Scoping Study

Future education and skills needs in the Irish maritime industry

Steelesrock
Strategy Consulting

Acknowledgements and Authors' note

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The interviews and desk study that informed this report took place in 2023, and in some instances the views of those interviewed may have been overtaken by developments in what is a rapidly changing sectoral landscape. On such occasions we have endeavoured to ensure that the report reflects the situation at the time of finalising the report.

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Executive Summary

Introduction

The Irish Maritime Development Office, working on behalf of the Department of Transport commissioned Steelesrock Strategy Consulting to undertake a scoping study on the future skills needs in the Irish Maritime industry. The need for such a study arises from a desire to fill two knowledge gaps around the skills and training needs in Ireland's maritime sector. The first concerns identifying changes in the sectors skills requirement since the publication of the Expert Group on Future Skills Needs in 2015; secondly, the need to understand how changes in the maritime sector, including plans to accelerate the development of the Offshore Renewable Energy sector, may result in the need for new skills; and finally, the impact for these skills on ports and related maritime industry sub-sectors.

This study focuses on the underpinning future skills requirements of five sub-sectors of Ireland's maritime economy: Maritime transport (incorporating shipping and ports); Shipbuilding and related services; Offshore renewable energy and Alternative fuels; Marine tourism; and Maritime monitoring, security and surveillance. All of these sectors include elements of maritime commerce, and this is considered principally under maritime transport in keeping with current and past practices in the reporting of the maritime economy. The chosen time horizon for the study was approximately 10 years. In keeping with the nature of a scoping study, the terms of reference were high level, necessitating a broad review of the maritime sub-sectors including consideration of the likely changes they face and how these might drive their skills needs.

Broadly, this study has followed a methodology that included a desk study of education standards and structures both in Ireland and internationally; consideration of key international trends of relevance to the maritime industry; characterisation of the Irish maritime industry as it exists today, and the current and likely future state of the Irish economy. This desk study informed a series of semi-structured interviews with 27 industry, trade-association, and state-sector stakeholders. Finally, a consideration of the feedback from interviews and material from the desk study provided the basis for several conclusions, observations and recommendations.

Education standards

Ireland operates a well-structured education and qualification system. Qualifications are typically organised within the National Framework for Qualifications (NFQ), managed by Quality and Qualifications Ireland. The implementation of this system is however highly distributed, with a range of government bodies and education providers working together to predict and meet the skills needs of the Irish economy. The system is currently undergoing a period of reflection and change. The national system of apprenticeships has seen a move away from the traditional craft apprenticeships to industry apprenticeships developed in partnership between industry and education provider consortia. These apprenticeships provide qualifications at multiple levels of the NFQ. Other innovations include the broadening of the NFQ to potentially encompass qualifications awarded by professional bodies and other non-traditional education providers through the establishment of so-called Listed Award Bodies.

Internationally, the International Labour Organisation (ILO) has a well-structured classification system for skills, education requirements, competencies and job role requirements. Various analyses of future skills requirements stress the need for skills development to match international trends, in particular equipping employees with transferable skills such as critical thinking, planning, communication, teamwork, entrepreneurship and digital fluency.

This mainstream education and qualification system serves the maritime industry well in the provision of professional, craft and other technical roles. However, specific maritime roles sit somewhat outside the system. Qualifications for roles such as bridge officers, ships engineers, and associated industry posts such as Harbour Masters and Pilots, are driven by the International Convention of Standards of Training, Certification and Watchkeeping for Seafarers (STCW). In Ireland, the Marine Survey Office of the Department of Transport, is the certifying body for maritime professionals in these roles. A range of education providers are involved in delivering courses to meet the requirements of the STCW competency qualifications. This includes private operators. However, the National Maritime College of Ireland and BIM dominate the provision of maritime training.

International trends

There are a multitude of industry reports highlighting trends in the international maritime industry, and two topics dominate: the role of digitalisation and associated automation; and the increasing importance of alternative forms of energy to fossil fuels. A confluence of demand for efficiency and environmental considerations, reinforced by increased regulation, drive these trends.

The process of digitalisation is seen as both a driver of efficiency, and an enabler of sustainability in the international maritime industry. Efficient use of data, physical assets and space, and integration with regulatory systems are seen as key challenges. Digitalisation is already well underway in the maritime sector internationally, with larger ports in Europe, and major shipping companies deploying automation which both takes advantage of and enables digitalisation projects.

There is an increased urgency for the use of alternative fuels, with climate adaptation targets internationally demanding a move away from fossil fuels. This urgency is reflected in national and EU policy, together with the targets being set by international organisations such as the IMO. There remains uncertainty as to what fuel systems will achieve dominance, except for electric power systems for port vehicles and workboats and maritime vessels in port.

The national and maritime economy

Estimates produced by Irish Government and European agencies and departments indicate that employment demand in Ireland is likely to remain strong and ahead of all other EU member states for the next decade. The fact that the Irish economy will experience full employment will have the effect of increasing competition for workers of nearly all types and skills levels. The Irish Ocean Economy reports, produced by the Socio-economic Marine Research Unit at the University of Galway show that there has been a rise in the overall trend in employment in all aspects of the Irish Ocean Economy since 2010. The effect of this will be to create pressure on maritime employers, necessitating a move by the sector to increase training opportunities, promote the sector to prospective employees, and seek mechanisms to transfer workers from other industries, as well as seeking more employees from overseas.

The views of stakeholders

Stakeholders view the next decade as crucial in which to build expertise and roll out technological solutions. The skills, education, and training requirements for these, while not immediate, will be significant. Interviewees recognise the net effect of such changes in the sector, will open it to new roles and responsibilities, coupled with the loss of some traditional ones.

There is overall optimism for the maritime sector over the next 10 years while recognising the challenges in securing specific skill sets. The State's plans and targets for growth in the Offshore Renewable Energy (ORE) sector is seen as a major growth opportunity for the entire maritime sector, though some are concerned that the articulated level of ambition is too high, with scepticism expressed about the Government ORE targets. Concerns include shortages of planning and consenting related skills, in ecology, surveying, maritime law and administration, and the absence of a significant heavy engineering track record nationally.

Interviewees concerns and frustrations about the general future of the maritime sector; despite being an island nation, with a dependency on ports for imports and exports, Ireland's maritime sector does not, in the mind of the major players, have a clear vision for its growth. Industry participants believe Ireland's maritime transport sector suffers from a low level of visibility and standing in the public and in government.

The interviews revealed a knowledge gap concerning some industry roles and skill sets; for instance the term "Engineer" was used to describe craft and professional roles. This appears to result in confusion about roles and skills, in some cases extending to policy makers, some educators, and interfacing industries.

A recurring theme in interviews was that maritime careers do not register with the public, school-leavers and their parents as offering attractive long-term careers. The importance of a central body to promote maritime careers was emphasised during interviews. Unless a third level qualification was required for a particular role, companies reported a preference for the recruitment of staff with skills from related sectors such as logistics. For posts that require a third level qualification as with professional engineering, finance or management; there is rarely a need for a specific maritime qualification.

There was no common perspective of Ireland's maritime sector. A small number of interviewees held the view, given the small scale of the Irish Maritime fleet, that Ireland does not require a dedicated training facility for ships' officers. Most participants strongly contested this viewpoint, arguing strongly that the NMCI is strategically important to the State, and has developed alternative international sources to provide seagoing experience to cadets. And whilst there might not be an immediate need for ships' officers and engineers on Irish vessels, the maritime sector will always demand people with sea-going experience.

The overall view of the established sectors in Ireland's maritime economy is one of satisfaction with the range of established courses available. Ireland's education and skills training system is seen as having served the sector well, providing highly qualified individuals from which to recruit staff. The emerging maritime sectors - ocean renewable energy; and maritime surveillance and monitoring require specific education in various engineering and scientific disciplines. Both established and emerging sectors will continue to recruit graduates from the higher education institutions and adjacent industries to fill positions. Increasing regulation is expected to create demand for skills in security (both cyber and physical), environmental law, maritime commerce and health and safety.

Conclusions

This report makes the following conclusions:

1. **There are identifiable skills needs in the Irish Maritime economy.** These exist in craft and operative roles, specific professional services, and maritime roles needed to support domestically operating vessels. The current competitive nature of the jobs market in the Irish economy is having a significant impact on this supply shortage, and this situation is unlikely to change in the next 10 years.
2. **There is an absence of firm employment data for the maritime sector in Ireland.** The study identified various job/skills in the maritime sectors based on feedback from interviews. No data on which to quantify, or estimate the numbers required to fill these roles across the maritime sector was available. Nor was it possible, due to this data gap, to identify deficiencies in the supply of employees from the higher and further education sectors. To address these shortcomings, it is necessary to establish a baseline of current employment levels by job type. The data for such a baseline does not exist, the last attempt to create it was the 2015 report of the Expert Group of Future Skills Needs for the Marine/Maritime Economy to 2020 (EGFSN).

3. **Specific training and education gaps exist.** There are gaps in the availability of some education and training courses needed to meet current and future skill needs, particularly in relation to emerging industries. Ireland's maritime industry provides in-house skills training, and on-occasion sources training from outside the State, principally from the UK. Examples of this include training for port operatives, training for tug drivers, and in meeting the anticipated need for Vessel Traffic Services (VTS). Because individual companies/ports adopt their own approach to training, it is not possible to identify the full extent of the demand for such courses.
4. **Plans and ambitions for the Offshore Renewable Energy sector are currently dominating considerations for the future skills needs for the maritime sector.** There is a general optimism about the opportunities that ORE will bring to the ports sector, however, this is countered by a degree of scepticism about the scale and level of government ambitions for the sector.
5. **The Maritime sector must compete with other sectors in a period of effective full employment and an era of increased skills specialisation.** While the current labour demand is expected to ease somewhat in the coming years, the Department of Finance and others project that the Irish economy will remain in effective full employment for the foreseeable future. The Irish Maritime Sector will have to continue to compete with other sectors, while also seeing increased specialisation. Combined, these factors will increase demand on existing providers of education and training.
6. **The Irish maritime sector has multiple distinct career paths and entry points.** Individuals directly involved in each sector have a clear understanding of the paths that workers use to enter and progress through their own industry sector. For the most part, these paths are not widely understood by those outside individual sectors, or by individuals from outside the Maritime economy. The general ignorance about the sector contributes to the poor visibility on marine career opportunities, and recruitment to the sector from adjacent industries.
7. **The influence of "mega-trends" will build and intensify over time.** Multiple industry reports and European policies indicate that global developments will significantly impact the maritime sector in the coming decade. Discussions with interviewees revealed that there is an expectation that automation will accompany digitalisation. Interviewees acknowledged the influence of these so called "mega-trends" but anticipate that their impact would most likely be incremental, rather than disruptive in the immediate future.
8. **There is a need for promotion of maritime careers.** Feedback received during interviews frequently included the need for greater visibility of the maritime sector, and to enhance the promotion of maritime careers.

In addition, while outside the terms of reference, the authors of this study note that many interviewees raised observations in relation to the National Maritime College of Ireland and the useful role a national maritime skills policy would play in supporting the sector. The NMCI is seen by interviewees as an essential component of the industry, with graduates returning from early careers at sea to take up critical roles in Ireland after a decade or so. However, its ability to service the immediate requirements of industry are seen as restricted, with suggestions that a wider range of courses, more autonomy, and a role in the promotion of maritime careers would serve the College and the sector well.

A national maritime skills policy that addresses the potential demands and opportunities would provide a useful context for maritime education planning, which itself may form part of a maritime transport development strategy. Several of the interviewees highlighted the distinction between skills and education for the maritime industry as it exists today, and for a potentially expanded industry where the sector becomes a primary driver for growth in the economy. Examples where services could be provided on an international stage include legal, financial and insurance services, fleet management activities, light engineering, ICT and data.

Recommendations

The flowing high-level recommendations address our conclusions.

I. An updated, quantitative, and replicable study of the current and future skills needs of the maritime economy (similar to "A Study of the Current and Future Skills Requirements of the Marine/Maritime Economy to 2020"[76]) should be commissioned, to include a methodology that allows for annual updates.

II. A Maritime Skillnet modelled on the Chartered Institute of Logistics and Transport (CILT) Mobility and Supply Chain Skillnet should be supported.

III. Irish Ports should be supported by the relevant Government Departments to advance an apprenticeship in Port Operations.

IV. Greater precision should be provided for the number of potential deck officer roles required by the ORE sector and how many of these can be filled by retrained fishers.

V. A national maritime careers officer role should be established.

VI. The feasibility of placing professional qualifications used in the maritime industry on the National Qualifications Framework should be explored, noting that STCW and fishing qualifications are regulated professions under International Conventions.

VII. Immediate attention should be paid by all to the need for digitisation skills required to support system integration activities related to ports and shipping, and this should be an area of focus for the careers officer role mentioned in Recommendation 6 above.

VIII. A working group/study to progress a national marine skills policy should be established to include in particular consideration of the emerging roles in the areas of technology and automation.

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Section 1. **Introduction**

This report presents the findings from a scoping study designed to identify issues related to the future skills and training requirements for five areas of Ireland's maritime sector set out below. It summarises and analyses information and data collected from an extensive desk study, and the feedback from an extensive engagement via interviews with personnel from the maritime sector, relevant government departments and agencies, and industry associations. These sources informed the key conclusions and recommendations to address the sector's future skills and training requirements. The Irish Maritime Development Office (IMDO) commissioned the scoping study on behalf of the Department of Transport. Steelesrock Strategy Consulting completed the work between October and December 2023.

The terms of reference directed the work to focus on maritime related skills required to work at sea, or in the ports and shipping industries as they relate to the blue economy. This involved consideration of training and skills requirements in five maritime areas fitting within the broader maritime/marine economy, namely: Maritime Transport; Shipbuilding and Related Services; Energy, in particular Offshore Renewable Energy and Alternative Fuels; Marine Tourism; and Maritime Monitoring Security and Surveillance.

Each of the five areas overlap to some degree when considering the connections that exist between them and their position within the maritime sector. For example, maritime transport concerns sea-going vessels, the ports that serve them and the services ports provide. Similarly: marine tourism relies on sea-going vessels and ports to facilitate and service those vessels. This study draws from OECD definitions[1] to clarify the scope of activity within each sector. Maritime commerce also is a topic that cuts across the areas, and unless otherwise stated, is considered under the heading of Maritime Transport in keeping with the approaches adopted by the Expert Group on Future Skills Needs (EGFSN) and the Socio Economic Marine Research Unit (SEMRU) at the University of Galway.

Maritime Transport: This incorporates shipping and ports, defined respectively as the "transportation of freight and passengers through the ocean, cargo handling, renting and leasing of water transport equipment and other services incidental to shipping and water transport" and "the operation and management of ports, such as storage, loading and unloading activities".

Shipbuilding and Related Services: Defined as "the manufacturing, repair and maintenance of ships, boats, offshore platforms and offshore supply vessels." The combination of ships and offshore platforms/vessels acknowledges that some shipbuilders produce offshore platforms as well as ships. The related services include "the economic activity of manufacturing marine equipment and materials such as machinery, valves, cables, sensors, ship materials, aquaculture supplies and so on."

Offshore Renewable Energy and Alternative Fuels: Offshore renewable energy (ORE) includes offshore wind energy and ocean renewable energy defined respectively as "the production of wind energy by generating electricity offshore" and the "production of ocean renewable energy, such as tidal energy, wave energy, osmotic energy and ocean thermal energy conservation." Alternative fuels in the context of the marine sector include a range of low carbon, neutral and zero emission fuels, e.g. liquified natural gas (LNG) and liquified petroleum gas (LPG), methanol, ammonia, biofuels and hydrogen used to power vessels and shore-based port vehicles.[2]

Marine Tourism: Multiple ocean and coastal activities fit within the OECD definition of marine tourism, including novel forms of tourism and cruise destinations. A truncated version of the OECD definition focuses on ocean-based activity and a diversity of tourism activities that operate independently of the cruise industry. In the context of this study marine tourism includes consideration of vessels, ports and services provided to the cruise industry (and other marine activity).

[1] OECD (2016) **Ocean Economy Defined**, Available at: https://www.oecd.org/ocean/topics/ocean-economy/

[2] Bureau Veritas (2022). **Alternative fuels outlook for shipping – an overview of alternative fuels from well to wake.** Available at: https://marine-offshore.bureauveritas.com/newsroom/bureau-veritas-lays-out-well-wake-approach-alternative-fuels

Maritime Monitoring, Security and Surveillance: This sector fits closely with the OECD definition concerning maritime safety, security, and surveillance. The core of the definition concerns surveillance of the marine environment and activities within it. Specifically, "the products and services in different maritime domains ranging from pollution and fisheries control, search and rescue, customs and coastal defence by government and public or private organisations."

The purpose of the scoping study is to inform the Department of Transport on the future training needs for an evolving industry comprising established and emerging sub-sectors of strategic importance to Ireland. The baseline for this study, was the report by the Expert Groups of Future Skills Needs "A Study of the Current and Future Skills Requirements of the Marine/Maritime Economy to 2020". The scoping study will provide the Department with a launch pad for further work to characterise and quantify, on an on-going basis, the future skills requirements of the Maritime sector as it develops and embraces new enterprise activities.

The scoping study is required to:

- Provide an introduction and overview of the maritime skills and training needs in relevant industry sectors.
- Engage in consultation with stakeholders, including, *inter alia*, the Department of Transport, National Maritime College of Ireland, Irish Maritime Development Office, Marine Survey Office, Commissioners of Irish Lights, Bord Iascaigh Mhara, shipping industry representatives, ocean renewable energy industry representatives, ports industry representatives; and education and training providers.
- Liaise and follow-up with key stakeholders as required.
- Prepare a report to include findings, conclusions and recommendations, including a gap analysis and general assessment of future skills and training needs across the maritime industry.

The approach to conducting the study was of necessity wide-ranging and involved both primary and secondary data sources. This included a desk study designed to inform an understanding of changes that have taken place in the sector since the publication of the Future Skills Report published in 2016; to understand current policy and other drivers of maritime activity, and to establish likely requirements for education and training in the sector over 10 years. This phase provided the background for a comprehensive stakeholder engagement process. After feedback from the IMDO, this was agreed as direct engagement with a broad range of stakeholders via video-conference enabled interviews. The desk study and discussions with IMDO identified candidates for structured interviews; with stakeholders identified from industry, Government and education/training. The interviews, completed following an initial contact by the IMDO, involved 27 participants from 23 organisations. These included ports(3), shipping companies(6), industry associations(4), education providers(2) and government departments/agencies(8). Three meetings with the IMDO occurred and there was one meeting of the steering group.

Following this introduction, the report includes a further eight sections as follows:

Section 2 Gives the background and context of the report by defining the global and Ireland's maritime economy as comprising established industries and emerging ones. It describes the main policy concerns and drivers of the wider maritime economy and identifies factors that inhibit its growth.

Section 3 Presents global "mega trends" and describes how they might shape future activities and skills areas in– transport; energy generation and use; ports; tourism, principally cruise tourism; and maritime monitoring.

Section 4 The focus of this section is on Ireland's ports and shipping activity, including cruise ships. It profiles Irish shipping by describing the types of vessels in the Irish maritime fleet and the nature and distribution of Irish ports. A summary of data available from the Central Statistics Office (CSO) gives an insight to trade and cruise activity through Irish ports.

Section 5 and 6 focus on skills and education. Section 5 describes a methodology used by the International Labour Organisation (ILO), to classify and compare employment skills and roles at different levels from general operatives to managers and describes the key elements of transferable skills and competencies. Section 6 goes on to consider the Irish skills and education landscape, identifying the various bodies involved in defining education and training requirements and describes the national framework for qualifications. It also identifies the education and training providers to the maritime sector, the various courses that are available and the different methods used in their delivery. Courses relevant to each maritime sector are listed, together with the associated National Framework for Qualifications (NFQ) level and providers.

Section 7 examines estimates of employment in the maritime sector by considering data available from the two main sources; the work of the Expert Group for Future Skills Needs (EGFSN) in 2015 and described in its report *A Study of the Current and Future Skills Requirements of the Marine/Maritime Economy to 2020*; and the reports on Ireland's Ocean Economy 2019 and 2022, prepared by the University of Galway SEMRU research group on behalf of the Marine Institute.

Section 8 summarises the feedback from interviews in an aggregated format to preserve the anonymity of individual contributors and their host organisation. This is organised under thematic headings e.g. drivers for growth; the impact of full employment on the maritime sector; skills in adjacent industries; skills needs; the promotion of maritime careers and many others.

Section 9 This section is reflective of the research carried out in the earlier sections, and provides a commentary on the sector, together with the authors' key conclusions and recommendations. During the course of the work several maritime related issues emerged, and these have been included under a separate heading of "observations" in Section 9.

Section 10 draws from the key elements from the rest of the report to highlight the major conclusions of the study. This includes a summary of the major skills gaps identified.

Section 11 gives recommendations arising from the conclusions outlined in Section 10.

Appendix 1 include names of participants in interviews and the questions. Sources are cited by way of footnotes throughout.

Section 2. **Background and context**

2.1 The global maritime economy

The OECD define the maritime economy as "the sum of the economic activities of ocean-based industries, together with the assets, goods and services provided by marine ecosystems."[1] Table 1 illustrates the diversity of the global maritime economy in positioning sectors as established and emerging industries.

Table 1: **Diversity of the global maritime sector**

Established Industries	Emerging Industries
Capture Fisheries	Marine aquaculture
Seafood processing	Ultra-deep and deep water oil and gas
Offshore oil and gas in shallow waters	Offshore wind energy
Shipping	Ocean renewable energy
Ports	Marine and seabed mining
Shipbuilding and repair	Maritime safety and surveillance
Marine manufacturing and construction	Marine biotechnology
Maritime and coastal tourism, including cruises	High-technology marine products and services
Maritime business services	
Marine R&D and education	
Coastal flood defences	

Source: *OECD (2016)*

Foresight studies and other initiatives reported a positive outlook for the future of the global maritime economy for several years[3,4,5]. These recognise that the sector is capable of addressing multiple challenges faced by the planet while enabling economic growth. Although the sector's economic activities are expanding this entails overcoming multiple constraints e.g. increased pressures on ocean resources and space, deterioration of the ocean environment, regulation and governance, sustainable development goals and staff shortages. The industry and policy perspectives on the future of the maritime economy reflect positive outlooks on the back of anticipated scientific advances and technological innovations [4,5,7] These developments play a key role in furthering the sector's economic activities and in resolving the major challenges they face. The sector has demonstrated its resilience and adaptability to cope with regional unrest and global emergencies by maximising new scientific and technological outputs and adopting new work practices to maintain growth and secure its future. Several recent contributions about the future of the ocean economy, stress a rapid transition towards more sustainable activities and a broadening of its impact on improved human health and welfare of the planet.[6,7,8] Together they draw attention to issues facing the maritime sector; highlighting climate change, nature and biodiversity loss, and pollution as challenges for decades to come.

