water supply challenges will give rise to:

- Transport of fresh water
- Transport of food
- Food production at sea (fish farming, aqua farming)
- Installation of desalination plants
- Need for specialised infrastructure

Society's increasing expectations with regard to health, safety, security and the environmental impact of industry will lead to stricter regulations and require the Waterborne industries to improve in these areas.

Civil society, consumers and workers will become less willing to accept negative environmental and social impacts of economic activities in the maritime sector such as, e.g. accidents, water pollution, and unsafe working conditions. The expected increasing scarcity of qualified personnel will also motivate the sector to improve working conditions. Societal expectations will, therefore, lead to the maritime sector becoming more socially and environmentally responsible by complying with stricter regulations and possibly by adopting voluntary standards. The impact of societal expectations related to health, safety, environmental and security on the maritime sector is moderate and will not fundamentally alter the sector's future prospects.

Health, safety and security expectations will affect:

- Crew working conditions, and seafarer safety
- Stricter safety and security standards

Limitations on GHG emissions will require:

- Reduction of energy consumption by Waterborne transport
- Use of cleaner fuels, like LNG, and hybrid solutions
- Electrification of ships
- Ports infrastructure for bunkering alternative fuels

Reduction of environmental impact will demand:

- Stricter environmental regulations for shipping to reduce emissions to air and sea
- Stricter regulations for offshore activities, including renewable energy
- Stricter emission control in port areas



Developing countries will continue to increase their share of global economic growth, which will in turn increase trade with these countries.

Future economic growth will be increasingly driven by innovation instead of population growth. The middle class in the developing countries will increase and will drive consumption of technological products. This will increase the need for raw materials and manufacturing and will also increase Waterborne transport of manufactured goods. As Africa will gradually replace Asia as the region with the highest growth rate, Waterborne trade to and from Africa will increase.

Economic growth

- Increased transport of goods, energy, raw materials
- Increased transport of fresh water
- Harvesting raw materials offshore
- Significant investment in new port facilities

European economic growth

- Competitive maritime industry
- Increasing number of maritime jobs within Europe
- Increasing number of ships under European flags



Global growth of population and GDP will increase energy consumption, despite higher energy efficiency of facilities and equipment.

The majority of the required energy will still be produced from fossil sources. There will be a nearly equal share between coal, oil and gas. Largest growth rate, however, will be seen for renewable energy sources. Based on an increase of oil price in the long-term, the trend for exploration of fossil energy sources will continue to offshore locations rather than onshore and to deeper waters and harsher environments. More complex energy sources such as tar sands or methane hydrates will also be exploited. Energy production on offshore wind farms will significantly increase and also other water-based energy production devices using wave and tidal current energy will have a larger market.



Energy demand and supply will require:

- In Europe large increase in renewable energy
- Significant increase in production and transport of clean fuels (LNG, shale gas, hydrogen)
- Exploration of reserves in deeper water, and harsher environments
- Port infrastructure for offloading

Waterborne trade growth will be driven by economic growth of developing countries and global growth in demand for food, water and technological products.

The low transport cost of shipping compared to other means of transport is the reason that about 90% of global goods transport is by sea. Improvement in port infrastructure and logistic chains and the new generation of energy efficient vessels will benefit seaborne trade and maintain the leadership in international freight transport.

Waterborne trade growth will lead to:

- Increase in throughput of ports
- Port congestion, increasing ship size will lead to port extensions
- Alternative fuel trade leads to transport of LNG, methanol or hydrogen
- Bunkering of alternative fuels



Climate change will lead to more flooding, drought, extreme weather events and polar melting and will impact all Waterborne sectors.

The climate will continue to change, increasing the frequency of temperature extremes, producing more severe rainfall and flooding, bringing a higher frequency of storms and continuous and increasing polar ice melting.

