LEADERSHIP
Skills of tomorrow in the European maritime sector

Co-funded by the European Union

Update of skills intelligence on emerging and urgent and skills gaps

Work Package:	WP 2
Task:	T2.7
Deliverable due date:	31/8/2025
Deliverable issue date:	31/8/2025
Responsible partner:	SeaEurope
Author:	Juha Valtanen
Co-authors:	Monia El Fazaki
Deliverable number:	D9
Deliverable type:	Report
Status of the deliverable:	
Dissemination level:	PU
First Created:	
Last Updated:	29/8/2025
Version:	1

DISCLAIMER

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor the granting authority can be held responsible for them.

TABLE OF CONTENT

1. Introduction

The aim of the report of D2.7. Update of skills intelligence on emerging and urgent and skills gaps is to update the work of WP 3 “Report on emerging skills and occupational profiles” conducted by UNIGE in August 2024. UNIGE analysed the questionnaire results, made the summary and some recommendation for the project. D2.7 aim is to update the gaps and needs of urgent and emerging skills, professional profiles, training and qualifications based on the other data we have collected or found out during the project.

Deliverable D2.7 provides some new assessment of skills gaps and emerging needs within the maritime sector, particularly in relation to green transition, digitalization, and evolving operational demands. Some findings are generated throughout the project and D2.7 not only highlights areas where workforce development is urgently required but also informs the design of targeted educational and professional development initiatives. Recent geopolitical developments influence also the European shipbuilding industry, altering both market dynamics and technological priorities, reshaping also the workforce competence requirements. Heightened tensions, trade restrictions, and strategic competition among major global actors—including the United States, China, and Russia—have accelerated the need for Europe to maintain strategic autonomy in shipbuilding and maritime technology. As a result, there’s growing demand for advanced naval engineering expertise, including electrification, automation, and hybrid propulsion systems, reinforcing the need for hybrid technical roles and multi-disciplinary teams.

2. Findings of Work Package 3

The survey conducted by UNIGE (D3.1: Report on emerging skills and occupational profiles) revealed a growing demand for cross-functional roles in shipbuilding, such as project managers, maintenance mechanics, and IT/cybersecurity specialists. This trend aligns with the industry's ongoing transformation driven by technological innovation, sustainability goals, and the shift toward Industry 5.0. Project managers are increasingly vital due to the complexity of modern shipbuilding, requiring strong coordination and resource management skills. Maintenance mechanics must adapt to advanced technologies for preventive maintenance and diagnostics. Similarly, IT and cybersecurity roles are crucial as digitalization and connectivity grow within the sector.

The demand extends across all skill levels, emphasizing the need to update training programs for traditional technical roles—welders, pipeliners, draftsmen, boilermakers, and logistics experts. These roles must evolve to integrate new technologies, materials, and sustainable practices. For instance, welders need training in advanced techniques like robotic welding; pipeliners must handle new fuels and piping systems; draftsmen require proficiency in CAD and 3D modeling; boilermakers need knowledge of alternative energy systems; and logistics experts must master digital tools and supply chain technologies. Overall, one important result was that the shipbuilding workforce must be reskilled and upskilled to meet the demands of ecological transition and Industry 5.0, ensuring both operational efficiency and environmental compliance.

Addressing these evolving skill requirements demands a dual approach—upskilling the current workforce and developing future-ready training programs aligned with technological and environmental imperatives to attract new talents. UNIGE found out that it is evident that the shipbuilding industry faces a significant challenge in meeting its workforce needs. There are some critical skill gaps in the shipbuilding labor market, driven by evolving technological and operational demands. To address these gaps, the industry should implement targeted upskilling and reskilling programs for the current workforce, ensuring rapid competency development. In parallel, industry–academia partnerships are essential to create curricula aligned with future trends, securing a sustainable pipeline of skilled professionals for the sector.