[3] Corbett, J.J and Winebrake, J.(2008) **The Impacts of Globalisation on International Maritime Transport Activity,** report for OECD/ITF Global Forum on Transport and Environment in a Globalising World Available at: https://www.oecd.org/greengrowth/greening-transport/41380820.pdf
[4] OECD (2016). **The ocean economy in 2030**. OECD publishing Paris
[5] DNV (2023) **Ocean's Future to 2050 – a sectoral and regional forecast of the Blue Economy,** DNV ASNO-1322 Høvik, Norway. Available at: https://www.dnv.com/maritime/publications/maritime-forecast-2023/download-the-report.html
[6] DNV (2021) **Ocean's Future to 2050.** Available at: https://brandcentral.dnv.com/fr/gallery/10651/others/a5a6931299684ac8a8922429963c073d/a5a6931299684ac8a8922429963c073d_low.pdf
[7] The Economist (2023) **Global Maritime Trends 2050. A Report Commissioned by Lloyds Register of Shipping,** The Economist Group, London. Available online at: https://impact.economist.com/ocean/global-maritime-trends-2050/
[8] European Environmental Agency (2021) **European Maritime Transport Report**, Luxembourg: Publications Office of the European Union, 2021 Available on line at: https://www.eea.europa.eu/publications/maritime-transport/

2.2 **Ireland's ocean economy**

The global maritime sector embraces multiple industries, most of which fall outside the scope of this study. SEMRU define Ireland's ocean (maritime) economy as – "any economic activity that directly or indirectly uses the sea as an input or produces an output for use in a sea-specific activity." [9] This definition differentiates the coastal economy from the ocean economy, as "representing all economic activity that takes place in the coastal region, which is not necessarily part of the ocean economy".

Table 2 illustrates the full extent of Ireland's Ocean Economy inclusive of established and emerging sectors and incorporating the ocean and coastal economies. Established industries include traditional activity such as shipping and maritime transport, tourism and leisure in marine and coastal areas, international cruise, sea fisheries, marine aquaculture, seafood processing, oil and gas exploration and production, marine manufacturing, construction and engineering and marine retail services. In contrast the emerging or nascent industries include advanced marine technology products and services, marine commerce, marine biotechnology and bio-products and marine renewable energy.

Table 2: **Ireland's Ocean Economy**

Ireland's Ocean Economy
Shipping & Maritime Transport
Tourism and leisure in Marine and Coastal Areas
International Cruise
Marine Retail Services
Sea Fisheries
Marine Aquaculture
Seafood Processing
Oil and Gas Exploration and Production
Marine Manufacturing, Construction and Engineering
Marine Advanced Technology Products and Services
Maritime Commerce
Marine Biotechnology and Bio-products
Marine Renewable Energy

Source: *SEMRU 2019*

[9] SEMRU definition from Ireland's Ocean Economy June 2019

Section 3. **Global trends**

Capturing the trends of the global maritime or ocean economy is reliant on simulation models, informed opinion and speculation concerning future events. The output from future trends analysis typically span periods up to 30 years or more, often reflecting possible outcomes from different scenarios. Whilst some maintain a focus on specific sectors within the ocean economy e.g., global port trends[10] or energy in the global shipping sector[11], others[12] take a broader perspective that includes consideration of the increased role of research and innovation and emphasizes the role of green technologies, digitalisation, and a dependency of the maritime on technological developments in other industries, e.g. ICT, engineering.

The OECD in 2016 published its views on the future of the ocean economy to 2030[4] and recently DNV published an industry-informed opinion on the sector's future to 2050[6]. This section draws from these and other sources to present an indication of possible medium to long-term trends of relevance to future training, education and skills needs. Some of these trends (e.g., energy, vessels, ports, digitalisation, automation and competition for ocean space) cut across several sectors, including both established and emerging industries.[13] Common threads exists within maritime sectors e.g. the primacy of data, digitalisation, the regulatory environment, funding for research and development and decarbonisation/sustainability.

3.1.1 **Transport**

The scale and performance characteristics of vessels will continue to evolve and become further enhanced on the back of new scientific and engineering developments. This will involve new configurations of vessels, and larger ones that offer greater flexibility, enhanced performance and provide better returns to the operators than current designs with an emphasis on sustainability.[5] Manning levels will be reduced as the use of automated systems increases. Expansions in the use of marine space for energy generation and aquaculture will stimulate demand for more specialized vessels. This increased use of marine areas will lead to a continuation of the reduction of ocean space available for shipping.[14] New digital technologies will lead to greater on-board intelligence to provide precise control, enable remote real time monitoring of fleets, and more use of automation at all stages of the voyage, including during cargo handling. The current trend towards deploying integrated data management to allow the sector to meet statutory reporting requirements, improve supply chain logistics and enhance efficiencies in the management of vessel and port operations is set to expand.[15]

Novel propulsion systems will demand new low or zero carbon fuels and new hull designs.[12] The changed nature of vessels, with increased demand for more sustainable shipping practices that incorporate resource efficient and climate friendly technologies will be widespread including e.g. wind assisted propulsion, use of slower speed vessels, reduced noise.[12,16] This is particularly relevant to sectors linked to marine foods (including the distribution chain), both capture and culture, in response to market demands, environmental concerns and changed regulatory systems. Vessels will become more self-reliant for repair and maintenance, with the on-board capability to manufacture critical components.[12] Major change in future shipping activity and related services is anticipated, including an increased demand for shipping, shipbuilding, marine equipment manufacturing and related services.[17]

[10] Deloitte (2020) **Global Port Trends 2030**. Available at: https://www2.deloitte.com/ua/en/pages/press-room/expert/infrastructure-interview-port-trends.html
[11] International Energy Agency https://www.iea.org/energy-system/transport/international-shipping
[12] American Bureau of Shipping (ABS) (2022) **Technology Trends – Exploring the Future of Maritime Innovation.** Available at: https://ww2.eagle.org/en/innovation-and-technology/technology-advancements/abs-tech-trends.html
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[15] Dalaklis, D. et al (2021) **Big data management in the shipping industry: examining strengths vs weaknesses and highlighting relevant business opportunities.** The Maritime Commons – Digital Repository of the World Maritime University. Available at: https://commons.wmu.se/cgi/viewcontent.cgi?article=1006&context=lib_papers
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[17] UK Maritime (2019). **Maritime Futures Programme – Skills**. Available on line at https://www.maritimeuk.org/media-centre/publications/maritime-futures-programme-skills-paper/

3.1.2 **Energy use and generation**

Countries accounting for around 70% of global CO_2 emissions, including the EU, made a commitment to reach a position of net zero emissions by 2050.[18] This is expected to result from actions designed to remove CO_2 such as increased afforestation, emission trading and from the increased use of zero-emissions electricity as well as eliminating the use of oil in transport and industrial operations. This shift in energy generation and use reflects a transition (largely by developed countries) to the use of renewables and economic penalties or premiums on the use of fossil fuels. Demand for energy is expected to continue to rise in line with global population growth, with the share of electricity doubling towards 2050.[6] Zero emission electricity requires investments in solar, wind and biofuels, coupled with energy storage systems to ensure a reliable supply[19]. Developments in these areas will affect all marine sectors as they strive to comply with national and international sustainability goals. Ireland already faces challenges in this regard, for instance Irish ports currently lack any "cold ironing", compared to access in 51 EU ports to 340 onshore power connections.

However, there remains a widespread use of fossil fuels in many regions, in parallel with facilitating new exploration for oil and gas. Oil and gas production facilities occupy 7,000 km^2 of sea area globally; exercising approved licences could see a further 350,000 km2 of sea area dedicated to oil and gas extraction.[21]

Ireland is no longer accepting new applications for exploration licences for natural gas or oil. However, this prohibition does not apply where applications and authorisations were in place prior to the imposition of the ban. This means that existing authorisations will be able to continue to apply to progress through the licensing stages towards production, until they reach a natural conclusion which may include expiry, relinquishment or production.[21] Despite the continued reliance on fossil fuels, there is a global trend towards a transition to a clean, carbon-free world, largely by increasing the use of renewables and increasing premiums on the use of fossil fuels.

Many alternatives to fossil fuels exist, some such as nuclear, geothermal and wind are well established. Others have reached early-stage adoption or advanced stages of development, offer significant promise. Wind and solar electricity are now cost competitive compared to fossil fuel generation[22]. Interest in biofuel as a net zero CO_2 fuel continues to rise, with ethanol, methanol, biodiesel and renewable diesel already in limited use.[23] Similarly interest in green hydrogen and ammonia has increased, though concerns exist regarding the rate at which their production is decarbonised in underdeveloped supply chains.[24] The IEA, however, issue a note of caution about green hydrogen concerning the "lack of clarity in regulation and certification, lack of infrastructure to deliver hydrogen to end users, and uncertainty about future demand".

Wind energy, inclusive of fixed offshore wind energy, is generally accepted as a reliable source of renewable energy generated using proven technologies. The installed generating capacity of wind turbines in 2022 was reported as predominantly land based, with offshore installations accounting for just seven percent of the 950 GW total global wind turbine generating capacity.[25] There are however, positive projections from multiple sources concerning the potential growth of ocean based

[18] International Energy Agency (2021) **Net Zero by 2050 - A Roadmap for the Global Energy Sector**
[19] Forbes (2022) **The 3 Biggest Future Trends (And Challenges) in the Energy Sector**, Available on line at https://www.forbes.com/sites/bernardmarr/2022/02/11/the-3-biggest-future-trends-and-challenges-in-the-energy
[20] Osipova, L and Cararro, C. (2023) **Shore power needs and CO_2 emissions reductions of ships in European Union ports: Meeting the ambitions of the FuelEU Maritime and AFIR.** Working Paper 2023-24.International Council on Clean Transportation. Available on line at: https://theicct.org/publication/shore-power-eu-oct23/
[21] Government of Ireland (2023). **Oil and Gas Exploration and production.** Available at: https://www.gov.ie/en/policy-information/bf1b50-oil-and-gas-exploration-and-production/
[22] World Economic Forum (2023) **The world can transition to carbon-free power systems. Here's how.** Available at: https://www.weforum.org/agenda/2023/06/carbon-free-electricity-just-transition/
[23] International Energy Agency (2023) **Biofuel demand growth by fuel and region, 2022-2024**. Available at: https://www.iea.org/data-and-statistics/charts/biofuel-demand-growth-by-fuel-and-region-2022-2024
[24] International Energy Agency (2023) **Towards hydrogen definitions based on their emissions intensity.** Available at https://iea.blob.core.windows.net/assets/acc7a642-e42b-4972-8893-2f03bf0bfa03/Towardshydrogendefinitionsbasedontheiremissionsintensity.pdf
[25] DVN (2022) **Energy transition Outlook 2022**

wind energy installations providing funding and infrastructural challenges can be overcome.[26,27,28] Projections by the Brussels based Global Wind Energy Council point to the installation of 380 GW of offshore wind capacity by 2032.[28] However, they expect only one third of this to be delivered in the period to 2027 due to changing near term market issues in Europe and the USA.

China, the global leader in offshore wind development experienced a sharp decline in installations during 2022 to just 5 GW, from 21 GW in 2021. The majority of Europe's installed offshore wind capacity of 30 GW is located within the UK and totals almost 14 GW. The offshore sector is facing multiple challenges by way of increased capital cost, supply chain capacity, regulatory instability, and staffing issues. Together these issues have caused some developers to reconsider projects and, in some cases, to terminate contracts, stopping the development of projects scheduled for the next five years. In the absence of major investments in developing resilience in the supply chain and capital equipment, the sector is facing major disruptions from 2026, leading to a slowdown in the pace of offshore wind developments in all regions except China.[26]

Next generation offshore wind generation is likely to be based on floating wind energy. A recent report from DNV on the challenges of developing such devices forecasts that 300 GW of floating wind generating capacity will be installed over the next 30 years.[29] DNV believe, based on industry feedback, that this will require the commercialisation of technologies that remain largely in their infancy and overcoming market, regulatory, supply chain and electricity connection/grid challenges if its potential is to be realised. Floating wind generation is still very much at the demonstration stage, even allowing for a 30 MW installation in Scotland that has been operational since 2017 and is recognised as a global leader in floating offshore wind energy.[30,31] More recently, Norway has seen during August 2023 the commissioning of the world's largest floating windfarm with a capacity to generate 88 MW.[32] Significantly, there are multiple different floating wind concepts under development, with a steady flow of new concepts emerging. The primary attraction of floating wind turbines is the potential to move to deeper waters to capture higher winds and increased viable sea area. Already the rating of wind turbines is increasing; in 2020 the average capacity was 8 MW, turbines rated between 13 MW and 15 MW are expected to become available by 2024.[33]

Offshore wind projects typically take several years to complete from initial planning to commissioning. They demand specialised construction equipment and the availability of dedicated wind turbine installation vessels. Additionally, construction of offshore turbines (floating and fixed) require access to ports where large structures can be built, and which also offer sufficient draft for floating structures.[29]

Harnessing the economic potential of marine areas in a sustainable manner is a long term goal for Europe.[34] Europe's Blue Growth Strategy identified the ocean energy sector as one of five growth sectors.[35] The recent reported global growth in offshore renewable installations confirms the earlier positive expectations about the sector because of substantial commitments made by governments.[36]

[26] McKinsey (2022) **How to succeed in the expanding global offshore wind market.** Available at: https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/how-to-succeed-in-the-expanding-global-offshore-wind-market#/
[27] International Energy Agency (2023)
[28] Global Wind Energy Council (2023) **Global Offshore Wind Report 2023** Available at: https://gwec.net/wp-content/uploads/2023/08/GWEC-Global-Offshore-Wind-Report-2023.pdf
[29] DNV(2022) **Floating wind: Turning Ambition into Action**. Available at: https://www.dnv.com/focus-areas/floating-offshore-wind/floating-wind-turning-ambition-into-action.html
[30] Equinor (2022) **Hywind Scotland.** Available at: https://www.equinor.com/energy/hywind-scotland
[31] Hannon, M. *et al* (2019) **Offshore wind, ready to float? Global and UK trends in the floating offshore wind market.** University of Strathclyde, Glasgow. Available at: https://core.ac.uk/reader/227455790
[32] Equinor (2023) **The world's largest floating offshore wind farm officially opened.** Available at: https://www.equinor.com/news/20230823-hywind-tampen-officially-opened
[33] Vestas (2023) **V236-15MW Product Brochure.** Available at: https://www.vestas.com/en/products/offshore/V236-15MW
[34] European Commission COM(2007). 575, 10.10.2007. **An Integrated Maritime Policy for the European Union.**
[35] European Commission COM(2012). 494, 13.9.2012. **Blue Growth - opportunities for marine and maritime sustainable growth**
[36] International Energy Agency (2023). **Government Energy Spending Tracker.** Available at: https://www.iea.org/reports/government-energy-spending-tracker-2

3.1.3 **Ports**

Ports will adopt new roles in support of vessels in addition to employing advanced handling systems for loading and unloading freight, and become more closely integrated with land-based logistic systems. Robotics and other automated systems will be in widespread use at ports, enabling more efficient and shorter turn-around and servicing of vessels.[10] Ports of the future appear set to face into an era of major change including e.g. changes in physical infrastructure, a changed workforce and skills profile, a greater dependency on data. Increased utilization of marine space is expected to lead to new roles for ports and in the type of vessels that use port facilities. Changes in port infrastructure will be needed to accommodate larger ships, including the provision of deeper harbours, improved access via wider locks, and larger cranes. Regulations around the reduction in CO_2 emissions will leads to greater roles for ports in the supply of electricity to docked vessels.[20] The expectation is ports will fulfil multiple roles in support of non-shipping activity; becoming hubs for ocean energy activity, fuels, marine aquaculture and energy generation.[37] Pressures to adopt these roles suggests that traditional ports will need greater land area, and some may consider moving to new locations to accommodate new activity. In response to market pressure and faced with increased regulatory pressures, ports will become reliant on and adept at managing data, including the use of artificial intelligence, advanced analytics, dynamic scheduling and pricing, and predictive maintenance. Port traffic and handling systems will incorporate greater autonomy; with battery powered self-driving vehicles becoming common. Ports have always acknowledged the challenges in maintaining a secure port environment; the security challenge is likely to expand in response to threats to physical and digital infrastructures, leading to a strengthening of their resilience to such threats and then provision of greater protection.[38] This emphasis on digital infrastructure is likely to overtake investment in physical infrastructures.[42,38] Reflecting the imperative of more sustainable operations, ports will play key roles in managing waste and in minimising the impact of port operations on the environment.

3.1.4 **Tourism**

Tourism generally has evolved to become a multidisciplinary sector with multiple subsectors, with cruise tourism playing a major role. Of the world's top ten busiest cruise ports, 64 percent of them are in the Americas, with the balance in Europe; principally Spain(16%) followed by Italy (14%) and the UK(6%).[39]

In common with other social and economic sector tourism is greatly influenced by global megatrends.[40] These trends influence how the sector responds to new opportunities and negative influences/impacts. However, there is no certainty that they will affect the strata of the tourism sector equally, or indeed at all.[41]

The OECD describe tourism as likely to be affected by four mega trends over the next 20 years; namely: evolving visitor demand; sustainable tourism growth; enabling technologies; and travel mobility.[41] Tourism products will be influenced by changing demographics including e.g. increased income, better education, population growth and structure. The sector will respond to increased customer awareness of issues around sustainability, and concerns for the environment by introducing low-carbon solutions and steps to minimise impact. Digitalisation and access to new technological solutions will influence how consumers will identify, engage with and access tourism; and for the provider, they will enable the creation of new business models. Increasing numbers of tourists, the regulatory environment, concerns over safety and security, the provision of tourism related infrastructure and innovations in transport will all affect travel mobility.[40,41]

[37] Llyods Register, ARUP (2022) **Port Energy Supply for green shipping corridors.** Available at: https://www.thesilkalliance.com/wp-content/uploads/Port-energy-supply-for-green-shipping_report_FINAL.pdf
[38] European Commission (2023) **Update of the EU Maritime Security Strategy and Action Plan.** JOIN(2023) 8 Final 10.3.2023
[39] Statistica (2023) **Busiest cruise ports worldwide in 2022.**
[40] Bilas. V, Franc, S. and Vukoja. M (2022). **The Impact of Global Megatrends on Tourism Industry.** UTMS Journal of Economics 13(1). Available at: https://www.utmsjoe.mk/files/Vol.13.No.1/10.THE-IMPACT-OF-GLOBAL-MEGATRENDS-ON-TOURISM-INDUSTRY.pdf
[41] OECD (2018) **Tourism Trends and policies.** Available at: https://www.oecd-ilibrary.org/sites/tour-2018-6-en/

The rebound of the global travel industry after the sharp decline during the Covid crisis demonstrates the sector's resilience. During 2022, international tourism activity increased to around 80 percent of the pre-Covid levels in Europe and to 65 percent across the Americas.[42] According to the World Travel and Tourism Council the sector faces a positive future, with GDP growth of 5.8 percent over the next ten years.[43] This growth is predicted at a time when the sector is experiencing something of a crisis in employment, with jobs remaining unfilled as staff departed for new positions in other sectors. A concern expressed by McKinsey is a continuation of labour shortages may limit its growth potential. Knowledge of future demand for services is enhanced by visibility of ship arrival and departure times, which in some instances give up to three years notice to destination ports, thus helping to plan service requirements.[42]

While the aviation sector accounts for the major share of international tourism travel, the maritime sector (particularly the cruise element) has experienced continuous growth over the past 40 years, a trend reported as likely to continue.[40] The sector has experienced a rapid recovery following Covid, with cruise passengers in 2023 expected to pass 31.5 million – 106% of the 2019 figures and reach close to 40 million by 2027.[44] This growth in cruise tourism drives activities in related areas such as e.g. shipbuilding, ports; influencing the rate of technological developments, the construction of infrastructure and the operation of vessels, ports. Between 2023 and 2028, 44 new cruise ships will become operational, and an additional 27 ports will provide plug-in shore-side power by 2025. These developments stimulate demand and innovations in a multitude of services both sea-based and shore side on which the cruise sector relies, e.g. energy, catering, local transport, etc.[40,41,42]

The cruise industry as represented by the Cruise Lines International Association (CLIA) has adopted an operational concept termed "responsible tourism", the knock-on effect of this shift is largely centred around ensuring new vessels maximise the use of technologies to support the industry drive towards decarbonisation and environmental sustainability.[44]

3.1.5 **Maritime monitoring**

Maritime monitoring spans a wide area including pollution and fisheries control, search and rescue, customs and coastal defence. Government and private sector organisations provide services to multiple stakeholders ranging from leisure sailors, emergency services (private and public), shipping, wild catch fisheries, meteorologists, the military and many more. Safety at sea is a major concern for the marine sector both current and future with increasing marine traffic, principally shipping and fishing. Trends indicate recent improvements in the safety record of both these sectors, similarly marine casualty events resulting in environmental damage have also fallen, though concerns remain that marine incidents may increase as the use of marine space expands.[45] The introduction of new technologies including automation and digitalisation will continue to bring about changes that enhance marine safety and reduce the environmental impact[46].

Realising the full potential of the oceans and the sustainable blue economy relies heavily on the provision of a safe and secure ocean. This demands appropriate maritime security to assess, anticipate and minimise threats at sea.[47] The European Union maintains a Maritime Security Strategy and Action Plan designed to deal with evolving maritime threats.[48] This indicates efforts to increase levels of monitoring ocean territories from land, sea and air involving collaboration between military and national agencies such as coast guards.[49] At the core of the monitoring systems are multiple sensor types including e.g.

[42] McKinsey(2023) **The Future of Tourism.** Available at https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/future-of-tourism-bridging-the-labor-gap-enhancing-customer-experience#/

[43] World Travel and Tourism Council (2022) **Economic Impact Report 2022,** Available at: https://researchhub.wttc.org/#geographic-reports-factsheets.

[44] Cruise Lines International Association (2023) **The state of the cruise industry 2023.** Available at: https://cruising.org/-/media/clia-media/research/2023/2023-clia-state-of-the-cruise-industry-report

[45] European Maritime Safety Agency. **The EU Maritime Profile – maritime safety**: Available at: https://emsa.europa.eu/eumaritimeprofile/section-3-maritime-safety.html

[46] IMO (2023) **World Maritime Theme 2024: "Navigating the future: safety first!**". Available at: https://www.imo.org/en/MediaCentre/PressBriefings/pages/World-Maritime-Theme-2024.aspx

[47] European Commission (2023) **Maritime Security: EU updates Strategy to safeguard maritime domain against new threats**. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1483

[48] European Commission (2023) **Update of the EU Maritime Security Strategy and its Action Plan "An enhanced EU Maritime Security Strategy for evolving maritime threats"** Available at: https://oceans-and-fisheries.ec.europa.eu/system/files/2023-03/join-2023-8-annex_en.pdf

[49] Dalaklis, D(2019) **Technology deployment in maritime security: emerging issues;** World Maritime University Available at: https://commons.wmu.se/cgi/viewcontent.cgi?article=1004&context=lib_presentations

satellite remote sensing, visualisation – optical and radar, smart buoys, various remote and autonomous underwater vehicles and hydrophones, in addition to systems that monitor communications.[50]

Marine monitoring systems also facilitate marine related research, essential in assessing the biological and environmental status of the sea and in assessing compliance with regulatory systems.[51] These monitoring activities provide governments, industry and researchers with data concerning contaminants in the water, assessing environmental change, monitoring sea-level rise, surveys of the coastline and seabed floor, physical, chemical, and biological data and other observations on the marine environment. Environmental monitoring systems appear set to continue to draw upon increasingly sophisticated systems and to be reliant on the use of advanced technologies (such as software, hardware and communications technologies) in their on-going development.