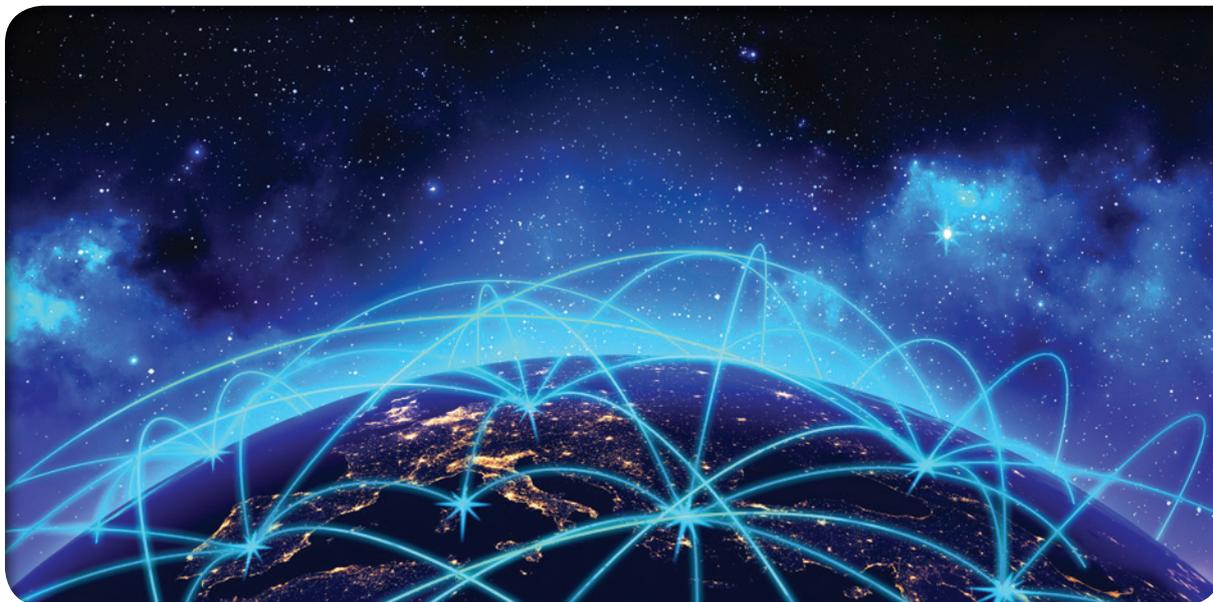
Extreme weather due to climate change will give rise to:

- Increased requirement for robustness of ships, ports and offshore structures for more severe weather conditions
- Increased use of weather routing
- Utilisation of arctic routes (Northwest, Northeast)
- Exploitation of arctic fossil fuel reserves
- Enforcement of coastal infrastructure (dikes, ship fairways)



The fast development in information and communication technologies will increase digitalisation in all Waterborne sectors and will significantly influence design and operation of assets.

With massive growth in computational capacity and data storage capabilities, globally accessible networks and high bandwidth cloud infrastructure, availability of smart devices (Internet of Things) and smart and cheap sensors, a significant increase of digitalisation in the Waterborne sector is predicted.



ICT developments will lead to:

- Higher degree of automation, automation of systems, autonomous operation
- Sea-based and shore-based operation: integration and transformation
- Need for secure connectivity against cyber attacks
- Electronic data instead of legal paper documentation
- Digitalisation will lead to data access issues, IPR, etc.

EU MARITIME COMPETITIVE STRENGTHS

The analysis of global trends through to 2030 clearly indicates an increasing demand for shipping of all types, from coastal food and water carriers, through vessels for supplying the growing mega cities, to large and sophisticated cruise ships to provide leisure activities for the new middle classes. This creates significant opportunities for the global maritime industry, its extensive supply chain and the infrastructure which supports it.

The EU's maritime industry is characterised by high value added endeavour, rapid innovation, high safety standards, and a leading position on green technologies. A strategy to build on these strengths will ensure that the EU retains its competitive position in the global maritime industry and reaps the rewards in terms of jobs and wealth creation.

With that aim in mind, over the next 15 years, research effort will be focussed on providing the sophisticated technologies which will be needed in the high value vessels, services and infrastructure of the future. EU strengths today include:

- Complex, high-value added vessels such as:

- Naval vessels
- Cruise ships, super yachts and recreational craft
- Supply vessel, offshore service vessels, tugs and harbour support vessels
- Short sea shipping
- Dredgers and inland waterway vessels
- Research and survey vessels
- Salvage, search and rescue vessels and supporting technology

- Specialised maritime equipment

- Propulsion components
- Underwater technology
- High power electrical components
- Vessel control and bridge equipment
- Systems integration technology
- Production and manufacturing technologies

- Port and infrastructure technologies

- Enablers

- Model basins, test and research facilities, universities
- Classification societies
- Training facilities, simulators, design tools
- Well educated staff

EU MARITIME OPPORTUNITIES 2030

The global maritime opportunities combined with the current EU maritime strengths, result in a list of target vessel types which have great innovation opportunities. By building on existing capabilities and developing the missing technologies required by these specific opportunities, the EU and its members states will gain the greatest commercial and strategic return on its research investment.