Companies face critical shortages in eg. naval architects and electric marine ngineers, roles essential for ship design and marine electrification. These positions require extensive university education, making them unsuitable for short-term training solutions. To address this gap, the project should focus on hybrid skill development—for example, “navalizing” electrical engineers or “electrifying” naval architects—while combining immediate upskilling initiatives with long-term education strategies. Naval architect training takes years but the idea of navalisation is something the project already has has made some actions. The University of the Basque Country (UPV/EHU), in collaboration with the Basque Maritime Cluster, has launched a specialization course on Navalization and Offshore Energy. A course for primarily active workers in partner companies and professionals with experience in the naval sector seeking specialization and new competencies. The course provides advanced training in strategic areas of marine operations and technology.

3. Updates of the emerging skills

Based on the analysis of the LeaderSHIP survey, industry consultations, workshops with project partners, and input from regional and national stakeholders, the updated skills needs in the shipbuilding industry largely confirm the trends previously identified. While the main findings have been established, certain details and updates can still be identified and incorporated to ensure a comprehensive understanding of the subject.

Green transition skills are even more important and critical competencies for advancing sustainable energy practices within the maritime and industrial sectors than expected. These skills encompass expertise in alternative fuels and energy systems, alongside the capacity to ensure the safe handling and operational integrity of emerging energy carriers such as liquefied natural gas (LNG), hydrogen, methanol, and ammonia. The integration and maintenance of advanced fuel systems is essential to support reliable performance and to mitigate technical, environmental, and safety risks. Collectively, these competencies contribute to the effective implementation of decarbonization strategies and facilitate the broader transition toward low-carbon energy solutions.

Energy efficiency and lifecycle management are central to advancing sustainability in the maritime sector, requiring systematic approaches to optimize vessel performance, reduce operational costs, and extend asset longevity. Equally important is the rigorous monitoring and reporting of emissions in accordance with regulatory frameworks such as FuelEU Maritime and the International Maritime Organization compliance mechanisms, which are to ensure transparency and accountability in reducing greenhouse gas outputs. The adoption of circular economy practices promotes resource efficiency and minimizes environmental impact by enabling the responsible recovery and reuse of materials at the end of a vessel's operational life.

As shipyards transition toward Industry 5.0, the collaboration between humans and intelligent systems becomes a critical competency area. Professionals must develop skills to safely operate and supervise collaborative robots (co-bots), ensuring seamless integration of automation while maintaining high safety standards in dynamic shipyard environments. This includes understanding co-bot programming, ergonomic task design, and risk assessment for shared workspaces.

In parallel, expertise in immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) is increasingly essential. These tools are transforming ship design, crew training, and remote inspections by enabling interactive 3D visualization, real-time simulation, and remote collaboration. Mastery of VR/AR applications allows engineers, inspectors, and operators to reduce errors, accelerate decision-making, and improve safety across the vessel lifecycle

The shipbuilding industry is rapidly adopting robotics and automated production systems to enhance efficiency, precision, and workplace safety. These technologies are transforming traditional processes such as welding, cutting, and painting into highly controlled, repeatable operations that reduce errors and improve quality. Skilled professionals are needed to program, operate, and maintain robotic systems, ensuring seamless integration with digital production workflows. In addition, expertise in automated material handling and inspection is essential for optimizing logistics within shipyards, minimizing manual handling risks, and enabling real-time quality assurance through sensor-based and AI-driven inspection systems. Mastery of these advanced manufacturing skills not only accelerates production cycles but also supports the

Co-funded by
the European Union

industry's transition toward Industry 5.0, where human expertise and automation work in synergy to deliver sustainable, high-performance vessels.

Additive Manufacturing (AM) is revolutionizing shipbuilding by enabling the production of complex components with reduced material waste and shorter lead times. Professionals need expertise in design for additive manufacturing (DfAM), which involves optimizing geometries for layer-by-layer fabrication and ensuring structural integrity. Equally important is understanding certification and qualification processes, as class-approved standards govern the use of AM parts in critical ship systems.