3.1.6 **Marine food production**

Although not directly related to this study, marine food production is an industry with an adjacency to maritime transport, occupying as it does sea-space and in some instances utilising similar skill sets in its management and operations. The projected increase in the global population to 9 billion by 2050 will challenge food security.[55] Research in the area, suggests food production systems will eventually change to secure sustainable food sources to underpin healthy diets resulting in increased demand for all seafoods.[52,53] Marine aquaculture output will approach the levels of reported wild catch, with wild stock capture and activity declining due to the effects of overfishing and climate change.[57] This all points to increased aquaculture activity, where this future demand will have to be met though more sustainable aquaculture resulting from increased innovation, improvements in feed and species diversification.[54] Aquaculture activities have already started to move to offshore locations, a move set to continue as demand for marine species, including seaweed increases. The expectation is that aquaculture output will rise to unprecedented levels. The OECD and FAO project production growth to reach 100 to 105 million tonnes by 2027, increasing substantially to 2030 and beyond.[55,56] Such increases present challenges for aquaculture production in mitigating the environmental impact of increased production and in countering threats from climate change requiring technology and engineering solutions.[57] The sector faces change across multiple areas driven by regulations, environmental concerns and sustainability goals, increased global demand for protein and competition between marine sectors for ocean space.[58] The existing offshore farming structures and proposed future concepts vary significantly. The design of future aquacultures structures and production systems are likely to become more standardised in response to the need for regulatory compliance and to secure productivity gains. Production methods will change as will production capacity; and regions producing high-value species will introduce new production technologies.[54]

[50] NOAA **Monitoring Oceans and Coasts.** Available at: https://oceanservice.noaa.gov/observations/monitoring/
[51] Liu, Y.; Lu, H.; Cui, Y. A., (2023) **Review of Marine in - Situ Sensors and Biosensors.** J. Mar. Sci. Eng. 11, 1469.
[52] European Commission (2022) **Transition to healthy and sustainable dietary behaviour.** Available at: https://cordis.europa.eu/programme/id/HORIZON_HORIZON-CL6-2021-FARM2FORK-01-15/en
[53] BusinessWire (2023) **Global Seafood Market Report 2023: Sector is Expected to Reach $730.28 Billion by 2030 at a CAGR of 8.92%**. Available at: https://www.businesswire.com/news/home/20230614396030/en/Global-Seafood-Market-Report-2023-Sector-is-Expected-to-Reach-730.28-Billion-by-2030-at-a-CAGR-of-8.92---ResearchAndMarkets.com.
[54] Borja, A et al (2022). **Ocean Optimism: Balancing the Narrative about the Future of the Ocean**, Front. Mar. Sci, July, Vol 9
[55] OECD, FAO (2018) **OECD-FAO Agricultural Outlook 2018-2027, Chapter 8: Fish and Seafood**. Available at: https://www.fao.org/3/i9166e/i9166e_Chapter8_Fish_seafood.pdf
[56] FAO (2004) **Global aquaculture outlook in the next decades: An analysis of national aquaculture production forecasts to 2030.** Available at: https://www.fao.org/3/y5648e/y5648e05.htm#bm05.1.1
[57] FAO (2020). **The state of world fisheries and aquaculture 2020 Sustainability in Action.** Available at: https://www.fao.org/3/ca9229en/ca9229en.pdf
[58] DNV (2021). **Oceans of the future to 2050 Marine Aquaculture Forecast.** Available at: https://www.dnv.com/focus-areas/offshore-aquaculture/marine-aquaculture-forecast/index.html

3.1.7 **The marine environment**

The marine environment – the world's oceans and seas – has experienced a decline in overall health status largely from the negative impact of human activities, and related climate change. This process of deterioration is well documented which points to persistent habitat disturbance, biodiversity loss, resource overexploitation, climate change, contamination, acidification, and invasive species.[59] Countering these impacts, whilst seeking to develop economic activities present multiple challenges. Avoidance of a continuation of global environmental catastrophe needs renewed effort, new actions and innovative solutions.[60] Addressing the impact of climate change is a major priority including reducing greenhouse gas emissions from all sources. Mitigation measures include e.g. ocean renewable energies, use of low carbon fuels, biofuels, decarbonisation of shipping and transport, and maintaining coastal vegetation. Litter, including microplastic waste is a further threat to the health of marine ecosystems. While most litter originates from land based sources, there are marine sources such as dumping at sea, waste-disposal from shipping and oil/gas rigs and from adverse events such as fuel spills.[61] Litter management is seen as a priority, involving multiple stakeholders engaging in processes to minimise waste production following the concepts of reduce, reuse and recycle. Increases in the use of marine space for transport, marine tourism, marine food production and oil and gas exploration and energy production pose continuing threats to the oceans.[62]

[59] United National (2021). **The second world ocean assessment Vol 1**. Available on-line at https://www.un.org/regularprocess/sites/www.un.org.regularprocess/files/2011859-e-woa-ii-vol-i.pdf

[60] Gattuso J-P, Magnan AK, Bopp L, Cheung WWL, et al (2018) **Ocean Solutions to Address Climate Change and Its Effects on Marine Ecosystems.** Front. Mar. Sci. 5:337. Available at: https://www.frontiersin.org/articles/10.3389/fmars.2018.00337/full

[61] Williams, A.T. and Rangel-Buitrago, N.,(2019). **Marine Litter: Solutions for a Major Environmental Problem,** Journal of Coastal Research, Vol 35, No 3. Available at: https://doi.org/10.2112/JCOASTRES-D-18-00096.1

[62] Singh, Bikram (2021) **Marine Pollution by Ships -Tips for Reducing & Recycling Waste at Sea,** Marine Insight. Available at: https://www.marineinsight.com/environment/marine-pollution-by-ships-tips-for-reducing-recycling-waste-at-sea/.

Section 4. **Characteristics of Irish shipping and ports**

4.1.1 Classification of vessels and qualification requirements for seafarers

There are approximately 40 merchant ships operating under the Irish flag; the majority of which are small cargo vessels owned and operated by one company.[63] Seagoing vessels registered in Ireland are classified according to their function and area of operation. Current legislation requires that officers (including engineering officers) and crew undergo certified training provided by a competent authority, appropriate to the vessel on which they are to serve. Table 3 and Table 4 below summarise the training and certification requirements for deck officers and engineering officers on the following vessel types.

- Merchant shipping vessels
- Merchant shipping vessels (domestic)
- Merchant shipping (passenger) vessels
- Passenger vessels (domestic)
- Fishing vessels
- Passenger boats

The Department of Transport, Marine Survey Office[64] provide full details of the certification and training requirements for deck officers and engineering officers for the above vessel types.

A process exists whereby a skipper of a fishing vessel possessing a full Certificate of Competency (i.e. a full Skipper qualification issued by the Marine Survey Office without distance from land, tonnage or other restrictions) can qualify as an officer in charge of a navigational watch on ships of 500 gross tonnage or more. This requires the skipper to complete a conversion course as defined in Regulation II/1 of STCW 78.[64]

[63] Department of Transport (2021) **An Environmental Analysis of the Irish (Internationally Trading) Fleet,** a report by the Maritime Safety Policy Division. Available at: https://www.gov.ie/en/publication/f618b-an-environmental-analysis-of-the-irish-internationally-trading-fleet/

[64] https://www.seafarers.ie

4.2 Ports and fishing harbours

In recognising Irish ports differ in terms of size, capabilities and future potential, the National Ports Policy (2013) introduced a classification system to replace the generic definition introduced in 1996.[65] The National Ports Policy provides a classification system that embraces all Irish ports. This positions ports within a framework comprising Ports of National Significance (Tier 1), Ports of National Significance (Tier 2) and Ports of Regional Significance. Table 5 illustrates the positioning of ports within this classification.

Table 3: **Certification for Deck Officers**

Vessel classification	Scope	Certificate of Competency required
Merchant shipping vessels	Vessels more than 3000 GT	• Officer in charge of a Navigational Watch on all ships
Merchant shipping vessels (domestic)	Cargo vessels (less than 200/300/500 GT) not undertaking international voyages.	• Officer in charge of a navigational watch and Master on ships of less than 500 gross tonnage. • Officer in charge of a navigational watch on ships of 500 gross tonnage or more. • Chief Mate unlimited and Master on ships of less than 3,000 gross tonnage. • Master unlimited • Chief Mate < 3000GT
Passenger vessels (domestic)	Vessels carrying less than less than 100 passengers	• Officer in charge of a navigational watch and Master on ships of less than 500 gross tonnage. • Officer in charge of a navigational watch on ships of 500 gross tonnage or more. • Chief Mate unlimited and Master on ships of less than 3,000 gross tonnage. • Master unlimited • Chief Mate < 3000GT
Fishing vessels	Every sea-going fishing vessel registered in the State or Government fishery research vessel of 17m or more operating within a Limited Area and fishing vessels of any length operating in Unlimited Area.	• Skipper (Full) • Skipper (Limited) • Second Hand (Full) • Second Hand (Special) • Second Hand (Limited)
Passenger boats (classes P1 to P6)	All vessels (80 gross tons or less than 24 metres) carrying up to 12 passengers for reward (which means they pay a fee to travel on the boat) or where persons are being carried onboard to / from a place of work.	• Master certificate as specified in Annex I of Marine Notice No.4 of 2006.

Source: *Marine Survey Office*

[65] Department of Transport Tourism and Sport (2013) **National Ports Policy**. Available at: https://www.gov.ie/en/publication/4aa3cc-national-ports-policy/

Table 4: **Certification for Engineer Officers**

Vessel classification	Scope	Certificate of Competency required for
Merchant shipping vessels	Vessels with engine power greater than 3000 kW, less than 3000 kW and less than 6000 kW operating in near coastal areas and/or unlimited areas.	• Engineer Officers • Marine Engine Operators • Electrotechnical Officers • Engine Room Watch Ratings
Fishing vessels	Every sea-going fishing vessel registered in the State or Government fishery research vessel which has a registered power of 750 kilowatt or more.	• Marine Engineer Officers Class 1, 2 or 3 as appropriate to registered engine power of the vessel.

Source: *Marine Survey Office*

Table 5: **Classification of Irish Ports**

Class of port	Port
Tier 1: National significance	Dublin Port Company, the Port of Cork Company and Shannon Foynes Port Company.
Tier 2: National significance	Port of Waterford Company and Rosslare Europort
Ports of Regional Significance	Drogheda, Dún Laoghaire, Galway, New Ross and Wicklow, and all other ports that handle commercial freight.

Irish ports operate under various ownership models including ownership by Harbour Authorities, Port Companies, Fishery Centres, Local Authorities, Commercial State Companies and Private ownership.

Separate to the ports in Table 5 above there are also six state -owned fishery harbour centres listed below falling under the remit of the Department of Agriculture, Food and the Marine, some of which also engage in the handling of commercial freight.

- Castletownbere Fishery Harbour Centre
- Dunmore East Fishery Harbour Centre
- Howth Fishery Harbour Centre
- Killybegs Fishery Harbour Centre
- Ros An Mhíl (Rossaveel) Fishery Harbour Centre and Cashla Bay
- An Daingean (Dingle) Fishery Harbour Centre

4.3 Trade through Irish ports

Trade (both imports and exports) handled by Irish ports is described by the category of goods and reported as total goods ('000 tonnes/annum) for the period 2016 to 2022 in Table 6 and Table 7 below.

Table 6: **Category of goods handled by Irish ports and total goods 2016 to 2022**

Category of goods	2016	2017	2018	2019	2020	2021	2022
				'000 tonnes			
Liquid bulk	11,274	12,211	12,171	11,736	11,294	11,096	11,436
Dry bulk	15,937	16,805	17,754	15,633	15,119	16,858	15,622
Lift-on/lift-off	7,230	7,346	7,629	8,009	7,806	8,796	8,457
Roll-on/roll-off	14,884	15,497	16,037	16,183	15,570	15,381	16,106
Break bulk & other goods	1,387	1,486	1,496	1,680	1,576	1,828	1,534
Totals	**50,712**	**53,346**	**55,086**	**53,240**	**51,364**	**53,958**	**53,155**

Source: *Extracted from CSO Statistics on port traffic 2013 to 2023*

Tier 1 ports account for almost 85 percent of goods (by volume) over the period 2016 to 2022. The tier two ports of Waterford and Rosslare handled 7.8 percent of goods over the same period.

Table 7: **Total goods('000 tonnes) handled by Irish ports 2016 -2022**

Ports	2016	2017	2018	2019	2020	2021	2022	Totals	% of Total
Arklow	-	-	-	-	-	-	-	0	0
Bantry Bay	298	846	542	728	1,318	501	282	4,515	1.2%
Castletownbere	46	52	58	65	60	66	51	398	0.1%
Cork	8,977	8,968	9,518	8,699	8,637	9,312	9,148	63,259	17.1%
Drogheda	1,223	1,282	1,455	1,530	1,286	1,229	1,001	9,006	2.4%
Dublin	23,849	24,996	26,332	26,334	25,210	24,485	25,635	176,841	47.7%
Dundalk	43	82	113	78	92	86	63	557	0.2%
Dun Laoghaire	-	-	-	-	-	-	-	0	0.0%
Galway	588	604	582	554	449	471	270	3,518	0.9%
Greenore	613	788	906	1,023	1,128	1,283	1,335	7,076	1.9%
Killybegs	38	33	32	94	58	62	63	380	0.1%
Kilrush	-	-	-	-	-	-	-	0	0.0%
Kinsale	24	-	47	25	12	69	37	214	0.1%
New Ross	270	345	390	363	-	270	173	1,811	0.5%
Rosslare	2,179	2,166	2,143	2,040	1,595	2,956	3,057	16,136	4.4%
Shannon Foynes	10,949	11,283	10,681	9,622	9,456	10,969	9,819	72,779	19.6%
Sligo	31	14	19	35	28	31	32	190	0.1%
Tralee Fenit	23	-	28	23	24	16	24	138	0.0%
Waterford	1,325	1,613	1,995	1,847	1,842	1,994	2,010	12,626	3.4%
Wicklow	152	142	193	168	153	142	153	1,103	0.3%
Youghal	85	-	53	11	15	14	2	180	0.0%
Totals	**50,712**	**53,346**	**55,086**	**53,240**	**51,364**	**53,958**	**53,155**		

Source: *Extracted from CSO Statistics on port traffic 2013 to 2023*

4.4 Cruise liners visiting Irish ports

Cruise ships visited 10 ports during the period 2016 to 2022. Table 8 shows the breakdown of these visits, while also clearly illustrating the impact of the Covid pandemic on global tourism. Cruise arrivals in 2022 though fewer than 2019 totalled 315, with visits to Dublin declining from 153 to 23 as visits to Dún Laoghaire increased from 6 in 2019 to 63 in 2022. Most visits by cruise ships to Irish ports occurred between May and September in 2022. Data for 2023 was not available at the time of writing this report.

Table 8: **Visits by cruise ships to Irish ports**

	2016	2017	2018	2019	2021	2022
Port	Number of cruise ships					
Bantry Bay	2	3	9	11	0	9
Castletownbere	1	0	0	0	0	0
Cork	57	68	93	100	0	81
Dublin	109	127	150	158	0	23
Dún Laoghaire	8	7	3	6	0	65
Galway	4	5	9	10	0	14
Killybegs	13	12	15	11	0	21
Rosslare	1	0	0	0	0	0
Shannon Foynes	0	0	3	2	0	3
Waterford	14	12	18	17	0	24
Totals	**209**	**234**	**300**	**315**	**0**	**240**

Source: *Extracted from CSO Statistics on port traffic 2013 to 2023*

Section 5. **Skills and education – a global perspective**

Multiple occupations exist across the marine sector in Ireland. The International Classification of Occupations (ISCO),[66] a long-standing initiative of the International Labour Organisation (ILO). provides an internationally agreed framework to define and compare occupations in generic terms. Known as ISCO-08 this hierarchical framework comprises various levels and groups of different occupations as described in Table 9.

Table 9: **Occupational framework**

Major Groups	Number of Sub Major Groups	Number of Minor Groups	Number of Unit Groups
1 Managers	4	11	31
2 Professionals	6	27	92
3 Technicians and Associate Professionals	5	20	84
4 Clerical Support Workers	4	8	29
5 Service and Sales Workers	4	13	40
6 Skilled Agricultural, Forestry and Fishery Workers	3	9	18
7 Craft and Related Trades Workers	5	14	66
8 Plant and Machine Operators, and Assemblers	3	14	40
9 Elementary Occupations	6	11	33
10 Armed Forces Occupations	3	3	3
Total number of groups	**43**	**130**	**436**

Source: *ILO – ISCO-08*

The generic characteristics of the ISCO major, sub-major group and minor groups provide a means to inform the profile of occupational skills across the five areas of interest in this scoping study, namely: Maritime Transport; Shipbuilding and Related Services; Energy (in particular Offshore Renewable Energy and Alternative Fuels); Marine Tourism; and Maritime Monitoring, Security and Surveillance. The profile is built around seven of the 10 major groups - Managers, Professionals, Technicians and Associate Professionals, Clerical Support Workers, Service and Sales Workers, Craft and Related Trades Workers, Plant and Machine Operators, and Assemblers and Elementary Occupations, with reference to the definitions and the work tasks in each major sub-group. A summary description of the ISCO-08 profiles is shown in Table 10 below. A more complete summary of each profile including the associated tasks is provided in Appendix 2.

[66] ILO (2007) **The International Classification of Occupations (ISCO)**. Available at: https://ilostat.ilo.org/resources/concepts-and-definitions/classification-occupation/

Table 10: **Summary of ISCO Occupation profiles**

Major Groups	Summary Description
1 Managers	Managers plan, direct, coordinate and evaluate the overall activities of enterprises, governments and other organizations, or of organizational units within them, and formulate and review their policies, laws, rules and regulations.
2 Professionals	Professionals increase the existing stock of knowledge; apply scientific concepts and theories; teach about the foregoing in a systematic manner; or engage in any combination of these activities.
3 Technicians and Associate Professionals	Technicians and associate professionals perform technical and related tasks connected with research and the application of scientific concepts and operational methods, and regulations.
4 Clerical Support Workers	Clerical support workers record, organise, store, compute and retrieve information, and perform various clerical duties in connection with financial operations, travel arrangements, requests for information, and appointments.
5 Service and Sales Workers	Service and sales workers provide personal and protective services related to travel, housekeeping, catering, personal care, or protection against fire and unlawful acts, or demonstrate and sell goods in wholesale or retail shops and similar establishments, as well as at stalls and on markets..
6 Skilled Agricultural, Forestry and Fishery Workers	N/A
7 Craft and Related Trades Workers	These workers apply specific technical and practical knowledge and skills in the fields to construct and maintain buildings; form metal; erect metal structures; set machine tools or make, fit, maintain and repair machinery, equipment or tools; produce metal and other articles. The work is carried out by hand and by hand-powered and other tools The tasks call for an understanding of all stages of the production process, the materials and tools used, and the nature and purpose of the final product.
8 Plant and Machine Operators, and Assemblers	Plant and machine operators, and assemblers operate and monitor industrial and agricultural machinery and equipment on the spot or by remote control; drive and operate trains, motor vehicles and mobile machinery and equipment; or assemble products from component parts according to strict specifications and procedures. The work mainly calls for experience with and an understanding of industrial machinery and equipment as well as an ability to cope with machine-paced operations and to adapt to technological innovations.
9 Elementary Occupations	Elementary occupations involve the performance of simple and routine tasks which may require the use of hand-held tools and considerable physical effort.
10 Armed Forces Occupations	N/A

Source: *ILO – ISCO-08*

5.1 Occupational skills

A *skill* includes two components: *a skill level* and *skill specialisation*.[67] The skill level is described "as a function of the complexity and range of tasks and duties to be performed in an occupation" and is measured considering one or more of:

- the nature of the work performed in an occupation in relation to the characteristic tasks and duties for each skill level;
- the level of formal education defined in terms of the International Standard Classification of Education (ISCED-97)[68] required for competent performance of the tasks and duties involved; and
- the amount of informal on-the-job training and /or previous experience in a related occupation required for competent performance of these tasks and duties.

The *skill specialisation* is considered in terms of four conceptual concepts:

- the field of knowledge required
- the tools and machinery used
- the materials worked on or with: and
- the kinds of goods and services produced.

The ISCO standard places skills on a four-point scale ranging from Level 1 which is associated with skills that require the performance of simple and routine physical or manual tasks, to Level 4 which require complex problem solving and decision making based on an extensive body of theoretical and factual knowledge in a specialised field. The standard itself makes reference to the ISCED levels of classification for education. More detail on the ICSO skills levels is included in Appendix 2.

5.1.1 Transferable skills – future competencies for the maritime economy

The maritime sector faces substantial change because of climate change, social issues, global uncertainty, increased competition, and the impact of new scientific and technological developments on how it functions.[4,70,71] Future global employment trends include the integration of new and frontier technologies and broadening digital access. These will produce both job losses and new recruitment, the effects of which are expected to largely balance each other out.[69]

The need for the industry to anticipate and plan how technological and other changes will affect future skills and competencies is not new.[69,70,71] Future global trends affect all sectors not just the maritime sector, requiring industries to consider the future skills needs of their workforce. Allied to skills are employee competencies - the "combination of observable and measurable knowledge, skills, abilities and personal attributes that contribute to enhanced employee performance and ultimately result in organizational success."[72] Technological developments will radically change the employment pattern in the maritime industry and trigger the necessities of highly qualified human resources. They may also require employees to acquire new competencies to support their role within organisations.[70]

[67] ILO (2006) **International Standard Classification of Occupations (ISCO-08) – Conceptual Framework**. Available at: https://www.ilo.org/public/english/bureau/stat/isco/docs/annex1.pdf
[68] UNESCO (1997) **International Standard Classification of Education.** Available at: http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-1997-en_0.pdf
[69] World Economic Forum (2023) **Future of Jobs Report.** Available at: https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf
[70] Kadir Cicek, Emre Akyuz, Metin Celik, (2019) **Future Skills Requirements Analysis in Maritime Industry**, Procedia Computer Science, Volume 158, 2019. Available at: https://doi.org/10.1016/j.procs.2019.09.051
[71] International Transport Workers Federation (2019). **Transport 2040 – Automation, Technology, Employment, the future of work**, World Maritime University, Malmo, Sweden. Available at: https://commons.wmu.se/lib_reports/58/
[72] University of Nebraska. **Core Competencies.** Available at: https://hr.unl.edu/compensation/nuvalues/corecompetencies.shtml

Examples of generic competencies defined as relevant to the future work roles are summarised below.