The target vessel groups towards 2030 are:

Smart vessels, fleets and ports

Waterborne transport will be an integral part of an efficient logistic chain. Connection with other transport modalities, or inland-waterway transport, will be seamless. Smart vessels will communicate with smart ports to limit congestion, waiting time and thus costs. Smart vessels will adapt their sailing speed to match harbour slots automatically.



An important facilitator for seamless integration of transport modalities will be the further harmonisation of administration between EU member states and regions. Smart vessels will automatically file the necessary paperwork, and provide port authorities with cargo information.

Constant real-time connected and monitored vessels worldwide will see ships become more closely integrated into logistics or supply chains. Global companies will focus on using a whole fleet to best effect, generating cost savings and improving revenue generation. This has the potential to create new shipping services, such as online cargo service marketplaces, more efficient pooling and leasing of assets, and new alliances.

Smart vessels will be able to adapt their operations not only to congestion in ports, but also to for instance weather conditions. Fuel consumption over the whole sailing route will be minimised by taking weather predictions and loading condition into account for selecting the optimal route and speed.

Ports will facilitate the energy transition of the fleet, by providing bunkering possibilities for different fuels, as well as recharging capabilities for electric or hybrid vessels. Safe solutions for bunkering of LNG will be provided, possible away from the quay.

Automated and autonomous vessels

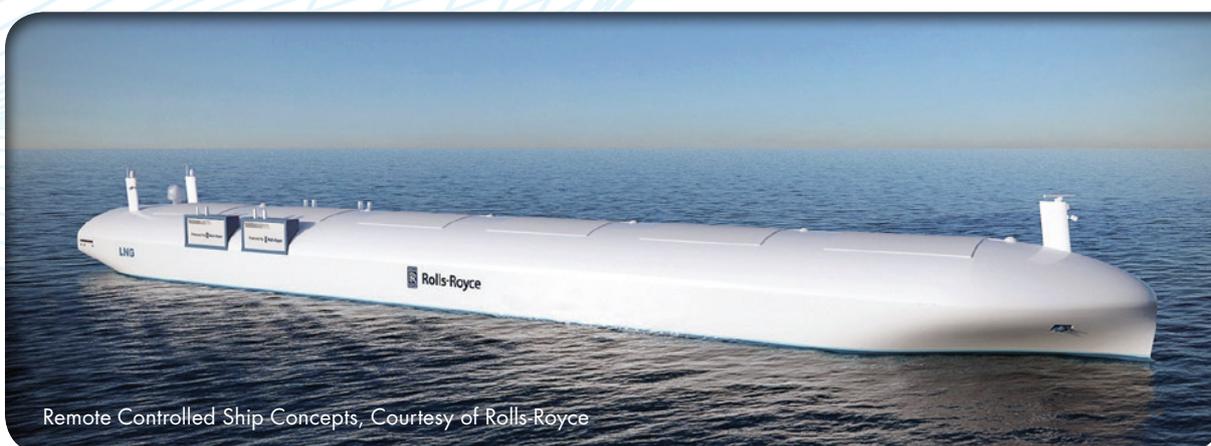
With the increasing possibilities of ICT technologies, ships will become fully connected throughout the world. This will create a wealth of opportunities in automated and autonomous vessels. Remote monitoring of vessels is already possible, allowing for condition-based maintenance. Building on the increasing automation on-board, remote operations of vessels will become possible, eventually moving towards full autonomy of vessels. The wider use of Unmanned Autonomous Vessels (UAVs) – either aerial, underwater or on surface – will increase flexibility and energy efficiency of operations.

Remote operations requires automation of all main systems on-board, and integration into a single communication channel to shore. A critical component will be the advanced navigation system, that will be able to maintain a vessel's course, detect and adapt to changing sea and weather conditions, avoid collisions and operate the ship efficiently within specified safety parameters. The system will be flexible to allow for different levels of autonomy, depending on location, congestion, or emergencies.