Modern shipbuilding demands materials and fabrication techniques that can withstand extreme environments while supporting sustainability goals. Smart materials, such as advanced composites and corrosion-resistant materials, are essential for reducing weight, improving fuel efficiency, and extending vessel lifespan. These materials require specialized knowledge in selection, processing, and integration into complex ship structures.

In addition, increasing operations in Arctic regions need for expertise of extreme conditions, including low temperatures and ice exposure. This involves applying advanced coatings, thermal protection systems, and fatigue-resistant designs to ensure safety and reliability in harsh climates. Mastery of these skills enables shipyards to deliver vessels that meet strict environmental standards and operate effectively in some of the world's most challenging regions. This area may interest only the Northern partners of the project.

Soft skills are increasingly important in the context of maritime technology environments and companies. Mew technical roles requiring professionals who can operate at the intersection of multiple disciplines to address complex design and operational challenges. As mentioned earlie, the emergence of "navalized" engineers and "electrified" naval architects reflects the need for engineers and architects who have both traditional expertise and advanced knowledge of electrification, digitalization, and alternative energy systems. Equally vital are project managers equipped with literacy in sustainability and cybersecurity, enabling them to oversee projects that balance environmental objectives with the protection of digital infrastructures.

Cybersecurity and data management have become critical dimensions of modern maritime operations, particularly as vessels and shore infrastructures adopt increasingly digitalized and interconnected systems. Protecting digital ship systems and operational data is essential not only for ensuring the reliability and safety of navigation, propulsion, and cargo-handling technologies but also for safeguarding against potential threats that could compromise operational continuity or environmental security. Robust data governance frameworks and cybersecurity measures therefore play a vital role in mitigating risks, enhancing trust in digital solutions, and supporting the sector's transition toward smarter, more sustainable shipping practices.

Cross-functional competencies, including project management, international collaboration, and regulatory literacy, have also become essential, as companies must navigate complex international partnerships, comply with varying national and supranational regulations, and adapt to rapidly shifting policy frameworks.Effective performance depends more and more on the ability to work within multi-disciplinary and international teams, where diverse expertise and cultural perspectives must be integrated to achieve innovative and practical solutions. This means that continuous learning mindset is essential, enabling individuals to remain responsive to technological advancements, regulatory developments, and changing industry practices. Collectively, these capabilities foster resilience, enhance problem-solving, and support the long-term sustainability of maritime operations in a rapidly changing global environment.

The LeaderSHIP project partners have so far drafted over 30 curricula for companies based on the surveys, workshops and discussion with the companies. Some of them have been piloted already. Project partners evaluate internally to determine the extent to which the drafted curricula correspond with the objectives of the project proposal and effectively address the operational requirements of the shipbuilding companies.

TITLE OF THE COURSE
New Fuels/Alternative Fuels
Weldability of material is shipbuilding
Interpersonal communication (Soft Skills)
Team work (Soft Skills)
Leadership (Soft Skills)
Decision Making (Soft Skills)
Change Manegement (Soft Skills)
Modelling Virtual twins using Discrete Event Simulation
Digital and Robotic Inspections on ship and in shipyards
Yacht Glazing: Sustainable Materials, Design, and Certification in Modern Shipbuilding
Methodology for Supporting Green Transition in Maritime Industry
Advanced 3D Printing for Naval and Nautical Applications
Predictive Maintenance with Digital Twins for the Maritime Sector

Operational lean training
Ship Machinery in Cold Climate
Circular economy in shipbuilding and dismantling
Critical welding design
Motivation Strategies for Maritime Professionals
IoT CONCEPTS, ARCHITECTURAL PRINCIPLES AND MARITIME APPLICATIONS

The Ship Structural Analysis (Fundamental chapters) with Finite Element Method
Experimental Methods for Naval and Nautical Aerodynamics
Hull building strategies
Introduction to Sustainable Shipbuilding
Advanced Maritime Electrical work course
Maritime building service technology
Preparatory welding exp
Preparatory welding basic
Sheet metal welder
Time Management
Versatile welding industry