Table 11: **Generic competencies required for future employment**

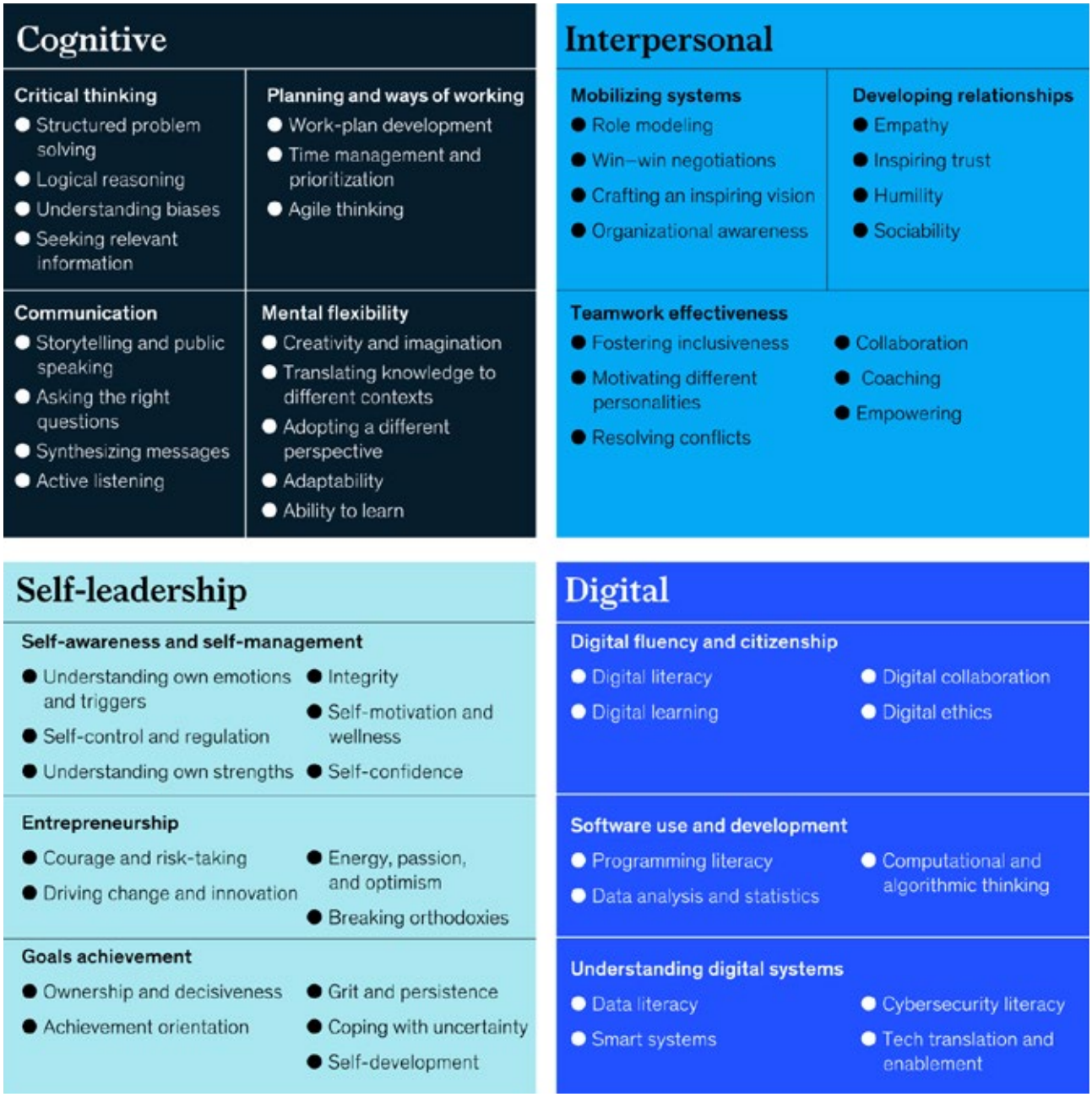
Competencies	Source
Technical, Social, Personal, Methodological, Transferable skills	Cicek[70]
Problem solving, Self-management, Working with people, Technology Use and Development	World Economic Forum[69]
Cognitive, Interpersonal, Self-leadership, Digital	McKinsey [73]

Global trends described above indicate the maritime sector is a highly specialised environment in which skills requirements converge around three essential skill areas/competencies. These include adding value beyond the capabilities of automated systems; functioning effectively within digital environments; and being able to adapt to new ways of working and new occupations.

McKinsey summarised the findings from an international survey of future work roles; they identified 58 competencies/skills within four generic competencies required to compete effectively in future work roles/occupations as outlined below in Figure 1.[73]

[73] McKinsey (2021) **Defining the skills citizens will need in the future world of work.** Available at: https://www.mckinsey.com/industries/public-sector/our-insights/defining-the-skills-citizens-will-need-in-the-future-world-of-work

Figure 1: **Future employment roles as defined by McKinsey**



Section 6. **The skills and education landscape in Ireland**

The mechanisms for addressing skill and education needs of the maritime industry in Ireland are dependent on the general education landscape that exists within the country. This chapter provides background on the key elements of Ireland's education framework. Policy responsibility for the framework lies with the Department of Further and Higher Education, Research, Innovation and Science and the Department of Education. The key bodies responsible for policy implementation are set out in this section, followed by a description of the changing Irish apprenticeship system. A brief overview of the National Framework for Qualifications (NFQ) is also provided.

Increasingly, individual sectors in the economy are utilising the NFQ as a mechanism to set out the qualifications required in individual roles. This is done in order to improve standards, enable employee mobility, ease the recruitment of staff from other jurisdictions, and recognise equivalence between qualifications achieved through different routes. For instance, the transport sector has introduced an apprenticeship that provides for Heavy Goods Vehicle drivers to achieve a qualification equivalent to a Higher Certificate awarded by the Higher Education Institutes.

Having set out the NFQ, current qualifications in Ireland of relevance to the maritime sector are examined. This is followed by an examination of the system for the certification of sea-going personnel which for the most part sits outside the NFQ framework.

6.1 Bodies involved in education and training standards and oversight

Several government bodies are involved in the establishment, management and development of education and training standards in Ireland on a statutory and non-statutory basis. These include:

- **The National Skills Council** was established as part of the National Skills Strategy (2017)[74,75]. The Council advises the Minister for Further and Higher Education, Research, Innovation and Science (DFHERIS) on the direction and prioritisation of skills. It also reviews emerging global trends, oversees research and approves reports and publications by the Expert Group on future Skills Needs (EGFSN), and the Skills and Labour Market Research Unit of SOLAS.
- **The Expert Group on Future Skills Needs** was originally established in 1997 with a membership from Government Departments, the Enterprise Development agencies, Business, Unions, Further Education and Training organisations and the Higher Education Authority. A secretariat is provided to the group by the Strategic Policy Unit of the Department of Enterprise, Trade and Employment. The group advises Government on projected skills requirements at national and sectoral levels, advises on how existing education and training systems can be adapted to best effect, and advises on skills that cannot be met nationally and so must be met through inward migrations. The group establishes working groups to examine sectoral needs. Such a group produced the report *"A study of the current and future skills requirement of the marine/maritime economy to 2020"* in 2015[76].
- **SOLAS** (An tSerbhis Oideachais Leanúnaigh agus Scileanna) is a statutory body, established under the Further Education and Training Act of 2013[77]. SOLAS works with the Education and Training Boards, and Regional Skills managers to provide a range of further education and training programmes, including apprenticeships, traineeships, and specific job advancement training. SOLAS also manages the National Skills Database and through its Skills and Labour Market Research Unit (SLMRU) publishes research and reports on the further and higher education sector and other related sectors. SOLAS is the agency with primary responsibility for management of apprenticeships in Ireland, in conjunction with the HEA and Quality and Qualifications Ireland (QQI), industry, and education and training providers. SOLAS maintains a register of employers approved to take on apprentices and a register of apprentices.

[74] Department of Further and Higher Education, Research, Innovation and Science (2021) **National Skills Council.** Available at: https://www.gov.ie/en/organisation-information/7637e6-national-skills-council/

[75] Department of Further and Higher Education, Research, Innovation and Science (2021) **Ireland's National Skills Strategy 2025 – Ireland's Future.** Available at: https://www.gov.ie/en/publication/69fd2-irelands-national-skills-strategy-2025-irelands-future/

[76] EGFSN (2015) **A Study of the Current and Future Skills Requirements of the Marine/Maritime Economy to 2020.** Available at: http://www.skillsireland.ie/all-publications/2015/a study of the current and future skills requirements of the marine maritime economy to 2020.html

[77] **Further Education and Training Act 2013.** Available at: https://www.irishstatutebook.ie/eli/2013/act/25/enacted/en/html

- **The Education and Training Boards** (ETBs) are sixteen regional bodies that are statutorily established under the Education and Training Boards Act 2013[78]. The ETBs are collectively represented by Education and Training Boards Ireland. The ETBs manage and operate Community National Schools, Post-Primary Schools, Further Education (FE) colleges, and a range of adult and further education centres delivering education and training programmes including Post Leaving Certificate courses to NFQ Level 5 or 6 (see below for further details of the NFQ). The ETBs also provide apprenticeship courses, community courses, traineeships and other courses.
- **Skillsnet** is a state agency, operating under the aegis of the Department of Education. The agency supports the establishment and operation of Skillsnet Business Networks, which are groups of industry bodies, federations or membership based professional bodies that are connected by industry sector or region. These take a lead in identifying skills requirements and sourcing education providers to address these. In addition, Skillsnet carries out research in conjunction with other bodies on the likely needs of industry sectors, technology developments, and other related topics.
- **Quality and Qualifications Ireland** (QQI) is the statutory body responsible for the external quality assurance of further and higher education and training in Ireland. Established under the Qualifications and Quality Assurance (Amendment) Act 2012 (as amended) QQI validate programmes, make awards and are responsible for the promotion, maintenance, and review of the National Framework of Qualifications (NFQ – see below)[79]. QQI also informs the public about the quality of education and training programmes and qualifications and advises the Government on national policy regarding quality assurance and enhancement in education and training.
- **The Higher Education Authority** (HEA) leads the strategic development of the Irish higher education and research system with the objective of creating a coherent system of diverse institutions with distinct missions. The HEA has been assigned statutory responsibilities under the Higher Education Act 1971, the Universities Act 1997, the Institutes of Technologies Act 2006 and the Technological Universities Act 2018 for the effective governance and regulation of higher education institutions and the higher education system. Significant elements of these Acts were consolidated and updated under the Higher Education Authority Act of 2022, which fully supersedes the 1971 Act. In addition to its more well known functions in relation to the Higher Education Institutes (HEIs), the HEA plays a significant supporting role to SOLAS in the operation of the national Apprenticeship scheme. The HEA also operates Springboard, the national skills development programme for areas with employment opportunities in the economy.

[78] **Education and Training Boards Act**. Available at: https://www.irishstatutebook.ie/eli/2013/act/11/enacted/en/index.html
[79] **Qualifications and Quality Assurance (Education and Training) (Amendment) Act 2019**. Available at: https://www.irishstatutebook.ie/eli/2019/act/32/enacted/en/html

6.2 **Apprenticeships in Ireland**

The apprenticeship system in Ireland is currently complex and in a period of transition in line with the *Action Plan for Apprenticeship 2021-2025*, published by Government in 2021[80]. A key objective of that action plan is to integrate two distinct apprenticeship systems into one. *Craft Apprenticeships* are typically associated with the manufacturing, electrical, motor and construction industries operating under the Industrial Training Act of 1967. SOLAS oversees these schemes with three off-the-job and four on-the-job phases each lasting between three and 6 months leading to a Level 6 qualification on the National Framework for Qualifications (NFQ – see below). So called *New* or *Consortia-led Apprenticeships* arose from a 2013 review of apprenticeships that led to a range of accredited apprenticeships being offered by a range of providers with differing delivery models. Industry must lead the new apprenticeships for a minimum of 2 years and incorporate 50% on-the-job training. These apprenticeships can lead to a qualification between level 5 and 10 on the NFQ.

Education and training standards bodies mentioned in the previous section that have roles relating to apprenticeships include **SOLAS**, the **HEA** and **QQI** and a range of education providers. In addition, there are a number of implementing bodies and structures that include:

- **The National Apprenticeship Advisory Committee** (NAAC) was established in 1994 as a subcommittee of the SOLAS board. It advises the board on all aspects of the standards-based craft apprenticeship system and has no role in relation to the consortia-led apprenticeships.
- **The Apprenticeship Council** (AC) oversees the expansion of *New* or *Consortia-led Apprenticeships* by issuing periodic calls for consortia. The Council has no role in relation to craft programmes. The Minister for Education appoints Members of the Council, with representatives from the Irish Congress of Trade Unions, further and higher education and training bodies and the Department for Education.
- **The National Apprenticeship Office** (NAO) is a new body, the requirement for which was identified in the *Action Plan for Apprenticeship 2021-2025* and which was established jointly by SOLAS and the HEA in 2022. The Office is assuming the role of being the lead agency responsible for all apprenticeships (both craft and consortia based) on behalf of the Government integrating the functions previously carried out by its parent organisations. As such, the Office will assume responsibility for maintenance of the national register of employers approved to take on apprentices and a national register of apprentices. As an office of both SOLAS and the HEA, the NAO must adhere to the corporate governance requirements of both its parent bodies.
- **The National Apprenticeship Alliance** (NAA) is also a product of the *Action Plan for Apprenticeship 2021-2025* and established in 2022. Its role is to assume (in a transition that is currently underway) the functions of the NAAC and the AC to provide advice and guidance to the NAO, support the NAO in the delivery of the *Action Plan for Apprenticeship 2021-2025*, recommend viable new apprenticeships and calls for their creation, review and approve *occupational profiles* for apprenticeships (an occupational profile is a technical term that is described further in the context of the National Qualification Framework below), establish subcommittees including a committee on equity of access, and working with SOLAS, the HEA and the NAO to develop a migration plan for craft apprenticeships to a single system in line with the *new apprenticeship* model.
- **Industry Consortia** are industry-led groups which identify the need for an apprenticeship, develop its programme, oversee its rollout and ensure it maintains relevance to industry. A consortium must involve, and be led by, industry representative bodies. A training provider will lead in the provision and coordination of the apprenticeship and may draw on collaborating training providers for delivery of the off-the-job parts of the programme. Typically, there is a geographic spread element to the inclusion of partner training providers. Industry Consortia develop occupational profiles for consideration by the AC (transitioning to the NAA when it assumes those functions).

[80] Department of Further and Higher Education, Research, Innovation and Science (2021) **Action plan for apprenticeship 2021-2025**. Available at: https://apprenticeship.ie/news-events/news/launch-of-action-plan-for-apprenticeship-2021-2025

6.3 The National Framework for Qualifications

6.3.1 Overview

The National Framework for Qualifications (NFQ) is the system used in Ireland to describe the level, class and award types of qualifications in the State's education and training system. QQI have a statutory responsibility for the development, maintenance and public awareness of the NFQ. This responsibility extends to approval of awards, maintaining a register of qualifications, recognition of foreign qualifications and the provision of information services to education providers and learners.

The system covers qualifications that range from literacy at (Level 1), through to the Leaving Certificate (at Levels 5/6), to Doctoral degrees (at Level 10). There are multiple benefits to the NFQ, which QQI summarize as[81]:

- It provides **individuals** with an understanding of a qualification and can help individuals to compare qualifications.
- It provides **learners** with a pathway for progression through education and training.
- It provides a resource for **employers** to learn more about the qualifications their employees have obtained and allows the levels to be used as a recruitment tool.
- It provides **Education & Training providers** with clear identification of qualifications achieved by applicants and may help with credit transfer between programmes and accessing new or additional programmes by the recognition of prior learning.

Ireland is not unique in the use of such a framework, with similar frameworks in operation in over 150 countries describing what qualification holders know, can understand and are able to do.[82] QQI maintain and publish reports comparing the NFQ to the European Qualifications Framework (EQF) and the Qualifications Framework of the European Higher Education Authority (QF-EHEA). [83]

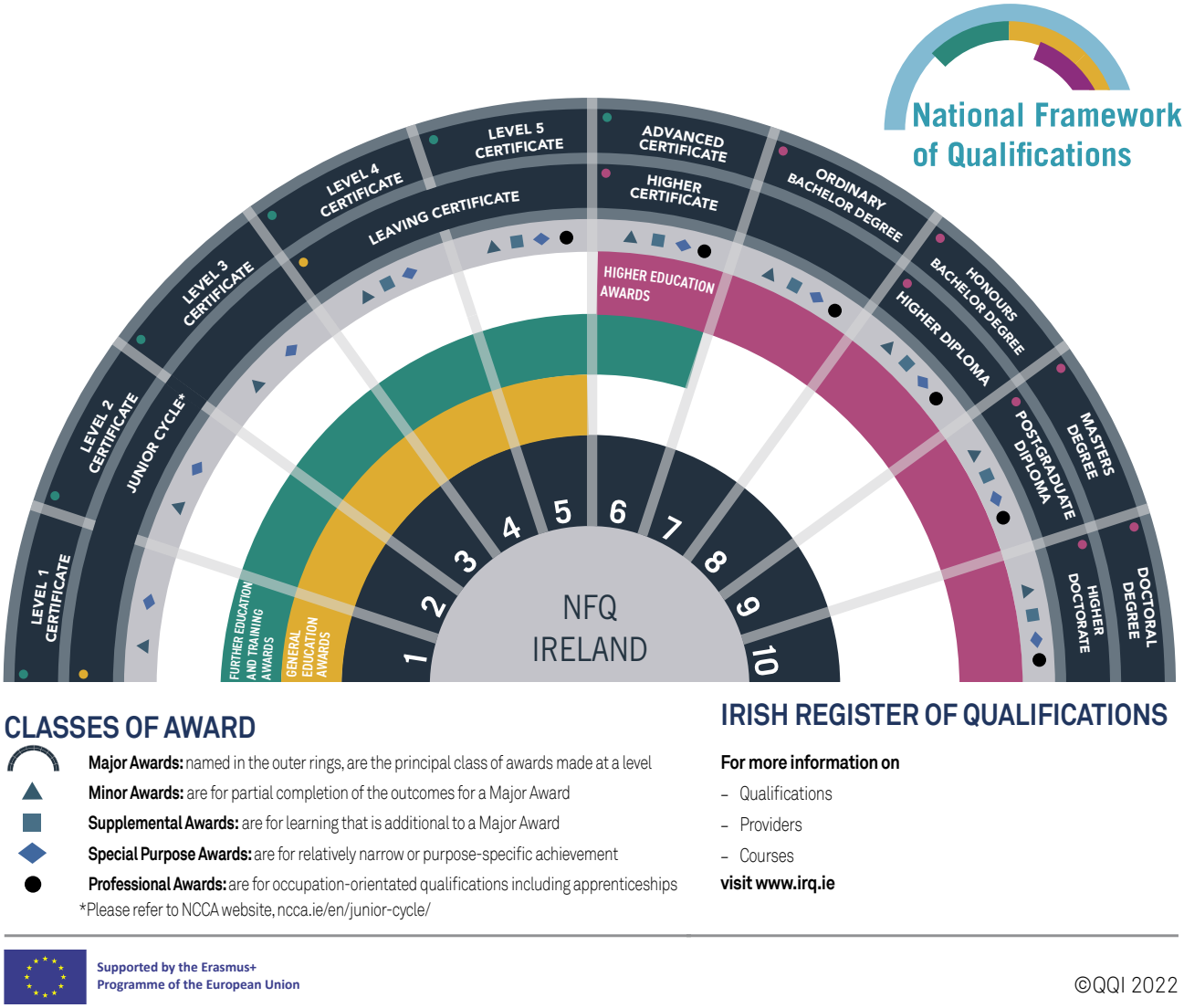
[81] Quality and Qualifications Ireland (2021). **National Framework of Qualifications.** Available at: https://www.qqi.ie/what-we-do/the-qualifications-system/national-framework-of-qualifications

[82] Quality and Qualifications Ireland (2021) **National Framework of Qualifications – Explanatory Video**. Available at: https://www.youtube.com/watch?v=qK15HlhDbo4&t=70s

[83] Quality and Qualifications Ireland (2020) **The Irish National Framework of Qualifications – December 2020 National Report**. Available at: https://www.qqi.ie/sites/default/files/media/file-uploads/NFQ Referencing Report 12-2020.pdf

The overall NFQ has been illustrated by QQI as shown in Figure 2.

Figure 2: **The Irish National Framework for Qualifications**



Similarly, the *UK and Ireland Frameworks and Policy Group*, of which QQI is a participant, have published a guide to comparing qualifications in Ireland and the UK.[84]

The diagram shows, in a quite intuitive fashion, the major elements of the framework and where the different award types arise in the education and training system. General Education awards, e.g. the Junior Certificate, occur exclusively at levels 1 through 5. There is overlap at Level 6 between Further Education and Training awards (which occur at Levels 1 through 6) and Higher Education awards which occur at levels 6 through 10. In the past there has been a popularly perceived association between some kinds of occupation-oriented qualifications and further education and training awards, e.g. apprenticeships. However, this is no longer the case with some apprenticeships resulting in awards at levels 7 or higher including the Supply Chain Manager apprenticeship at level 9.[85]

[84] QAA (2023) **Qualifications can cross boundaries – a guide to comparing qualifications in the UK and Ireland.** Available at: https://www.qqi.ie/sites/default/files/2023-08/Qualifications Can Cross Boundaries-Aug-2023_0.pdf

[85] See https://apprenticeship.ie/ for the complete list of apprenticeships currently available.

6.3.2 Implementation of the NFQ

In 2020 QQI published a green paper on the Qualifications System in Ireland, and this is accompanied by a Technical Paper which sets out considerable detail on the current implementation of the NFQ and the underlying principles that inform qualification frameworks.[87,88]

While a complete summary of these papers is beyond the scope of this report, a number of key concepts are set out that are worth highlighting here, as they set out the nature of qualifications and the elements that are relevant to assessing skills and education gaps.

- The Technical Paper clarifies that, in the Irish Context, **Tertiary Education** is taken to mean Further and Higher Education and Training, Higher Education, and Professional Education and Training.
- A **Qualification** is knowledge, skill, and/or competence assessed to a specified standard.
- **Occupational Standards** are statements of the activities or tasks related to a specific job and its practice.
- An **Occupational Profile** is a description of knowledge, skills and/or competencies (i.e. the qualifications) that a professional or worker must have to perform a task in the workplace.
- An **Occupation** may refer to a fulltime occupation (e.g. an electrician, engineer) or an activity that forms part of a person's job, e.g. handling fluorinated gasses, operating particular kinds of machinery or tools, etc.

The technical paper sets out that there are four types of body that can make awards in the context of the NFQ. They are:

1. **QQI itself as an award body.** QQI certifies qualifications of those who have completed a programme that QQI has validated; completed a prior learning process that QQI has approved; or a combination of these. There are QQI awards in Further Education and Training (FET) and Higher Education (HE) with different methodologies for their application. Both use an assessment of the Minimum Intended Programme Learning Outcomes (MILPOS) as the definitive standard for an award,
2. **Designated Awarding Bodies** (DABs). These are effectively the universities, the technological universities and the Institutes of Technology (up to level 9). Recent legislative developments mean that the Technological Universities are envisaged as having a lesser role in FET. DABs determine the award standard for their own awards (that is the NFQ level the award is made at), using the award-type descriptors included in the NFQ as a standard.
3. **Delegated Authority (DA) awarding bodies are bodies who must make reference to the standards set out by QQI,** but can validate that their programmes meet those standards. This is different to the DABs who can determine where their awards sit on the NFQ without reference to the QQIs own standards and rely instead on the NFQ alone. In real terms this is a pathway for providers such as the IOTs who previously relied on QQI to make awards in their own right, and some IOTs still do this (or rely on other HEIs) to make awards for professional or research doctorates. To some extent for the IOTs the DA designation has become redundant with their designation as DABs in 2020. The relevance of the DA designation for future education development is that other bodies can apply to become DAs. Currently this applies to the ETBs and bodies such as Teagasc. Subject to suitable enabling regulations, this route may be relevant to private education providers.

[87] QQI (2020) **Green paper on the qualifications system**. Available at: https://www.qqi.ie/sites/default/files/2021-10/green-paper-on-the-qualifications-system.pdf
[88] QQI (2020) **Technical paper on the qualifications system**. Available at: https://www.qqi.ie/sites/default/files/2021-10/technical-paper-on-the-qualifications-system.pdf

4. **Listed Awarding Bodies** (LABs) are provided for under the Qualifications and Quality Assurance (Education and Training) (Amendment) Act 2019, although the relevant provision of the Act has not yet been enacted (at the time of writing). The LAB designation is, broadly, intended for providers of education making awards in respect of ETB programmes that currently are not placed on the NFQ (in order to bring such qualifications into the NFQ structure), and for professional bodies to place their awards on the NFQ. In respect of professional bodies, it should be noted that an LAB does not need to be a provider of a training or education programme (unlike DABs or DAs), but can partner with other providers.