Onshore control centres will be responsible for operating vessels in congested sea lanes, or in proximity to ports and terminals, and in emergency situations. These control centres will be equipped with system simulators designed to swiftly simulate scenarios including all ships involved, and facilitate human intervention.

Reliability and security of communication will be key to the success of the connected vessel.

Inland waterway transport and short-distance ferries will be early adopters of the newest technology for autonomous shipping.



Ultra low energy and emissions vessels and systems

LNG will be the main fuel, with uptake first on short-sea ships operating in areas with developed gas bunkering infrastructure. Large ocean-going vessels will follow when bunkering infrastructure becomes available around the world. All new-builds will be equipped with multi-fuel engines, to allow for a smooth transition of main fuels.

Ultra low or zero emissions will be achieved by electric propulsion in special areas, such as ports or ECAs. Locally operating vessels will be fully electric; other vessels will have hybrid propulsion systems. Ships will become wind-assisted, and batteries for non-propulsion workload will be recharged by solar energy.



The power required to propel the ship will be minimal due to high efficiency propulsors, air lubrication or special coatings, and a hull design optimal for actual operational conditions. Latest virtual reality and simulation tools will be used to design the ship fit for operations.

Safe, secure and adaptable passenger vessels for inland, inshore and offshore duties

Increasing population in coastal areas will require safe and swift Waterborne transport. Ferries will be built according to high safety standards and with low emissions. Many ferries will be all electric, recharging in ports and from solar energy.

Demand for cruising will be driven by the growing middle class worldwide. Next generation cruise vessels will not only be larger, but also more diversified to match local market requirements and environmental restrictions. Use will be made of the newest light-weight materials to save energy. Noise emissions under water will be low to comply with strict regulations. Customer experience will be enhanced by more open spaces and glass in the superstructure, and by an integrated interconnection between ship's IT infrastructure and passengers' personal devices.



The structural and safety aspects will be tackled by the latest insights in composites with regards to strength and fire resilience, hydrodynamic loads in the structure in intact and damaged situations, and in human behaviour for evacuation. Innovative rescue equipment will be applied.

Many technologies developed for cruise vessels and ferries will be applied to the newest recreational craft. On the other hand, recreational craft will be used as test beds for larger vessels, because of their relatively low power demand. Examples will be the electrification, and use of light-weight new materials. Super yachts will be used as launching customer for cutting edge technologies.

In a polarising world, security of passenger vessels against outside external attacks is a growing concern. The newest vessels will be able to withstand terrorist attacks, and be invulnerable to digital hijacking.

Flexible craft for coastal and offshore duties

With the onset of the Blue Economy, an increasing number of vessels for coastal and offshore duties will be in operation. Although many of these activities require dedicated vessels, all activities benefit from lowering of costs by employing a modular design of vessel and equipment. Within a relatively short period of time, ships can be refurbished to facilitate new offshore activities. Many of the vessels will be deployed as search-and-rescue vessels in case of emergencies.

The offshore workboats will be characterised by a large operation window in adverse sea states. Cost of operation will be minimised by allowing crew to perform their tasks in a safe and healthy manner for most of the year. Although energy efficiency will not be the main economical driver for these vessels, dedicated ship design and propulsors will ensure a low power consumption in transit and operation. Noise emissions, both into the ship and under water, will be low to comply with strict regulations.



Anchor Handling Tug Supplier 200, Courtesy of Damen

Green, efficient and flexible inland-waterway vessels

The new generation inland-waterway vessels will provide an integrated, energy-efficient, and flexible alternative to road transport.

Emissions from inland shipping will be very low through the use of low-carbon fuels, and hybrid propulsion. Dedicated shallow-water propulsors, and air lubrication will increase the efficiency of ships significantly.



Ecoliner, Courtesy of Damen

All ships will be digitally connected to shore and each other to exchange information on local water depth, current profile, operations of locks, and congestion. Based on this information, the operation of the vessel is optimised with respect to fuel consumption and interaction with the logistic chain. Parts of the river navigation will be autonomous.

Flexibility of the inland fleet will be achieved by modular concepts, and the further application of barge trains.



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