The QQI paper sets out that (at the time the paper was prepared), while there are many providers of Higher Education that lead to NFQ awards that are awarding bodies (either DA or DAB), there are no providers making FET awards on the NFQ. Instead such providers are relying on a body that is a DA, DAB or QQI itself to make the award. In the future, such providers could instead turn to a LAB. In the context of this scoping study, the introduction of the LAB designation opens the possibility of professional bodies and regulatory authorities placing their awards on the NFQ working in partnership with Higher or Further Education providers.

In relation to apprenticeships, QQI state that the award must be made at levels 5 to 9, and that the apprenticeship must align with the descriptor of that award specified in the NFQ (known as a Professional Award Type Descriptor) and an approved Occupational Profile (OP).[89] As noted in the previous section, an OP is developed (for so called new apprenticeships) by an industry consortium. An OP is approved by the Apprenticeship Council, while the actual award is typically made by a DA (the former IOTs): so, apprenticeships are examples of qualifications that have aspects of their approval carried out by separate bodies. In addition to the characteristics of an Occupational Profile as defined earlier which an apprentice will have on completion of their training, the Apprenticeship Council require that consortia also specify the duration and the proposed NFQ level.

6.3.3 Employment groups and educational awards

Those maritime sector employees educated in Ireland generally possess a formal qualification placed on the NFQ. Where employees possess qualifications awarded from outside the state, some awards may have a recognised equivalent within the NFQ levels. Table 12 indicates the typical qualification possessed by individuals in major employment groups.

Table 12: **Typical qualifications for employment groups**

Employment Group	NFQ	Qualification	Providers
Managers	8,9 10	Honours Degree or Higher Diploma, Professional body award	Universities, Technological Universities, private bodies
Professionals	8,9 10	Honours Degree or Higher Diploma, Professional body award	Universities, Technological Universities, private bodies
Associate professional and technicians	5,6 &7	Higher Certificate/Advanced Certificate and Ordinary Bachelor's Degree	Technological Universities, Technical colleges, private bodies, Professional bodies
Skilled trades	5,6	Higher Certificate/Advanced Certificate	Technological Universities, Technical colleges, Professional bodies
Administration	5, 6	Higher Certificate/Advanced Certificate	Technical colleges, Professional bodies, commercial training companies
General operatives	3,4&5	Secondary School Leaving Certificate and Certificate FET awards	Secondary schools, ETBs, commercial training companies

Source: *compiled from ILO, EGFSN, QQI and interviews*

[89] Separate guidelines are proposed for Level 10 awards in apprenticeships.

6.4 Education and training providers for the sector

This section identifies the main education and training providers that contribute to developing the pipeline of new recruits to the maritime sector, together with organisations that deliver further education and training to current and potential employees. It should be noted that during the engagement with interviewees carried out as part of this study, it became apparent that a degree of confusion exists regarding the terms "education", "training" and "skills development" on the part of some participants. It was common for the terms to be used interchangeably in discussions around future skills needs.

Not all positions in the maritime sector require specialist knowledge or need staff with sector specific skills. This is particularly so for many of the financial, information and communications technology and administrative/support roles in each of the sub-sectors. Similarly, positions such as general operatives, mechanical and electrical trades, transport, catering; unless the employee is engaged in offshore work, do not require specialised maritime training, but rather they acquire industry knowledge during their employment.

The education and training providers identified in this section are mostly public sector organisations: traditional universities, the new technological universities, state agencies, and Education and Training Boards (ETBs). A minority of private sector training providers offer maritime related courses.

There is an extensive body (95 organisations) of private commercial training providers offering close to 4,000 courses in 11 areas including e.g. marketing, communications, management and organisational development. Delivery is predominantly on-line, though some offer blended and classroom delivery.[90] While these are typically unrelated to the maritime domain, they do provide general skills training that can be applied to the maritime sector.

Individual training providers are listed in the subsections below only when it was possible to identify a specific marine/maritime related course; and where institutions offer courses identified on the QQI Register of Qualifications. A minority of courses delivered in conjunction with professional bodies are included within the National Framework of Qualifications. For instance, the Level 6 Certificate in Sustainable Supply Chain and Logistics offered by South East Technological University is accessed by students through the Chartered Institute of Logistics and Transport. By contrast, courses offered by the Chartered Institute of Shipbrokers in Ireland are not currently on the NFQ.

Some of the courses form a means to achieve some, or all, of the education requirements of the certification requirements for seagoing personnel. For instance, the NMCI offers Level 8 courses which satisfy the MSO education requirements for roles such as bridge and engineering officers. The requirements for seagoing personnel are the subject of a separate section later in this document.

No data describing employment levels in terms of occupational roles in the maritime sector is available. Only estimates of replacement and demand for employees in major employment groups, somewhat like the groups used by the International Labour Office exist.[76] These data provide no insight to specific roles or disciplines, being limited to generic groups, which include managers, professionals, associate professional and technicians, skilled trades, administrative and operatives.

6.4.1 Maritime transport – including ports

Ireland has a fleet of approximately 40 Irish flagged vessels; less than 2000 fishing vessels of which 1486 are less than 10m in length and small numbers of domestic ferries and work boats.[91] There are less than 20 ports, as summarised previously in Table 5. These figures indicate that Ireland's maritime transport sector, while of strategic importance, remains relatively small compared to the major international shipping countries. Total employment (FTEs) in the sector, which excludes employment in the fishing fleet, has remained constant over the past 5 years at around 4,800 FTEs.[92]

[90] **Corporate Training.ie – Ireland's Corporate Training Database.** Available at: https://www.corporatetraining.ie/training-providers/
[91] European Commission (2021). **The Irish Fishing Fleet for 2020**. Available at: https://oceans-and-fisheries.ec.europa.eu/system/files/2021-09/2020-fleet-capacity-report-ireland_en.pdf
[92] Hynes et al (2022) **Ireland's Ocean Economy Report 2022**. SEMRU, University of Galway. Available at: https://www.universityofgalway.ie/media/researchsites/semru/Irelands-Ocean-Economy-2022-Final-Web-low-res.pdf

Ireland's shipping and ports operations employ staff in many roles. Table 13 summarises these roles according to each employment group. The sector is relatively mature, stable, and subject to strict regulations. In the case of shipping, seagoing staff are required to have followed training as specified by the Department of Transport in accordance with Irish and international law. Similarly, some port staff e.g. harbour masters, must hold a Certificate of Competency as Master or Chief Mate STCW, for service in the Irish Merchant Marine; have commanded a ship in the naval service; or be the holder of a Skippers Full certificate of competency for vessels of 24m in length. Table 13 identifies employment roles in the Maritime Transport sub-sector.

Table 13: **Typical job roles/ descriptions**

Employment group	Role/job description
Managers	Directors, Project Managers, Fleet Managers, Harbour Masters
Professionals	Master Mariners and other Deck Officers, Engineering Officers, Naval Architects, Marine Surveyors, Hull Surveyors, Cargo Surveyors, Maritime Business Analysts, Shipping Accountants & Lawyers, Hydrographic Surveyors, Engineers – Mechanical, Civil, Electrical, Structural
Associate professional and technicians	Marine Insurance Agents, Marine Underwriters, Cargo Claims Personnel, Ships Agents, Freight Forwarders, Commodity Traders, Charterers, Ship Brokers, Ship Chandlers, ICT managers and technicians, HR managers
Skilled trades	Pilots, Radio Operators, Chefs, Mechanical Fitters, Electricians, Maintenance Technicians
Administration	HR staff, General Administrators, Receptionists
General operatives	General Operatives, Stevedores, Tug Operators, Crane operators, Deckhands, Boat Crew, Riggers, Tractor Drivers, Security

Source: *EGFSN and interviews*

Ireland's higher and further education providers offer multiple courses without a specific maritime component that equip staff to enter employment in multiple roles in the sector. Specialist areas such as engineering, law or finance may require staff to have followed an NFQ university course that is also accredited by a professional body. For instance, most accountants must be accredited by one of the accounting bodies, while typically professional engineers will attain Chartership status. Not all NFQ level courses meet the requirements of professional bodies, without additional education and training. Table 14 lists the main providers of marine dedicated education courses relevant to the maritime transport sector. The qualifications provided by Munster Technological University are delivered at the National Maritime College of Ireland.

Table 14: **Providers of marine dedicated courses relevant to the Maritime Transport and Shipping Sector**

Course	NFQ level	Provider
Bachelor of Engineering in Marine Electrotechnology	7	Munster Technological University
Bachelor of Science in Nautical Science	7	Munster Technological University
Bachelor of Engineering in Marine Engineering	7	Munster Technological University
Certificate in Nautical Studies	7	Munster Technological University
Higher Certificate in Science in Nautical Studies	6	Munster Technological University
Certificate in Marine Engineering and Processes	4	Bord Iascaigh Mhara
Masters of Law in Marine and Maritime Law	9	University College Cork

Source: *Irish Register of Qualifications (irq.ie)*

The ports sector is strategically positioned within the national transport network providing nodes that handle imports and exports essential to the national economy. Several providers deliver courses in transport, logistics and the management of transport: Table 15 identifies these courses. The Bachelor of Business in Supply Chain and Transport Management offered by MTU is delivered at the NMCI.

Table 15: **Providers of transport and logistics related courses**

Course	NFQ level	Provider
Bachelor of Science (Honours) in Transport Management	8	Munster Technological University
Bachelor of Business in Supply Chain and Transport Management	7	Munster Technological University
Certificate in Sustainable Supply Chain and Logistics	6	South East Technological University
Certificate in Warehouse and Transport Management	6	South East Technological University
Certificate in Digitalisation in Transport and Logistics Management	6	South East Technological University
Logistics and Supply Chain	8	Technological University Dublin
Logistics and Distribution	5	Multiple National ETBs

Source: *Irish Register of Qualifications (irq.ie)*

Courses delivered by professional bodies and other accredited providers support the shipping sector to comply with national and international requirements or local requirements concerning employment within the sector. For instance, the Chartered Institute of Ship Brokers deliver foundation and advanced diploma courses to shipbrokers, ship managers and agents. Qualifications arising from Professional body courses may not be accompanied by placement on the NFQ.

Training courses relevant to specific roles such as pilots and port crane operators are available from commercial providers. Separately, courses dedicated to the operations of vessels, radio communications and maritime safety and courses required by the Maritime Safety Directorate are delivered by public and commercial providers and summarised below in Table 16. A more comprehensive list of such courses is provided later in this section in Table 24 in relation to the certification of seagoing personnel.

Table 16: **Training courses for mariners**

Course	NFQ level	Provider
Shipping and Port Sector Training	n/a	Various public and commercial providers
STCW 95 courses and modules	n/a	NMCI/ Munster Technological University
STCW Sea Safety Training Courses	n/a	NMCI/Munster Technological University
STCW GMDSS Radio Communication Training Courses	n/a	Various commercial providers
Short and Long Range Certificate for VHF Operators	n/a	Various commercial providers

Source: *EGFSN, BIM, MTU and interviews*

6.4.2 Shipbuilding and related services

Despite the absence of a major shipyard, Ireland's shipbuilding and related services activity displays a small but steady growth in employment from 2014 to reach 919 FTEs in 2022. It is worth noting that this sector comprises SMEs. Table 17 identifies employee roles in each major employment group in this sub-sector.

Table 17: **Employment roles in shipbuilding and services**

Employment group	Role/job description
Managers	Directors, Project Managers
Professionals	Naval Architects, Marine Surveyors, Engineers – Mechanical, Civil, Electrical/ Electronic, Structural, Software Engineers, Accountants, Marketing and Sales Executives
Associate professional and technicians	Engineering Technicians, ICT Technicians, Computer Aided Design Modellers
Skilled trades	Mechanical Fitters, Electricians, Electronic and Computer Technicians, Metal Fabricators, Welders, Maintenance Technicians, CNC Machinists
Administration	HR staff, General Administrators, Receptionists
General operatives	General Operatives, Crane operators, Deckhands, Riggers, Tractor Drivers, Security

Source: *EGFSN and interviews*

It was not possible in the course of this study to identify marine/maritime specific education or training courses for the shipbuilding and services sector roles identified in Table 17. Employees obtain qualifications that span the full range of NFQ levels from Universities, Technological Universities, Apprenticeships, SkillsNets, ETBs and commercial training providers. Specialised engineering and science staff would typically obtain a level 7-8 or greater at institutions delivering courses accredited by relevant professional bodies, e.g. Engineers Ireland. Multiple providers deliver project management training at post-graduate (level 9), degree (level 8/7) and certificate (level 5/6) levels. Where people in the above roles work offshore, they take specialised training in safety at sea and other marine relevant courses, of the kind described later in this report in respect of sea-going personnel (see Table 24). There are no Naval Architecture Courses in Ireland. Naval architects working in Ireland obtain their qualifications at overseas educational institutions. Several UK universities award degrees in naval architecture, e.g. University of Strathclyde and Newcastle University offer options at undergraduate and post graduate levels in naval architecture, whilst Southampton University and others offer post graduate courses.

6.4.3 Energy – Offshore renewable energy and alternative fuels

Ireland's offshore renewable energy sector is an emerging area of high potential growth, which to date has been overshadowed by land-based wind energy installations. While there are high expectations about its future growth, these coincide with uncertainty arising from changes in the system for issuing maritime consents and government policy with regards to plan led development.[93,94] Employment in the sector shows a gradual growth from 2017 to 2021, reaching an estimated 558 FTEs. Companies have made significant investments over the last 3 years in developing responses to Ireland's Offshore Energy Programme to install a target of 5GW of offshore wind generating capacity by 2030, and the prospect of developing 2GW of non-grid connected capacity through floating offshore wind. Achieving these goals relies on the sector's ability to recruit necessary skills to support projects at the planning stage.[94] The ports and shipping sector has a key role to play in supporting the sector's needs for services and infrastructure from installation to eventual decommissioning of offshore wind turbines. Table 18 lists employment roles in the offshore renewable energy sector.

Table 18: **Employment roles in offshore renewable energy**

Employment group	Role/job description
Managers	Directors, Project Managers
Professionals	Naval Architects, Marine Surveyors, Engineers – Mechanical, Civil, Electrical/ Electronic, Structural, and Software, Planners, Lawyers, Ecologists, Oceanographers, Geologists, Biologists, Accountants, Marketing and Sales Executives, Ships Masters and Deck Officers, Economists
Associate professional and technicians	Engineering Technicians, ICT Technicians, Scientific Technicians, Computer Aided Design Modellers
Skilled trades	Mechanical Fitters, Electricians, Electronic and Computer Technicians, Metal Fabricators, Welders, Maintenance Technicians, CNC Machinists, Divers
Administration	HR staff, General Administrators, Receptionists
General operatives	General Operatives, Crane operators, Deckhands, Riggers, Tractor Drivers, Security

Source: *Interviews conducted as part of this study*

Most education and training needs for the Offshore Renewable Energy sector is delivered by the higher education sector. Specialised engineering, science and business employment follows the path of NFQ level 8 qualifications. Skilled trades, administration and general operatives follow established education and training courses from level 5 to 7, obtaining much of the practical training and experience working in sectors other than the ORE sector.

A relatively recent development is the introduction by the higher and further education sector of dedicated renewable energy education and training courses, including some focused on offshore renewable energy.

Table 19 lists courses which include renewable energy in the name of the course.

[93] Maritime Area Regulatory Authority (2023) **Guidance for completing an application for a Maritime Area Consent.** Available at: https://www.maritimeregulator.ie/wp-content/uploads/2023/08/General-Guidance-for-completing-an-application-for-a-MAC.pdf

[94] Clark Hill (2023) **Offshore Renewable Energy Projects in Ireland – Overview of the Risks and Challenges in the Planning Process and with Judicial Review.** Available at: https://media.clarkhill.com/wp-content/uploads/2023/07/13110730/Clark-Hill-Briefing-Document-Offshore-Renewable-Energy-Projects-in-Ireland.pdf

Table 19: **Renewable energy education and training courses**

Course	NFQ level	Provider
Certificate in renewable energy	6	Dundalk Institute of Technology
Post graduate diploma in renewable energy	9	Dundalk Institute of Technology
Certificate in renewable energy	6	Atlantic Technological University
Post graduate certificate in offshore renewable energy	9	University College Cork
Bachelor of engineering, mechanical and renewable energy	7	Technological University of the Shannon
Bachelor of engineering, renewable energy and electrical engineering	8	Technological University of the Shannon
Cert. in renewable energy technology and control systems	5	National ETBs

Source: Irish Register of Qualifications (irq.ie)

6.4.4 Marine Tourism

Marine tourism makes considerable contributions to Ireland's ocean economy.[92] The broad definition of the marine tourism sector, as inclusive of activities in Marine and Coastal areas defined as municipalities (LAU-2) that either border the sea or have 50% of their surface within a distance of 10 km from the sea, does not allow for a separate analysis of contributions from cruises or marinas.[92] No data exist that support a profile of employment levels in cruise or marinas.

Though there are no Irish owned cruise vessels, Ireland is a destination for cruise ships. Cruise tourism is a growth sector internationally and Ireland has experienced increasing numbers of cruise vessels to Irish ports in recent years.[44,95]

Tourism education and training courses total 150, (slightly more than 10 percent of all education and training courses available in Ireland).[96] Only one of the available courses included specific reference to 'marine' in its title – a level 6 certificate course in Marine Tourism and Food delivered by the Atlantic Technological University. Table 20 identifies direct and indirect employment roles in marine tourism - cruises and marinas.

Table 20: **Employment roles in marine tourism**

Employment group	Role/job description
Managers	Managers - Adventure Centres & Marine Parks, Hotel & Catering Managers, Harbour Masters
Professionals	Marketing and Public Relations Staff, Translators, Environmental Managers
Associate professional & technicians	IT technicians
Skilled trades	Sailing and Wind Surfing Instructors, Canoeing/Sea Kayaking Instructors, Angling Instructors, Adventure Sports Instructors, Life Guards, Boat Builders, Tour Operators/ Guides, Maintenance Technicians, Marine Engine Maintenance, Electricians, Chefs, Pilots, Radio Operators, Port Traffic Managers, Mechanical & Electrical Technicians
Administration	HR staff, General Administrators, Receptionists, Customs officials
General operatives	Bar Staff, Waiting staff, Cleaners, Drivers, Retailers, General Operatives, Security, Divers, Stevedores

Source: *EGFSN and interviews*

[95] **CSO Statistics of Port Traffic.** Available at: https://www.cso.ie/en/statistics/transport/statisticsofporttraffic/
[96] **QQI Irish Register of Qualifications database**. Available at https://irq.ie

6.4.5 Maritime monitoring, security and surveillance

No clear insight into employment levels in this sector exists. Current data presents total employment for a number of different activities under the heading of "Advanced Marine Technology Products and Services".[92] There is an emphasis on the development and manufacture of sensor products, including software, in descriptions of the sector. These provide totals employed across a wide ranging group of application areas, with no separation of monitoring, security and surveillance activities. Maritime Monitoring, Security and Surveillance relies on the use of a wide array of different sensors, sensing platforms and the deployment of systems to capture, analyse and present data concerning activity and processes in Ireland's marine territories. This enables Government Departments and agencies, research institutions and commercial entities to monitor environmental conditions for marine biological research, meteorological forecasting, oceanography, and to monitor physical access on, beneath or above the ocean surface and coastline.

Table 21: **Employment roles in maritime monitoring, security, and surveillance**

Employment group	Role/job description
Managers	Directors, Project managers
Professionals	Engineers - mechanical, electronic, structural, software, communications aviation and aerospace; scientists - chemical, biological, physical, and computer; - oceanographers, civil and military officers, lawyers, planning
Associate professional and technicians	Technicians – ICT, mechanical, electrical and electronic, CAD modellers, web-design, visualisation/simulation; sales and marketing staff, remotely operated vehicle (ROV) operators
Skilled trades	Mechanical fitters, CNC operators, electricians, boat handlers, divers
Administration	General administrators, HR staff
General operatives	Security, deck hands, riggers

Source: *EGFSN, interviews*

A dependency on associate professionals, largely scientific and engineering specialists exists in what is a sector driven by research and innovation. These posts typically require staff to be qualified from NFQ level 7 to 10. Ireland's higher education institutions provide courses relevant to many of the posts identified in Table 21 in engineering, scientific and business-related disciples; they are also the source of many graduates possessing relevant masters and doctoral qualifications.

There is a low visibility in higher and further education courses providing specific maritime/marine related education for the above roles. The main exception relates to courses in marine biological / environmental sciences and ocean sciences; areas, which subject to funding attract exceptional graduates to pursue masters and doctoral awards.

Table 22 lists courses identified within the Irish Register of Qualifications that include marine/maritime/ocean/space in the course description.

Table 22: **Maritime monitoring, security and surveillance related education and training courses**

Course	NFQ level	Provider
Bachelor of Science (Marine Science)	8	University of Galway
Diploma in Scientific Studies (Earth & Ocean Sciences)	7	University of Galway
Bachelor of Science (Earth and Ocean Sciences	8	University of Galway
Master of Science: Ocean, Atmosphere and Climate	9	University of Galway
Postgraduate Diploma in Marine Biology	9	University College Cork
Master of Science in Marine Biology	9	University College Cork
Bachelor of Science (Honours) In Applied Freshwater & Marine Biology	8	Atlantic Technological University
Certificate (SPA) in Space Studies	9	Munster Technological University
Master of Science (Space Science & Technology)	9	University College Dublin

Source: *Irish Register of Qualifications (irq.ie)*

6.5 **Certification of seagoing personnel**

6.5.1 **Seafarers**

Ireland is a party to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) under the auspices of the International Maritime Organisation (IMO). The 1978 Convention was revised in 1995 (STCW-95), and amended in 2010 (The "Manila amendments").[97] The Convention is an important element of the global shipping industry as it allows inter-operability of ship-board personnel between jurisdictions and includes provisions for national regulatory authorities to verify the qualifications and standing of seafarers. There is a requirement on National administrations to make reports to the IMO on compliance, education and training and certification procedures. The Convention includes two codes; Part A is mandatory and defines the minimum standards of competence required of seafarers. Part B is guidance for national authorities on implementation of the Convention.

The Marine Survey Office (MSO) of the Department of Transport is Ireland's competent authority for the implementation of STCW and specifies the national requirements in keeping with the European Union (Training, Certification and Watchkeeping for Seafarers) Regulations 2014 (SI 242/2014) for examinations and course preparation as set out later in this section.

The STCW convention does not apply to seafarers serving on military vessels, government vessels not engaged in commercial service, pleasure vessels, or to those working on board fishing vessels (fishers).[98] A separate code operates for fishers (see below).

To support national authorities, the IMO publishes a series of "model" courses that include a course framework detailing the scope, objectives, entry standards and other information about the course. They also include a course outline (timetable), a detailed teaching syllabus (including the learning objectives and competencies required on completion of the course), and guidance notes for an instructor.[99]

The STCW sets out in detail the requirements for seafarers to perform certain functions on board a ship. Attainment of these standards, through training and time at sea, is evidenced by Certificates of Competency, and Certificate of Proficiency. A competency certificate is issued to masters, officers, radio operators and ordinary seagoing personnel (ratings) who form part of the watch on board a ship. These certificates can be issued with area (e.g. near coastal) tonnage (for bridge roles), or propulsion (for engineer roles) limitations. Certificates of proficiency are issued to evidence that a seafarer has met the required standards of competence for a specific duty. Endorsements of the certificates are issued (separately to the certificate) either by the assessing national authority, or by another national authority to state that the certificate is recognized (this latter scenario might arise where a bridge officer proposes to serve on a ship that sails under the flag of a different country for example).

The STCW also requires cross compliance with the International Safety Management Code (ISM) and the Maritime Labour Convention (MLC). These include safety, security, medical and vessel familiarisation training.

Traditionally, a seafarer would spend their career within a single ship's department, e.g. bridge operations, engine room or deck, with certificates issued with reference to those departments. Under the original STCW-78, seafarers could qualify for a certificate based on sea-going experience alone. Subsequent revisions of the STCW have changed these norms. Seagoing experience must be accompanied by minimum standards of training for certification. In addition, certificates can now be issued to enable the holder to carry out functions and levels of responsibility that apply to multiple departments. However, to do so, the holder must first attain certification in one department before receiving alternative certification for other departments. The introduction of this innovation caters for technological developments and to facilitate new career path options.

The STCW is a detailed and expansive set of standards, and a full explanation of the convention is beyond the scope of this report. The International Transport Worker's Federation's *STCW - Guide for Seafarers* is an accessible and concise summary of the provisions of the convention.[98] The guide's summary table of certification requirements for ships' roles is reproduced as Figure 3.

[97] IMO (2010) **International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)**. Available at: https://www.imo.org/en/ourwork/humanelement/pages/stcw-conv-link.aspx

[98] International Transport Workers Federation (2017) **STCW – A guide for Seafarers (taking into account the 2010 Manilla amendments)**. Available at https://www.itfglobal.org/en/reports-publications/stcw-guide-guide-seafarers

[99] IMO (2023) **IMO Publications Catalogue (with Prices)**. Available at https://indd.adobe.com/view/a21a12ad-3de5-42c2-86d4-6cf890ae7ac2

Figure 3: **Summary of requirements a seafarer requires based on function and responsibility.**

Summary of STCW for seafarers requirements

Key: ◆ = compulsory requirement.
D = if designated with specific function.
A = radio operator on non GMDSS ship needs to hold a certificate.
Training records must now be kept by all crew if they wish to be claim dispensation from the 5 yearly refresher on safety training etc but may not require a record book in all cases..

		Deck				C
Category	**STCW title**	Master	Chief Officer	Officer of the Watch	Radio Officer	
Main Certificate	Certificate of competency	◆	◆	◆	A	
	Certificate of proficiency					
	Endorsement	◆	◆	◆		
	Watch keeping certificate for ratings					
	Endorsement of recognition, foreign flag	◆	◆	◆		
	Medical fitness	◆	◆	◆	◆	
Catering	Certificate of qualification as cook					
Basic safety training evidence	Personal survival techniques	◆	◆	◆	◆	
	Fire fighting	◆	◆	◆	◆	
	Elementary first aid	◆	◆	◆	◆	
	Personal safety and social responsibility	◆	◆	◆	◆	
Familiarisation	Ship specific familiarization	◆	◆	◆	◆	
	Security familiarisation	◆	◆	◆	◆	
Personnel assigned with other safety or security functions	Proficiency in survival craft and rescue boat	◆	◆	◆	D	
	Fast rescue boat	D	D	D		
	Advance fire fighting	D	D	D		
	Medical first aid			◆		
	Medical care	◆	◆			
	Ship security officer	D	D			
	Security awareness or security training	D	D	D	D	
ARPA RADAR GMDSS	ARPA (if fitted)	◆	◆	◆		
	Radar	◆	◆	◆		
	GMDSS-ROC or GOC	◆	◆	◆	◆	
Personnel on tankers cargo operations	Basic training on oil and chemical tankers	◆	◆	◆		
	Advanced training for oil tankers	◆	◆	D		
	Advanced training for chemical tankers	◆	◆	D		
	Basic training on oil & chemical tankers for ratings					
	Basic training for officers on liquefied gas tankers	◆	◆	◆		
	Basic training for ratings on liquefied gas tankers	◆	◆	◆		
	Advanced training for liquefied gas tankers	◆	◆	D		
Personnel on passenger ships	Crowd management	D	D	D	D	
	Safety training					
	Passenger safety	◆	◆			
	Crisis management & human behaviour	◆	◆			
Training	Training record book	◆	◆	◆	◆	

Source: *STCW – A Guide for seafarer*

Officers						Ratings														Other
Engine						Deck					Engine						Catering			Others
Chief Engineer	Second Engineer	Officer of the Watch	Electro-technical Officer	Electrical Engineer	Cadet (deck/engine)	Bosun	Watch-keeping rating	AB Deck/Integrated	OS/Welder/Mechanic	Deck-boy/trainee	Electro-technical Rating	Pumpman/Motorman	Watch-keeping Rating	AB Engine/Integrated	Electrician Rating	Engine Trainee	Chief Steward/Purser	Cook/2nd Steward	Steward/Messboy	All Personnel providing direct services to passangers
◆	◆	◆	◆																	
								◆		◆		◆								
◆	◆	◆	◆																	
							◆	◆		◆	◆	◆								
◆	◆	◆	◆																	
◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
																		◆		
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6.5.2 **Fishers**

As noted above, the STCW does not apply to fishers or fishing vessels. The International Convention on Standards of Training, Certification, and Watchkeeping for Fish Vessel Personnel (STCW-F) was developed under the auspices of the IMO. Adopted by the IMO in 1995, the convention is limited insofar as it generally applies to officers in the deck department of vessels over 24 meters in length, and officers in the engine department of vessels whose main propulsion is 750kW or more. As a consequence, a significant portion of the Irish fishing fleet falls outside its scope.

Ireland, like most EU States and the UK, is not a party to STCW-F. Instead, the requirements for the various certifications required by a fisher are set out in national legislation under the Fishing Vessels (Certification of Deck officers and Engineer officers) Regulations 2023 (SI 313/2023). These follow a similar model to the STCW-F in terms of the use of Certificates of Competency and Certificates of Equivalence. On a case by case basis Ireland recognises certificates issued in accordance with the requirements of the STCW by other EU members states, and other states with some additional standards and conditions. This applies only to Engineering positions and is done by reference to the European Union (Training, Certification and Watchkeeping for Seafarers) Regulations 2014 (SI 242/2014). It should be noted, that this does not imply interoperability between the two sets of regulations for Engineer Officers; an engineer certified under the Fishing Vessel Regulations will not automatically receive a Seafarer equivalence certification. Procedures for the conversion of some fishers certificates of competency are set out in the exam directions operated by the MSO as set out in the next section.

The positions (Certificates of Competency) provided under the Fishing Vessel Regulation (together with accepted STCW equivalent and operating limitations) are as shown in Table 23.

The regulations also provide for equivalence between certificates issued under previous Irish regulations and the regulations of the UK for a limited time.

6.5.3 **The State examination and certification system**

As stated above, the Irish statutory provision for those working at sea are the European Union (Training, Certification and Watchkeeping for Seafarers) Regulations 2014 (for seafarers, and which codify the requirements of STCW) and the Fishing Vessels (Certification of Deck officers and Engineer officers) Regulations 2023. Both regulations provide for the Minister for Transport to issue Certificates of Competency (or equivalent), to designated competent training providers, and to administer examinations. These functions are administered by the Irish Maritime Administration of the Department of Transport; specifically, the Marine Survey Office and the Mercantile Marine Office.

The Department, at its website www.seafarers.ie, provides those working at sea with directions on the requirements for certification and, examinations, as well as practical information on items such as the oral examinations administered by the Department.

Table 23: **Certificates of Competency for Fishers under the Irish Regulations**

Fishing Vessel Certificate	Accepted certificate issued under SI 242/2014	Limitations Applying
Skipper (Full)		None
Skipper (Limited)		Skipper of a fishing vessel of less than 100m in length in the limited area.
Skipper (Limited) <24m		Skipper of a fishing vessel of less than 24m in length in the limited area.
Second Hand (Full)		None
Second Hand (Special)		Skipper of a fishing vessel of less than 24m in length in the limited area only or Deck Officer in the limited area.
Second Hand (Limited)		Deck Officer in the limited area.
Engineer Officer (Fishing Vessel) Class 1	Chief Engineer Officer STCW Regulation III/2	None
Engineer Officer (Fishing Vessel) Class 2	Second Engineer Officer STCW Regulation III/2, or Chief Engineer Officer STCW Regulation III/3 on vessels of less than 3000 kW propulsion power	None, or Chief Engineer Officer on a fishing vessel of less than 3000 kW propulsion power.
Engineer Officer (Fishing Vessel) Class 3	Engineer Officer in Charge of a Watch STCW Regulation III/1	None, or Second Engineer Officer on a fishing vessel of less than 3000 kW propulsion power.

Four sets of examination directions are provided:

- Navigation (for deck officers on merchant vessels)
- Engineering (for officers, operators & engine room watch ratings on merchant vessels)
- Fishing vessel deck officers
- Fishing vessel engineers.

The directions state that the written examinations for merchant vessel positions are held at the NMCI in Cork; while examinations for fishing vessels are held at National Fishery College, Greencastle, Co. Donegal, and at the Regional Fishery College, Castletownbere, Co. Cork. Oral examinations are held at the Department's offices in Dublin.

In addition to the written and oral examinations, candidates must demonstrate having gained knowledge from training courses (e.g. Medical First Aid at Sea). The directions also set out these required ancillary requirements for each grade of Certificate of Competency. A high-level syllabus is also provided in each of the directions for each class of Certificate of Competency. Where pathways for the conversion of fishers' Certificates of Competency exist, these are also set out, as are the procedures for certificates of equivalence (for personnel who received Certificates of Competency or Proficiency from other national administrations). The knowledge required by an applicant for Certificates of Competency is set out in the relevant syllabus, and there are a range of providers that provide courses that result in an MSO issued Certificate of Competency. While these include both public and private providers, they are dominated by BIM and operating units of the NMCI as shown in Table 24.

Table 24: **Course providers of maritime certification related courses**

	Course	
	NMCI(MTU)	
Course		
AB Deck Course	*X**X**X*	
Advanced Fire Fighting		***X***
Basic Training Elementary First Aid	***X***	
Basic Training Fire Prevention and Firefighting		*X*
Basic Training for Officers and Ratings in Liquefied Gas Tanker Cargo Operations		
Basic Training for Officers and Ratings in Oil and Chemical Tanker Cargo Operations		
Basic Training Personal Safety and Social Responsibilities	***X***	
Basic Training Personal Survival Techniques	***X***	
Designated Security Duties	***X***	
Electronic Chart Display and Information Systems (ECDIS)	***X***	
Fast Rescue Boats	***X***	***X***
GMDSS General Operators Certificate (GOC)	***X***	
GMDSS Restricted Operators Certificate (ROC)	***X***	
Medical Care		
Medical First Aid	***X***	
Medical Fitness		
NAEST (M)	***X***	
NAEST (O)	***X***	
Radio Operators Long Range Certificate	***X***	
Radio Operators Short Range Certificate	***X***	
Security Awareness Training		
Ship Security Officer	***X***	
Survival Craft and Rescue Boats other than Fast Rescue Boats	***X***	***X***
Updating Training Advanced Fire Fighting		
Updating Training Fast Rescue Boats		
Updating Training Fire Prevention and Firefighting		
Updating Training Personal Survival Techniques		
Updating Training Survival Craft and Rescue Boats other than Fast Rescue Boats		

Providers															
NMCI Irish Naval	*NMCI Services*	*SEFtec NMCI Offshore Ltd*	*BIM College Castletownbere*	*BIM College Greencastle*	*BIM Skills Services*	*BIM Mobile Training Unit*	*Moher Technologies Ltd*	*VHF and Chartplotter Training*	*Chris Mee Safety Engineering*	*Atlantic Marine Training Ltd*	*25 Additional Providers*	*86 Medica Practitioners*	*Seamanship Centre Donegal*	*Sail Training Int. Dublin*	*ASL Safety & Training*
													X**X**		
X	**X**	**X**	**X**	**X**					**X**						
	X	**X**	**X**	**X**									**X**	**X**	
X	**X**			**X**					**X**						
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	X	**X**													

Section 7. **Estimates of employment in the Irish maritime sector**

The Socio-Economic Marine Research Unit (SEMRU) at the University of Galway produce biennial estimates of employment in the Marine and Maritime sector under the heading of *Ireland's Ocean Economy*. Produced in conjunction with the Marine Institute, they include employment and other data relating to Shipping and Maritime Transport; Tourism in Marine and Coastal Areas; Marine Manufacturing, Construction and Engineering; Marine Retail Services; and Marine Commerce.

The SEMRU reports use a range of data sources, including CSO annual surveys, the IMDO iShip index, the IMDO Irish Maritime Transport Economist and company surveys conducted by SEMRU to provide estimates of employment as Full Time Equivalents (FTEs). Since the initiation of the Ireland's Ocean Economy series in 2012, it has become the most cited source of data in Ireland's maritime sector. The absence of further reliable data precludes further refinement of Maritime sector employment by job-type, skills or qualifications.

7.1 The Report of the Expert Group for Future Skills needs, 2015

The Expert Group for Future Skills Needs (EGFSN) in its 2015 report *A Study of the Current and Future Skills Requirements of the Marine/Maritime Economy to 2020* provides the most recent estimate within the categories Operative Grades; Administration; Skilled Trades; Associate Professional and Technical; Professionals; and Management. [76]

7.1.1 Methodology

The principal input to the EGFSN report was SEMRU's first *Ireland's Ocean Economy* report which established 2010 as a base line year based on data from 2007-2010, and which noted that this period reflected the lowest point of the economic contraction in the Irish economy following the 2007-2008 Global Financial Crisis[100]. The EGFSN report used data from CSO, ESRI and SOLAS as well as SEMRU. It supplemented these data with feedback from structured telephone interviews, thematic workshops, and stakeholder interviews, including maritime enterprises, Government departments, agencies, education providers and industry associations.

Using this data, the report defined a baseline for employment in 2014 together with three demand scenarios. Scenario 1 assumed the targets of *Harnessing Our Ocean Wealth* would be met.[101] Scenarios 2 and 3 included zero growth for Aquaculture, and higher growth for Energy respectively. The report for the most part concentrated on Scenario 1 and included a modelling exercise based on company interviews to estimate the distribution of employment growth across several occupational grades in each sub-sector.

7.1.2 Changes to estimates for Tourism Data

Following the publication of the EGFSN report, a methodological change by SEMRU resulted in significant changes to the estimates of Marine Tourism in the Ocean Economy Reports 2012 and 2014. The 2012 report estimates Marine Tourism employment to be 5,195, whereas the 2014 report. restates the 2012 figure as 13,000.

These changes are relevant when considering the performance of marine tourism as reported in the EGSFN report. The EGSFN report of 2014 estimate of marine tourism employment was 3,502, the same as reported in the 2012 Ocean Economy Report, rising to 5,199 by 2020 an increase of 48.5 %. Applying this increase to the 13,003 figure reported by SEMRU in the 2014 report results in a projected increase in marine tourism employment to 19,301.

[100] Vega, A., Corless, R., Hynes, S. **Ireland's Ocean Economy – Reference Year: 2010**. SEMRU, NUI Galway. 2013. Available at https://ageconsearch.umn.edu/record/161676/?ln=en

[101] Government of Ireland (2012) **Harnessing Our Ocean Wealth – An integrated Marine Plan for Ireland**, The Inter-Departmental Marine Coordination Group, 2012. Available at: https://www.ouroceanwealth.ie/publications

Assessing the EGFSN future skill demand to 2020 estimates

Table 25 shows the EGFSN estimated demand for skills in 2020 and SEMRU estimates for 2021 as published by SEMRU in December 2022, based on reference data from 2020. The table includes the revision of marine tourism data as outlined above. This indicates a difference of 69% between the Ocean Economy Report 2020 compared to the projected total employment in the sector reported in 2015 EGFSN report. When the totals are adjusted, considering the change in the calculation of tourism employment totals, the difference is 15%. While the overall estimates provided by the EGFSN coincide with the latest SEMRU data, given the passage of time, and the significant shocks to the Marine and Maritime Economy in the corresponding period in the form of Brexit and the Covid-19 pandemic, it is difficult to conclude whether this is coincidence or not. There are considerable variances in some of the sub-sectors in particular those provided by the EGFSN for Maritime Monitoring which corresponds to the Advanced Technology Products and Services category reported by SEMRU. While the percentage variance in this sector is high with 450% more jobs created than anticipated by the EGFSN, the category itself is small in the context of the broader sector.

The EGFSN forecast for Maritime Shipping, Transport and Services sector differs from that of the Ocean Economy Report by 3%. This sector, at 7,064 jobs, accounts for a large share of the sectors included in this study.

These estimates and comparisons must be treated with a high degree of caution in the context of this report. For instance, the sub-sector of Marine Retail Services was included by the EGFSN in the category of Maritime Transport, Shipping and Services as it covers services such as chandlery and the retail of maritime personal protective equipment. However, it also includes fish monger and other seafood retail businesses. Similarly, Tourism estimates relate to the entire marine tourism sub-sector in Ireland. This by far the largest subsector covered by the Ireland's Ocean Economy Report. The latest report estimates it as employing 16,556 in 2021 compared to 15,544 in all the other subsectors combined. Within these marine tourism employment numbers, it is not possible to isolate the component relevant to the maritime sector, e.g. employment arising from marinas associated with ports and harbours. For this reason and arising from the changes in methodology in how marine tourism numbers have been calculated since the publication of the EGFSN report, we exclude marine tourism from further analysis for the purposes of this study.

Table 25: **EGFSN estimated demand for skills in 2020 and SEMRU estimates for 2021** (including adjustments to Marine Tourism data)

Current and Future Skills Requirements of theMarine/Maritime Economy to 2020 (Expert Group on Future Skills Needs, April 2015)	Maritime Transport, Shipping and Services		En
Occupation	2014 Baseline Estimate	2020 Projection	2014 Baseline Estimate
Operatives	814	1,326	4
Admin	445	934	7
Skilled Trades	1,727	1,527	16
Associate. Professional and Technical	803	1,054	12
Professional	1,183	1,868	60
Management	717	592	13
TOTAL	5,689	7,301	1,14

Ireland's Ocean Economy (reference year 2020) (SEMRU, Dec. 2022) Selected Sectors(*)	Maritime Transport, Shipping and Services		En
Shipping and Maritime Transport	*4,847*		
Maritime Commerce	*401*		
Marine Retail Services	*897*		
Manufacturing, Construction and Engineering	*919*		
		7,064	
Oil and Gas Exploration			*15*
Marine Renewable Energy			*55*
Tourism in Marine and Coastal Areas			
International Cruise (‡)			
Advanced Technology Products and Services			
TOTALS		7,064	

Ocean Economy 2020 variance from EGFSN 2020 Estimate (Original)	96.75%
Ocean Economy 2020 variance from EGFSN 2020 Estimate (Revised) [§]	*96.75%*

(§) Adjusted figures to reflect updates in tourism figures arising from adjusted SEMRU methodolo

(*) This table omits data produced by SEMRU for the Sea Fisheries; Aquaculture; Seafood Processi

(‡) No employment figures are provided for the International Cruise sector as crews are not empl

ergy		Tourism		Maritime Monitoring		TOTALS	
	2020 Projection	2014 Baseline Estimate	2020 Projection	2014 Baseline Estimate	2020 Projection	2014 Baseline Estimate	2020 Projection
7	26	1,604	2,805	33	14	2,498	4,171
0	34	422	535	44	71	981	1,574
6	75	506	784	15	12	2,414	2,398
5	72	253	279	125	78	1,306	1,483
3	300	295	333	166	125	2,247	2,626
7	46	422	463	74	45	1,350	1,146
8	553	3,502	5,199	457	345	10,796	13,398
		13003 §	*19374* §			*20,297* §	*27,573* §

ergy		Tourism		Maritime Monitoring		TOTALS	
5							
3							
	713						
		16,556					
		-					
			16,556				
				708			
					708		
	713		16,556		1,627		25,960
	128.93%		318.45%		471.59%		193.76%
	128.93%		*85.45%*		*471.59%*		*94.15%*

gy 2014
ng; and Seaweed, Marine Biotechnology and Bioproducts sub-sectors
loyed in Ireland.

7.1.3 Performance of employment in the Maritime Economy

Employment data for the years 2010-2021, from Ireland's Ocean Economy reports 2019 and 2022, for maritime sub-sectors included in this study (excluding marine tourism), are shown in Table 26. An increase in total employment in these sub-sectors of 45 % occurred between 2010 and 2021 (8,485 FTEs). The table also shows changes in total labour force participation as reported by the CSO for the same years indicating a difference between the 2010 total and the 2021 total of 18 %.

Table 26: **Maritime subsector employment (excluding Tourism) 2010-2021**

Ireland's Ocean Economy Report - Selected Sectors*	2010	2011	2012	2013
Maritime Transport, Shipping and Services				
Shipping and Maritime Transport	4,092	3,864	3,933	4,336
Maritime Commerce	110	*136*	161	165
Marine Retail Services	252	*421*	590	613
Manufacturing, Construction and Engineering	726	*801*	875	953
Sub Total	**5,180**	**5,221**	**5,559**	**6,067**
Energy				
Oil and Gas Exploration	57	64	84	83
Marine Renewable Energy	216	*231*	245	276
Sub Total	**273**	**295**	**329**	**359**
Advanced Technology Products and Services	**391**	***406***	**420**	**437**
TOTALS	**5,844**	**5,921**	**6,308**	**6,863**
CSO Labour Force Participation ('000s) (‡)	2232	2226.5	2212.3	2245.8

(*) Data from Ireland's Ocean Economy Reports 2019 and 2022

(e) Data reported in the 2022 Ocean Economy Report for 2021 is estimated.

(‡) Based on CSO Labour Force (15yrs+) Particpation Annual Q4 Data (CSO Table QLF18)

This matches the increase in the Shipping and Maritime sub-sector which, with 4,847 FTEs estimated in 2021, is the most significant of the sub-sectors shown. This may indicate that growth in that sub-sector likely tracks the national economic situation over the longer term, with major sources of employment growth coming from smaller niche sub-sectors more responsive to targeted economic development activities.

2014	2015	2016	2017	2018	2019	2020	2021(e)		% Change 2010-2021
4,375	4,553	4,629	4,861	4,852	4,832	4,616	4,847		18%
322	339	342	365	389	405	377	401		265%
743	755	810	831	867	915	807	897		256%
906	860	779	806	821	867	832	919		27%
6,346	**6,507**	**6,560**	**6,863**	**6,929**	**7,019**	**6,632**	**7,064**		36%
85	90	145	151	159	150	155	155		172%
401	432	*454*	461	467	496	509	558		158%
486	**522**	**599**	**612**	**626**	**646**	**664**	**713**		161%
561	**574**	**695**	**608**	**683**	**697**	**687**	**708**		81%
7,393	**7,603**	**7,854**	**8,083**	**8,238**	**8,362**	**7,983**	**8,485**		45%
2259.9	2290.4	2329.4	2370.3	2405.3	2467.8	2418.5	2633.3		18%

7.2 Indicators of employment growth

The Irish Government forecasts national economic growth, predicting an annual rise in Gross National Income (GNI) of $2^{1}/_{3}$ percentage points by the end of 2030. Reporting by the Department of Finance also predicts a declining contribution to the economy from labour due to demographic factors, for example low population growth, resulting in downward pressure on the employment participation rate.[102] Additionally, the current low rate of unemployment is predicted as unlikely to continue.

The EU's European Centre for the Development of Vocational Training (Cedefop) anticipate in its *2023 Skills forecast – Ireland* that the country's employment growth will continue to outpace the EU-27 average. Employment in Ireland is also predicted to grow at slower rates than seen in the last five years.[103] Cedefop also predict that employment growth in Ireland will be around 1.5 % per annum between now and 2030 (compared to 0.2-0.3 % in the EU as a whole), and that this growth will sustain at over 1 % per annum to 2035. Cedefop forecasts sectoral employment growth in Distribution and Transport, Business and other Services, and Construction activity.

According to Cedefop, Ireland's workforce is set to see 2.3 million job openings comprising 1.6 million replacement positions and 780,000 new jobs over the period 2020 to 2035. Their report notes that Ireland's workforce is highly qualified, and that as a result, it is difficult to discern whether trends in the Irish workforce towards higher qualifications are due to supply or demand factors. Despite this, the forecast suggests that 61 % of job-openings will require higher qualifications, resulting in some graduates being employed in jobs below their skill levels into the next decade. Cedefop predict most job openings will be in highly skilled non-manual operations, such as *business & administration professionals, business & administration associate professionals, teaching professionals, production & specialised services managers and hospitality, retail & other services managers*. These occupational groups correspond broadly to educational attainment and include a variety of roles. For instance, business and administration professionals includes IT professionals, who are specifically referenced as a cohort that will present hiring challenges. Amongst skilled manual occupations, *building & related trades workers, drivers & mobile plant operators* are both expected to see strong demand. Skills to support the green transition in areas such as e.g. manufacturing, transport and construction, and digital transition feature prominently in the Cedefop predictions for high-skilled roles as mentioned above. Cedefop also predict fewer job openings in lower skilled jobs, with a contraction in total jobs for some occupations, such as labourers.

The increased level of specialisation within occupations is a key driver of demand for skills; other less significant drivers, include changes in industry size, increasing automation and digitalisation, and moves towards a more service-oriented economy.

The SOLAS Skills and Labour Market Research Unit (SLMRU) produce an annual National Skills Bulletin. The latest SLMRU Bulletin notes professional, associate, and managerial positions in 2022 made up 1.1 million persons, or 44 % of national employment[104]. The SLMRU report identifies 16 occupational groups where skills shortages are likely. Table 27 shows the skills shortages in occupational groups (bold) relevant to Ireland's maritime sector. Demand for skilled operatives is expected to continue; with increased use of automation set to drive demand for upskilling/reskilling.

[102] Department of Finance (2023) **Horizon Scanning – calibrating medium to long-term economic projections.** Available at: https://www.gov.ie/en/publication/c31bc-horizon-scanning-calibrating-medium-to-long-term-economic-projections/

[103] Cedefop (2023) **2023 skills forecast – Ireland**. Available at: https://www.cedefop.europa.eu/en/country-reports/ireland-2023-skills-forecast

[104] SOLAS (2023) **National Skills Bulletin – 2023**. McNaboe, J., Condon, N., Shally, C., Hogan, A.M., Daly, F. SLMRU/SOLAS, October 2023. Available at: https://www.solas.ie/research-lp/skills-labour-market-research-slmru/research/

Table 27: **National occupational group skills shortages**

Occupational Groups	Expected Skills Shortages
Science and Engineering	• Analytical, process, and medical scientists • **Engineers (quality control/assurance, process, design, mechanical, electrical, automation)** • **Maintenance/**Lab **technicians**
IT	• **IT Project managers** • **Software developers/engineers** • **IT analysts/engineers**
Business and Financial	
Healthcare	• Medical practitioners • Nurses
Education	
Social and Care	• Healthcare assistants • Care Workers
Legal and Security	
Construction	• **Civil engineers and construction project managers** • **Quantity Surveyors** • Plumbers • Carpenters
Other Craft	• **Welders/fabricators** • **CNC programmers**
Agriculture & Animal Care	
Hospitality	• Chefs
Arts, Sports & Tourism	
Transport and Logistics	• **HGV drivers** • Bus & coach drivers
Administrative & Secretarial	
Operatives and elementary, not elsewhere classified	

Source: *SOLAS Skills and Labour Market Research Unit (SLMRU) 2022*

Section 8. **Perspectives from the Irish maritime community on education and skills**

Interviews with a cross section of individuals from Ireland's maritime sector provided informed feedback to the scoping exercise. This process used semi-structured interviews to guide participants through a broad discussion about current and future challenges they face, ranging from those of a day-to-day operational nature, to the likely impact of global trends.

Each participant in the interview process possessed considerable experience of offshore or onshore maritime activity in established or emerging areas of Ireland's maritime economy. Despite the diversity within a relatively small sample of the sector, several common themes emerged from the discussions. We caution against drawing definitive conclusions from this limited feedback. Interviewees provided significant detail and insights to their operations, and concerning the challenges they face from a skills and education perspective. Maintaining the anonymity of individual contributions led to the omission of some specific feedback; however, where possible we have included the generality of a comment rather than details of the issue.

8.1 **Drivers for Growth**

There was uniform optimism amongst participants for Ireland's maritime sector over the next 10 years. Although many participants identified specific constraints – usually connected with their company, the overall sentiment was that the sector would continue to grow, keeping pace with the national economy. Despite the recent economic shocks of Brexit and the Covid-19 pandemic, many observed that the maritime economy had demonstrated considerable ability in its responsiveness and resilience in coping with a global emergency.

Several interviewees cited the State's plans and targets for growth in the Offshore Renewable Energy (ORE) sector as a major growth opportunity for the entire maritime sector. While ORE tended to dominate the thoughts of many, it was not the only growth area mentioned. They mentioned other opportunities in cruise tourism; harnessing and exploiting the existing service capabilities of the Irish maritime sector e.g. legal, finance, fleet management, training, etc. including targeting these areas internationally, as occurred with the Dublin Financial Services initiative. Building on Ireland's research reputation in science and technology to meet the global demand for surveillance and monitoring of the marine environment, was identified as a priority by some interviewees.

The positive view of ORE in the long run included cautionary comments about over selling the opportunity. A major concern was that the emerging ORE sector faced uncertainty in some key areas. There was considerable scepticism about the Government ORE targets, which many felt were overoptimistic. In acknowledging both the need and opportunity, participants cited gaps in the State's planning and consent apparatus as a likely constraint; coupled with skill shortages. They cited specific planning and consenting related skills, in ecology, surveying, maritime law and administration, as major resource gaps and the absence of a significant heavy engineering track record nationally, unlike the situation in e.g. Norway and Scotland on the back of their offshore oil and gas sectors. This situation was not, according to some, unique to Ireland, such skills are in short supply globally, not just in Ireland. And even when skills are available, specific knowledge of different aspects of the Irish marine environment is required.

Others expressed the view that over-stating the ORE opportunity may lead to disillusionment, and an inability of the state to build the skills capacity in any one area of ORE activity. They believed the prospect of Ireland establishing itself as a location for the manufacture of ORE structures was unrealistic in the absence of the essential engineering expertise. Those expressing this view favoured a more targeted approach that focuses on national strengths in areas such as the ICT sector in order to develop niche areas of global leadership in ORE.

There was an overall belief that the maintenance of offshore structures and associated generating equipment is a feasible and realistic goal, since this opens new opportunities around remote monitoring and surveillance. This emerging sector will draw from skills/expertise available in the ICT sector and builds on demonstrated education and research expertise in the higher education sector.

There was a fear that the focus on the ORE opportunity could deflect attention and development finance from other maritime areas. The essential role of shipping and ports to an island economy must be strengthened to ensure continuity of international trade as well as facilitating the growth of ORE.

8.1.1 Development of Ireland's maritime transport sector

Despite overall optimism, the consultation process uncovered concerns and frustrations about the general future of the maritime sector. Despite being an island nation, with a dependency on ports for inward and export trade, Ireland's maritime sector does not, in the mind of the major players, have a clear vision for its growth. A fundamental concern is the signalling effect of this apparent gap which leads to business uncertainty and undermines skills planning. The sector believes its performance during the Covid crisis is a clear demonstration of its ability to act cohesively, in keeping Ireland supplied with essential needs, and the capability of the sector to be a primary driver of growth.

Industry believe Ireland's maritime transport sector suffers from a low level of visibility and standing in the public. The assumed importance and image of the aviation sector is far superior to that enjoyed by maritime transport and overshadows it. This poor standing deters high potential talent from considering careers in the sector.

There is a belief that the National Maritime College of Ireland, through no fault of its own, is not adequately aligned to the immediate needs of industry, an issue discussed later in this section, although multiple reasons were identified for this. Ports experience difficulties in accessing investments to support new physical infrastructure and find the recruitment of key operational staff a worsening situation. Shipping companies believe there is a need for greater effort to promote Ireland as a focal point for shipping, by way of services - brokerage, finance, legal, education and training, etc. The views expressed on these matters point to a vicious circle of a lack of supply of certain skills, skills gaps supressing development, lack of development highlighting skills gaps, and reduced development leading to reduced demand for courses. Many consultees expressed the view that an active economic policy would break this cycle.

8.2 The absence of a common understanding of some roles and skills

The interview process uncovered a knowledge gap concerning some industry roles and skill sets. This appears to result in confusion about roles and skills, in some cases extending to policy makers, some educators, and interfacing industries.

An example of this issue is use of the terms "engineer" and "engineering". Some interviewees, particularly those who had spent time at sea in the maritime sector interpreted these terms as meaning a "Ship's Engineer". Others extended the term to a variety of roles and educational backgrounds, including Merchant Vessel Engineer Officer, Fishing Vessel Engineer, and Maritime Electro-Technical Officer. Even individuals unconnected with fishing, maritime transport etc. assumed such roles to be interchangeable. Those from adjacent industries such as ORE, understood the term "engineer" to refer to professional engineering roles such as e.g. Civil Engineer, Electrical, and Mechanical Engineers. Others took the term as inclusive of shore-based instrumentation technicians and fabrication crafts/specialists and other manual operatives.

Similar confusion and misunderstanding exists regarding "Naval Architect". This term was variously interpreted to mean a vessel design engineer, a civil engineer involved in the design of marine structures, a marine surveyor, and a mechanical engineer who had specialised in maritime vessel design. This confusion may be because there are no courses in naval architecture in Ireland.

For the purposes of this report, Naval architecture is understood to refer to a multi-faceted professional engineering discipline, which has evolved to incorporate the design of marine vessels and ocean structures. Typically, naval architects engage in the design and development of new vessels and ocean engineering structures, including surface and sub-surface equipment used in transport, energy conversion and the exploration and exploitation of ocean resources. Naval architects possess expertise in mechanical and structural engineering, fluid mechanics, ocean and underwater technologies. [105]

[105] Definition based on course descriptions at the University of Strathclyde and Shanghai University.

8.3 "Soft" and transferable skills

Participants in industry interviews made multiple references to the importance of "soft skills" in current and future employment. "Soft skills" typically concern the possession of characteristics additional to the core expertise/domain knowledge required for a specific position. Participating in a global industry like the maritime sector, demands companies being globally competitive. Firms must adapt to thrive in such an environment. The introduction of changed work practices is one of many areas that challenge the competitiveness of Irish firms. Employers seek to recruit staff with specific competencies, knowledge and skills that are applicable to different employment roles, in addition to the possession of the requisite technical knowledge. The possession of a "digital competence" rests at the boundary of hard and soft skills; and will continue to expand as a core task in all employment. Other transferable skills mentioned during interviews included teamwork, adaptability, problem-solving, communications, and organisation/time-management.

8.4 The impact of full employment and the nature of maritime industries

At the time of preparing this report, the Irish economy is effectively operating at full employment. This was mentioned by most interviewees, in pointing out that this phenomenon means the maritime industry must compete with other industry sectors for staff. Most roles in the maritime sector do not demand specific maritime/marine skills, but the same talent and skills as other sectors of Ireland's economy. Further, specific challenges mentioned in this regard included the nature of some maritime operations, described by one participant as being "outdoors in all weathers, shift-based and 24/7", and the need to recruit staff who have experience in at-sea maritime operations, for shore-side or in-port roles. Under these circumstances, not only is the maritime economy competing with other sectors, but competition for skills exists between employers in the maritime sector.

Employers have adopted various strategies to cope with these challenges; these include direct recruitment of school leavers followed by the provision of in-house training, enhanced conditions of employment – principally increased wages and salaries, and internal promotion of high potential employees. Some positions within the maritime transport sector remain difficult to fill; particularly crane drivers – both fixed and mobile. Similarly, ports experience shortages in pilots and have started to recruit from abroad. These positions require substantial training prior to qualification. And with rising demand for such skills in the construction sector, retention and/or recruitment remain challenging. The same holds for port tractor drivers, mechanical and electrical crafts (Fitters, electricians, tool makers, welders etc.) and general operatives. Some ports have started to recruit these positions from overseas. Difficulties in recruitment is not confined to port operations, transport companies reported difficulties in recruiting ships agents and staff with logistics expertise.

8.5 The supply of experienced mariners for downstream industry activities

Discussions concerning the training of ships' officers, as provided by the National Maritime College of Ireland (NMCI) resulted in contradictory views. Some were of the view, given the small scale of the Irish Maritime fleet, that Ireland does not require a dedicated training facility for ships' officers. This was frequently accompanied by the view that the seagoing experience required by cadets to secure officer certification, is rarely available from Irish flag carriers or shipping companies with a corporate presence in Ireland.

Other participants contested this viewpoint, arguing strongly that NMCI is strategically important to the State and has developed alternative international sources to provide seagoing experience to cadets. Those with this view stated that whilst there might not be an immediate need for ships' officers and engineers on Irish vessels associated with the Irish maritime sector, there will always be a demand for people with sea-going experience. These posts included roles associated with port and harbour operations such as harbour masters and pilots; roles within shipbroking, client management and operations – e.g. Crewing and logistics; positions in national maritime administration, training and education, and statutory bodies; the naval service; and to support supply and operational requirements in emerging maritime sectors

such as ORE. A consensus viewpoint was that mariners tend to work at sea for the early portion of their career, and after a period of 10-12 years many seek to return to Ireland. Some of those expressing this view went further, arguing that in order for the sector to grow beyond the current status quo, an increased supply of these type of roles is required to ensure international competitiveness and attractiveness.

8.6 Skills in adjacent industries

Interviewees emphasised the strength of the connectivity of Ireland's maritime sector with other industry sectors. This was particularly strong regarding the maritime link to the logistics sector; and with the legal and financial sectors, where Ireland has an international reputation. This inter-dependence with other sectors is likely to increase, with Offshore Renewable Energy cited as the most obvious example. A number of those interviewed from an ORE perspective questioned the policy distinction between commercial ports and fishery harbours in circumstances where there are national targets set by Government for the ORE sector, noting that the skills and expertise required to support the ORE industry is the same.

There is an increased visibility of transferable skills and the importance of such skills in all sectors. Feedback during interviews included reference to the need for employees with communications skills; being digitally literate; abilities to work within teams and being self-starters/highly motivated. There was also reference to the need for maritime "core skills" – such as understanding the principals of cargo loading, fuel, ships safety and port operations - typically in roles with direct contact with ships and ship's cargo, e.g. pilots, harbour masters, shipbrokers, shipping agents, general port operatives etc. Reference to "non-core skills" needed within the maritime sector include ICT roles, tractor and truck drivers, crane operators and professional skills as such as professional engineers, solicitors and other legal professional, financial and general management. Recruits to the sector with non-core skills generally avail of "top-up" training in Ireland on an "as-needed basis".

Several interviewees mentioned that in some professional areas there is insufficient work in Ireland to sustain full-time careers in the maritime sector. Occasionally, this leads to others without an in-depth maritime knowledge, working in the sector. There was a strong belief that the ORE sector may face such recruitment challenges in the short-term.

8.7 The role of in-house training

Participants identified several career paths in the maritime industry. In all cases, on-the job training and in-house training forms a significant part of the way in which specific maritime knowledge and skills are acquired by such employees.

The in-house training is most apparent where new employees are typically school leavers or unskilled workers and is a feature in multiple facets of the industry such as port operations, port asset management and freight operations. In the case of freight operations, some staff go on to obtain further qualifications through study in the third level sector and/or with professional bodies (such as the Irish Institute of Ship Brokers). The absence of readily available external training initiatives, leaves employers with little option other than to provide on the job training. Similarly, in port operations, where staff are required to be flexible and carry out a wide range of reasonably well-defined tasks including driving port vehicles (as distinct from truck driving for which there is an apprenticeship), vessel mooring, buoy repair, and other port related roles, specific training is not available. Employers recruit from the fishing community, or from ship's crew seeking land based employment to fill positions.

Similarly, while crane drivers can enter the industry from other sectors, principally the construction industry, some specialists crane driving roles such as cargo handling, were reported as having no or limited specific training avenues and rely on in-house training.

8.8 Training outside the state

Not all skills training required by the maritime sector is available within the state. This according to industry feedback primarily concerns the specialised training needed for tug boat drivers (where tugs operate within the confines of a port/harbour), shore based ships supervisors and vessel traffic systems (VTS) operators (VTS officers ensure the safe navigation of vessels in

bringing them safely into a harbour: a role analogous to that of air traffic controllers at airports). Interviewees also believe the continued absence of such training in Ireland, will increase Ireland's reliance on foreign training for Pilots, Harbour Masters and others following changes in the nature of port traffic. Specific examples of these changes include increased deployment of autonomous vessels, and vessel operations associated with the ORE industry such as towing and anchorage operations. The impact of these changes is seen as being likely to be exacerbated by reduced numbers of returning ships officers (arising from increased global demand and fewer new entrants to the NMCI) traditionally associated with these roles, and the fact that such returning ships officers' existing training is in larger vessels, whereas ORE will be dominated by smaller vessels. Any demand for naval architects is unlikely, according to the industry, to justify the creation of a primary degree third level course in Ireland, although some did consider there being scope for a post-graduate course. This specialised professional education is accessible in the EU and elsewhere.

8.9 Sufficiency of education and training courses

Dedicated maritime and marine oriented courses number far fewer than general courses in science, engineering and commerce. Ireland's higher education and training institutions, comprising universities, institutes of technologies and private sector institutions, offer close to 4,000 courses falling within the National Framework for Qualifications from certificate to doctoral level awards. The QQI database includes 30 courses with reference to maritime/marine/nautical in their title. Most of these are at NFQ level 7 or lower, whilst 13 courses offer NFQ level 8-9 qualifications. The courses typically range from one to five year in duration to reach the award stage.

Learners can also access shorter NFQ accredited courses, such as those termed MicroCreds[106], offered by members of the Irish Universities Association.[107] These courses vary in duration and employ different delivery methods, including on-line delivery. Most courses cover specialised topics, and applicants generally require a relevant level 8 qualification for admission. Credits awarded on completion of a MicroCreds Courses are additive, leading to more formal awards. Only one MicroCreds course includes maritime, marine, nautical or ocean in the title.

Where job responsibilities require staff to work at sea, even for short periods of time, employees must complete relevant safety training as required by Department of Transport. Several public and private sector organisations deliver one or more of the 28 courses identified earlier in this report in the section dealing with the certification of seagoing personnel (See Table 24), although most are delivered solely by the NMCI and BIM. These courses are not placed on the NFQ.

More specific, and often shorter duration courses provide dedicated training to employees and persons wishing to return to employment in the workforce. Most such courses are accessed through the Education and Training board or SkillsNet network.

The overall view of the established sectors in Ireland's maritime economy is one of general satisfaction with the range of courses available. Ireland's education and skills training system serves the sector well, providing highly qualified individuals from which to recruit staff. The need for dedicated maritime education and training mostly applies to seagoing roles or roles requiring seagoing experience. However, with few home based opportunities for those following seagoing careers, shortages of skills in this area are few though there are issues surrounding the ability of the sector to attract staff compared to other sectors. Many Irish trained ships officers eventually return to Ireland during their career to fill shore-based roles that demand seagoing qualifications and experience. This view was caveated by a number of participants who highlighted that this assumes a static industry. For the industry to grow, more trained staff will be needed.

The emerging maritime sectors - ocean renewable energy, surveillance and monitoring require specific education in engineering and scientific disciplines. Industry will continue to recruit graduates from the higher education institutions and adjacent industries to fill positions.

[106] https://microcreds.ie/

[106] The IUA members are: University College Dublin, University College Cork, University of Limerick, Trinity College Dublin, Dublin City University, University of Galway and Maynooth University

8.10 The National Maritime College of Ireland (NMCI)

Industry expressed frustration that the NMCI has not been supported to establish itself as a prime source of maritime sector education and training, with a view that if expansion of the sector is to be achieved the college will not be able to support this. This stems from a perception of a narrow focus on seagoing careers at the expense of providing much broader education in land based maritime careers. Despite its designation as a "national" college, it is a department within an academic faculty of the former Cork Institute of Technology, now the Munster Technological University. This relationship is claimed to result in an overly academic approach in its relations with industry and students: and which constrains it operationally. Some pointed to models found in leading international maritime training institutions as being preferable to the one imposed on NMCI, such as e.g. Maine maritime Academy, Texas A&M University Maritime Academy; where both encourage graduates from scientific, engineering and business disciplines to follow further training for maritime careers.

The NMCI is not seen as attracting international students. The maritime sector is a global industry facing multiple future challenges ranging from the introduction of new technologies, greater automation and the recruitment of qualified staff. Industry is convinced the NMCI could develop as an international maritime training academy. However, this is unlikely unless NMCI developed greater autonomy, whilst retaining a link to an academic institution. Under this model, NMCI could offer the broad base of education and training for shore-based maritime employment.

NMCI does not have a high visibility internationally: the importance of this is significant given its reliance on foreign owned and foreign flagged vessels to provide sea-going experience to the College's merchant cadets. By becoming attractive to international students, particularly if funded by shipping companies, they could benefit from the experience of NMCI and complete sea-based training on sponsors' vessels. This relationship could also create positions for Irish students to avail of training on international vessels.

The issue of Irish cadets securing berths on vessels in order to complete their training drew a divergence of views amongst those interviewed. Some argued that if the training and calibre of students is good enough, the berths will be secured, Others expressed frustration with shipping companies with a presence in Ireland who do not make berths available, while availing of benefits such as tonnage tax. Some of those expressing this view argued that a portion of maritime taxation should be ring-fenced for maritime education and be contingent on cadet placement.

The NMCI and BIM are public sector organisations that offer maritime training. Industry shared the view that this appears to be a duplication of services; and that competition for students and resources does not benefit the sector. The differentiating factor of BIM training fishers and NMCI training merchant staff does not reassure the industry that this arrangement is optimal in servicing the industry.

It is obvious to industry, that national policy needs to consider the development of the NMCI hand in hand with the development of the sector. Failing to do so would leave the maritime sector reliant on recruitment from overseas to fill posts.

8.11 The increasing role of regulation

A recurring theme amongst interviewees was the impact that regulation in various forms has had, and is continuing to have, on the skills and education requirements of the Irish maritime industry. This feedback drew attention to what was termed as the increased constraints placed on the industry in the past decade, and how these impact the operational requirements of Ireland's maritime sector. Specific examples where these regulatory changes are likely to lead to the need for continued skills development included:

- **Security:** Ports and shipping companies will have to respond to EU plans to implement NIS2Directive to create a common high-level of cyber security across the European Union. A general view is that Ireland is ill-prepared for possible cyber security attacks in the maritime domain. Specific areas believed as lacking in preparedness include autonomous and semi-autonomous vessels; an increased security focus on ports, and port traffic, particularly the cruise industry. Port

security is typically outsourced to private security contractors, where their primary focus is on threats emerging from the land-side. Skills gaps in monitoring security threats from the sea-side exist, except in Revenue Customs and Excise activity. An Garda Síochána has jurisdiction for maritime security within the 12 nautical mile limit; however, the belief is the force has little expertise in the area. The Naval Service is responsible for security in sea areas outside this limit. The importance of providing the maritime sector with enhanced physical and cyber security protection has increased. The industry believes there is a need for considerable upskilling in security over the next decade.

- **Environmental law:** Environmental law has become multi-faceted and impacts maritime operations both at sea and on shore. Although regulations concerning fuel have started to affect shipping and fuel supplies elsewhere, Ireland's industry does not anticipate any significant impact on Irish shipping in the next 10 years. Thereafter, changes are likely necessitating careful and continuous monitoring of trends in the industry to make the correct preparations. A more immediate concern of the industry is to develop the on shore-electricity supply required by docked vessels (cold-ironing). Doubts exist concerning the ability to provide the necessary infrastructure, coupled with the availability of the technical expertise to deliver it.

  Interviewees noted that a significant proportion of the Irish port estate is in urban areas, and subject to regulations designed to mitigate air, noise and light pollution. There is a national shortage of suitably skilled environmental expertise in these areas, which could inhibit future port development. Similarly, there is a shortage of specialist biological and environmental expertise such as e.g. ecologists. These experts perform a major role at the early preparatory stage in planning for expansion and improvement works in the offshore and land based marine environments. Laws, such as the Habitats and Birds Directive, while not new have become increasingly challenging to implement, largely because of developments in the law surrounding their implementation.

- **Maritime Transport:** The implementation of Regulation (EU) 2019/1239 of the European Union establishing a European Maritime Single Window environment was said to drive the way essential shipping information is stored, tracked and exchanged. This regulation defines the information vessels need to provide in advance of making calls to ports. Ireland is to yet fully implement the regulation, having failed to provide the required standardised information system. Because the existing Safe Seas Ireland fails to fully integrate with the information systems used by Irish ports, shipping companies must make multiple data entries. This situation is due to a shortage of ICT staff across state and industry and competition with other more attractive and competitive sectors.

- **Employment and Health & Safety:** There was frequent reference during interviews to the implementation of these regulatory areas. The requirements for safety training for sea-going staff (including pilots) and shore-based staff are different, and regulated separately. The Health and Safety Authority have jurisdiction on land, while the STCW regulations drive health and safety consideration at sea. This, according to some, has led to the potential for ambivalence around health and safety issues: the belief is that there is less impetus to implement stringent conditions on the shore side. This was said to be linked to changes in how ports managed their staff. Regulation EU 2017/353 governs the provision of port services including maintaining responsibility for Health and Safety matters under the port authority. However, most ports do not directly employ many of those working in the port, preferring to licence firms that do employ staff. Consequently, where companies such as those providing stevedoring employ higher skilled staff and provide greater training on health and safety this raises costs. From the ports perspective, this increases costs which in turn influences the decisions made regarding the type of vessel they target. The impact from a skills perspective is that there is a drive away from cargos that require more skilled staff. The alternative is for the port authority not to monitor the levels of Health and Safety training provided in order to avoid increasing costs. Interviewees expressed the view that in Ireland the approach is generally to accept the increased costs and adjust their business accordingly.

8.12 The promotion of maritime careers

A recurring theme in interviews was that maritime careers do not register with the public, school-leavers and their parents as attractive long-term careers. It is no longer the case that local communities, and families with a history of engaging maritime and vocational careers, fill maritime posts. In recent years with near-full employment and increasingly varied and accessible education opportunities, these traditional sources have largely dried-up, or were insufficient to meet growing demand. The importance of a central body to promote maritime careers was repeatedly emphasised during interviews, with interviewees asserting that state bodies and educational institutions have neither the remit nor the funding to pursue the promotion of maritime careers.

In the course of interviews, it became apparent that two broad categories of role exist; those that require or benefit significantly from fundamental maritime training, and those that do not. Examples of roles requiring fundamental maritime training include harbour masters, pilots, and those engaged in maritime commerce activities that require an in-depth understanding of the maritime world. Examples of roles that do not require fundamental maritime training include professional engineers, ICT specialists, logistics specialists, import/export clerks. These examples are not exhaustive, there is a myriad of roles in each category.

In the case of those not requiring a fundamental maritime training, unless a third level qualification was required for a particular role, companies favoured recruitment of staff with skills from related sectors such as logistics. For posts that require a third level qualification as with professional engineering, finance or management; there is rarely a need for a specific maritime qualification. In these cases, the required specific maritime training is readily available from several providers. The provision of training is not an issue for these employers: the challenge they face is attracting the candidates into the field in the first place.

Where fundamental maritime training is required, the visibility and attractiveness of a maritime career is also seen as a major impediment. The major training centre for such roles is the NMCI, and the near-consensus view amongst those interviewed is that for the Irish maritime sector, there is a lag between deck officer graduates of the NMCI leaving that college and entering key roles of about 10 years, as they go elsewhere to earn their professional experience. That not enough school leavers are electing to pursue a deck officer related course in the first place, and that the NMCI (or other colleges) do not provide courses that allow a shorter lag for entry to the workplace, is seen as a major impediment. Courses associated with maritime commerce were particularly cited as examples of courses that could be provided.

Section 9. **Analysis and Conclusions**

This scoping study examined multiple aspects of maritime skills, training and education. These included consideration of the maritime economy in Ireland and worldwide (Section 2), the characteristics of Irish shipping and ports (Section 4), global trends that may affect the maritime economy (Section 3), and education systems and standards nationally and internationally (Sections 5 and 6). Feedback from structured interviews (Section 8) further informed an understanding of the current and likely future skills and training needs of the sector, resulting in the emergence of several themes that inform the conclusions.

The scoping study explored possible changes in the maritime sector up to 2033. The prevailing sentiment expressed in interviews is that the global trends described in Section 3 will slowly begin to impact on Ireland's maritime sector in the next 10 years. It is largely EU based legislation that will be the key driver of digitalisation in an Irish context. This is unlike the adoption and progress of digitalisation by large industry players outside the state which will be driven by efficiency considerations. However, there is a recognition that eventually the international developments in digitalisation will have a knock-on effect on Irish industry, and Irelands maritime sector needs to be actively aware of these, with mechanisms in place to monitor and respond to developments.

Decarbonisation, principally the use of "green fuels" is similarly viewed as likely to have an impact, but beyond the 10-year time horizon as there remains uncertainty as to which fuels will gain dominance requiring ongoing monitoring of developments; even though some industry sectors reported progress on meeting sustainability goals. There was also an awareness of factors that drive future changes across the entire sector; including national and international regulations, technological change, demographics and outcomes from research and technological innovations.

Section 8 is a summary of interview feedback. It is evident that consideration is already being given to these trends; with the next decade seen as crucial to assess the technological solutions emerging and identify the skills, expertise and training that will be required. It is widely accepted that while the precise natures of these remain unclear, they will be significant. Interviewees recognise the net effect of such changes in the sector, will open it to new roles and responsibilities, coupled with the loss of some traditional ones.

There are immediate skills needs within the Irish maritime industry. These concern craft and skilled trades, general port operatives, associate professional and technical, and maritime specific business and ports operation roles (a summary is provided below in Table 28). These latter roles include functions carried out by individuals with sea-going experience or whose careers have progressed within the maritime industry. Of concern is that most, if not all, of these maritime related roles coincide with the demands of the Irish economy in general (Section 7) and the global maritime industry. A clear trend is the rising importance attached to transferable skills – cognitive, digital, leadership and interpersonal skills in all areas.

There are also examples of specific gaps in future skills needs. For example, many consultees pointed to the current and future need for cyber-security specialists, who are non-maritime specific and in demand in virtually all sectors of the economy. With the economy at near-full employment believed to be driving wage inflation, companies have turned to recruit from overseas where possible, but believe better promotion of maritime careers could help to alleviate the recruitment challenge.

While economic growth is likely to slow somewhat in the next 10 years, employment growth in Ireland is expected to continue to outpace the rest of the EU27. Greater skills specialisation will require increased further and continuing education activity. This puts pressure on employers in the maritime economy to compete with the wider economy and to provide or source the required training and education. An absence of data with which to characterise employment in the Irish maritime economy, is a constraint on planning for current and future skills needs. Section 7 considered the report of the Expert Group on Future Skills Needs. This provided a useful characterisation of the sector as it existed in 2015. Having considered the projections of the EGFSN report, and found them broadly accurate at the sectoral level (albeit with variances within sub-sectors), it can be observed that there were no provisions made to maintain the data, hence the data are now obsolete. Although SEMRU maintain annual estimates of employment in the maritime sector the granularity of this data does not support the planning needs of the sector.

The following conclusions are set in the context of the above general commentary. Following the conclusions are several observations; and whilst these do not directly relate to the terms of reference of the study, they surfaced during the interviews and research, and considered as relevant to this scoping study.

9.1 **Conclusion 1**: There are identifiable skills needs in the Irish Maritime economy

There are immediate skills supply issues in Ireland's maritime industry. These exist in craft and operative roles, specific professional services, and maritime roles needed to support domestically operating vessels. The current competitive nature of the jobs market in the Irish economy is having a significant impact on this supply shortage, and this situation is unlikely to change in the next 10 years.

While global trends, may not have a direct and significant impact on the maritime sector in Ireland over the next 10 years, there was a firm view that additional skills needs reflective of those trends are likely to start to emerge in the next 10 years. For the most part these are expected to relate to technological and legislative developments, and demand will accelerate beyond 2033. Consultees highlighted the need to try and anticipate and prepare for these roles to commence without delay. This feedback is reinforced by the findings of the Skills and Labour Market Research Unit of SOLAS, and the European Centre for the Development of Vocational Training (Cedefop).

Table 28 summarises the current and future skills need, using the standardised classification of the International Classification of Occupations (ICSO). The bracketed (L1 to L4) refer to the ICSO skills levels (See Section 6). Demand for current skills will continue in parallel with the demand for new skills for the foreseeable future.

9.2 **Conclusion 2**: There is an absence of firm employment data for the maritime sector in Ireland

The study identified various job/skills in the maritime sectors based on feedback from interviews. No data on which to quantify, or estimate the numbers required to fill these roles across the maritime sector was available. Nor was it possible, due to this data gap, to identify deficiencies in the supply of employees from the higher and further education sectors. To address these shortcomings, it is necessary to establish a baseline of current employment levels by job type. The data for such a baseline does not exist, the last attempt to create it was the 2015 report of the Expert Group of Future Skills Needs for the Marine/Maritime Economy to 2020 (EGFSN).

The scope of the EGFSN report was far wider than the five broad sectors of interest to this scoping study. Though useful as an insight to the maritime sector, it did not provide a baseline; a source of an up-dated dataset; or a replicable methodology. The Central Statistics Office (CSO) does not routinely gather such data on the Maritime Sector.

The skills mentioned under Conclusion 1, and listed in Table 28, reflect the opinions of interviewees and findings from various industry reports. In the case of current needs, there are challenges in distinguishing between systemic supply issues and the consequences of an economy at near full employment (with a few exceptions as detailed in Conclusion 3).

Table 28: **Current and Anticipated skills needs**

Employment Groups	Current needs	Anticipated future needs	Sub-Sector
Managers			
Professionals	Harbour Masters (L4) Planning, sustainability, and related roles (e.g. Ecology) (L4) Cyber Security Specialists (L4) Professional Engineering (L4) Contracts Specialists (L4)	Information Systems Integration Specialists (ICT) (L4)	Maritime, Ports, ORE, Professional Services Maritime monitoring
Technicians and Associate Professionals	Domestic Vessel Deck Officers (L4) Tugboat Drivers (L4)	Ships Supervisors/VTS Operators (L3) Mechanical, electrical and electronic technicians/ engineers (L3)	Maritime, Ports, ORE, Maritime monitoring
Clerical Support Workers	Import/Export Clerks (L2)		Logistics
Service and Sales Workers	Ships' Cooks (L2)		Maritime
Craft and Related Trades Workers	Port Operatives (L2, L3)	Electricians (L3) Mechanical fitters (L3) Electrical Vehicle Technicians (L3)	Ports, ORE
Plant and Machine Operators, and Assemblers	Crane Drivers (L3) Cargo Handling Operators		Ports
Elementary Occupations	Ships' Crew (Ratings) (L2) Stevedores (L1)	Security guards (L1)	Maritime, Ports

There is poor definition of certain maritime roles in an Irish context. This is exacerbated by overlaps between traditional maritime roles with those in the emerging Offshore Renewable Energy sector. Some persons interacting with the maritime sector do not possess a firm knowledge of traditional maritime roles, nor fully understand the meanings of roles in other sectors. Examples of this encountered during this study include roles of "Engineer", "Master Mariner", "Naval Architect" and others. The International Classification of Occupations provides a framework to use in establishing an unambiguous classification of roles and skills in the Irish Maritime sector.

9.3 **Conclusion 3**: Specific training and education gaps exist

There are gaps in the availability of some education and training courses needed to meet current and future skill needs. Ireland's maritime industry provides in-house skills training, and source training from outside the State, principally from the UK. Examples of this include training for port operatives, training for tug drivers, and in meeting the anticipated need for Vessel Traffic Services (VTS). Because individual companies/ports adopt their own approach to training, it is not possible to identify the full extent of the demand for such courses. Were the ports and other maritime companies to coordinate their efforts in this regard through, for example, a SkillsNet or similar mechanism there are likely opportunities for training providers to address these needs.

The STCW has a defined training route to enable fishers to move into maritime deck officer roles. An Irish standard has recently been provided by the MSO to course providers.

The importance of transferable skills is widespread in the maritime sector. To meet the current and future expectations of employers, employees need to demonstrate they possess these skills, this is not always the case and results in delaying the recruitment of staff.

9.4 **Conclusion 4**: Plans and ambitions for the ORE sector are currently dominating considerations for the future skills needs for the maritime sector

There is a general optimism about the opportunities that ORE will bring to the ports sector, however, this is countered by a degree of scepticism about the scale and level of government ambitions for the sector.

The interviews identified three issues arising from the current focus on ORE. Firstly, many of those interviewed found it challenging to differentiate between skills gaps that might arise because of ORE, and those that arise in any event irrespective of whether ORE developments take place or not. The second, is the likely pressure that the ORE sector will place on demand for certain skills that are already in short supply. Examples of these include access to those involved in the planning process, environmental compliance and sustainability. A commonly held view was the State's ORE ambitions will add increased pressure on an already under-resourced planning system. Finally, despite the attention given to opportunities for fishers to transition to roles that support the ORE (such as deck officers for crew transfer vessels), these may be being overstated.

Many of those interviewed for this study considered that there will be increases in the numbers of employees required to support the future ORE sector in Ireland. Opinions as to the scale and nature of those roles varied. While some expressed an opinion that these roles would include expertise in the assembly and in some cases construction of ORE equipment, for the most part those interviewed focused on Operations and Maintenance activities as being the most likely sustained areas of ORE activity. This is expected to result in increased demand for those roles already identified, e.g. port operatives, and deck officers for domestic vessels involved in bringing O&M personal to ORE installations.

9.5 **Conclusion 5**: The Maritime sector must compete with other sectors

The Maritime sector must compete with other sectors in a period of effective full employment and an era of increased skills specialisation.

While the current labour demand is expected to ease somewhat in the coming years, the Department of Finance and others forecast that the Irish economy will remain in effective full employment for the foreseeable future. The Irish Maritime Sector will have to continue to compete with other sectors for workers with transferable skills, and for new entrants to the jobs market such as school leavers. However, the next 10 years is also likely to see increased job specialisation. While in the past the maritime industry has relied on competitive pay to attract workers from other sectors, increasingly this will need to be accompanied by training, re-training, and commitments to further education.

9.6 **Conclusion 6**: The Irish maritime sector has multiple distinct career paths and entry points

Individuals directly involved in each sector have a clear understanding of the paths that workers use to enter and progress through their own industry sector. For the most part, these paths are not widely understood by those outside individual sectors, or by individuals from outside the Maritime economy. The general ignorance about the sector contributes to the poor visibility on maritime career opportunities, and recruitment to the sector from adjacent industries.

This scoping study identified four principal routes of entry to employment in Ireland's maritime sector as follows:

1. **Returning Ships' Officers.**
   Interviewees reported that Irish ships' officers typically work at sea in the international maritime industry for between 10-12 years, at which point many decide to seek shore or ports-based roles in Ireland.

   Returning officers play a crucial role in the operation of Ireland's ports; they take up roles as Harbour Masters, pilots and in some instances, ship supervisors. A further cohort of officers fill roles in training and civil administration for the maritime industry. And others move to roles in shipping and logistics companies, where they contribute an invaluable understanding of the maritime industry in roles associated with fleet operations and other commercial activities.

   The importance of returning ships' officers to the maritime sector, most of whom received their training at the NMCI, was identified as a poorly understood contribution of the NMCI to the wider maritime economy, particularly its role in the supply of staff to commercial and operations roles in the sector 10 years or so after graduation. It is notable that the same opportunities do not appear to arise for Ships' Engineers, likely as there is no corresponding industry element for such engineers to move into.

2. **School Leavers and unskilled or partially skilled workers.**
   Multiple segments of the maritime industry in Ireland rely on the recruitment of school leavers or workers who have partial skills or are unskilled. Companies typically provide dedicated training to this cohort that includes port operatives and those involved in logistics and cargo related administrative tasks. Where possible, employers reported a preference to recruit from adjacent industries such as warehousing and logistics.

   Having entered the maritime industry, these workers have access to multiple career paths, including port related operational roles, up to and including ships supervisor and various careers accessible via courses such as those offered by the Institute of Chartered Shipbrokers, other professional bodies and the higher/further education sector.

3. **Adjacent industries.**
   Semi-skilled workers from sectors such as logistics and warehousing frequently take up employment in the maritime sector; where they are typically recruited at entry level. Higher skilled workers frequently transfer directly into the maritime industry, without the need to progress from more junior levels. Examples of positions filled through this recruitment path include crane drivers, logistics specialists, and professional engineers.

   In all such cases, the main challenge for the employee is to gain experience dealing with the realities of the sector, for some roles employees receive specialised health and safety training.

4. **Fishers.**
   The potential role that fishers might play in the ORE sector, or in port related roles, was a prominent item raised in the interviews. There was a frequent mention of their contribution to filling multiple roles where a general "sea-sense" is required, including tugboat driving, dredging, and general port operative roles. Once established in the maritime sector, former fishers have multiple opportunities for career development, largely due to their familiarity with operating in the marine environment and knowledge of maritime safety. The interviews also revealed that expectations of fishers filling roles in the ORE sector as skippers, or using their vessels for ORE crew transfer lacked credibility.

9.7 **Conclusion 7**: The influence of "mega-trends" will build and intensify over time

There was specific reference in the terms of reference to the impact of offshore renewable energy, alternative fuels, and digitalisation in the maritime economy. **Multiple industry reports and European policies, as discussed in Section 4, indicate that developments in these areas will significantly impact the global maritime sector in the coming decade. Discussions with interviewees revealed that there is an expectation that automation will accompany digitalisation.**

Interviewees acknowledged the influence of these so called "mega-trends" but anticipate that their impact would most likely be incremental, rather than disruptive in the immediate future. According to interview feedback Ireland's maritime industry tends to mirror national innovation performance as a late adopter of technological developments. This is not to infer a reluctance on the part of the sector to embrace technology, but rather interviewees see benefits by delaying any commitment to candidate technologies until greater certainty is established. For instance, whilst the introduction of alternative fuels is widely acknowledged, individuals involved in the operation and purchase of vessels, and those providing fuel in the ports, point out that there is no clear non-fossil fuel front runner in the maritime industry. Delaying decisions around fuels, while the larger multi-national shipping companies settle on a preferred fuel, was seen as a sensible course of action in the context of a typical sea-going vessel having an operating life of around 25 years.

Similarly, digitalisation and automation are seen primarily as opportunities for business efficiency and sustainability improvements, with associated projects primarily resourced from professional service providers outside the maritime industry. Where maritime specific expertise is required, this was typically associated with the integration of cargo systems operated by industry participants and state bodies, and safety at sea requirements. Industry participants highlighted the key role government plays in providing a basis for such integration is in the form of a Maritime Single Window system and the operation of a Vessel Traffic Service. There was also reference by some to the opportunity available to Ireland to capitalise on its existing digitisation skills for the ORE and autonomous vessel sectors.

Throughout the interviews, the position of Ireland as a smaller player in a globalised maritime industry was emphasised, together with the necessity of putting in place preparatory actions now, for events that will occur towards the end of the decade. An approach of active monitoring of technology developments by industry and government was advocated.

The exception to this "wait and see" approach was the need to intensify provision for the electrification of ports operations. The electrification of tugs, tractor units, port busses and other port vehicles is already a priority from a sustainability perspective, as is the provision of onshore power facilities ("cold ironing") for vessels entering Irish Ports. These developments are expected to create demand for electricians and electrical engineers. Significant concern was expressed about the suitability of the national electrical infrastructure and planning in this regard.

9.8 **Conclusion 8**: There is a need for promotion of maritime careers

Feedback received during the interviews frequently mentioned the need to enhance the promotion of maritime careers across all facets of the sector. The statutory body charged with this activity is the Irish Maritime Development Office, which operates a section of its website on the topic.

As discussed above in Conclusion 6, there are multiple entry points and career paths within the maritime industry in Ireland. Issues surrounding the supply of suitably skilled candidates for each of these depends on elevating the visibility and standing of the available training and education courses. This will become increasingly important in a period of full employment and job specialisation as discussed in Conclusion 7.

A more proactive approach to the promotion of maritime careers is required; one that is aligned with the principal providers of maritime skills training and education, as well as the professional bodies operating in the sector.

The MSO is the key regulator of the maritime industry in Ireland. Through its role in setting required standards for maritime professionals and in examinations that professionals must satisfy, it has a role in the national maritime skills and education system, but it does not have a statutory role in the promotion of maritime careers. In practice, there appears to be a lacuna in this regard.

9.9 **Observation 1**: The role and nature of the NMCI needs clarification

The primary focus of this report has been to carry out a general assessment of future skills and training needs across the maritime industry in Ireland, and to scope out actions required to address those needs. Inevitably, this has necessitated an examination of the courses offered by the National Maritime College of Ireland (NMCI), as detailed in Section 7. The NMCI was the subject of commentary received during the interviews, as detailed in Section 8. The NMCI participated in the interview process, and provided valuable insights not just on its own functions, but on the broader maritime skills, education and training landscape in Ireland. The industry perspectives (Section 9) included that the NMCI does not provide the range of training desired by industry, including courses associated with maritime commerce, and that it is also constrained in its educational role, by virtue of it being a school in a wider Technological University. Industry also shared a perceived ambiguity of the role of both the NMCI and BIM in the provision of maritime training.

The role of the NMCI is tightly coupled with the promotion of maritime careers, and the perceived standing of courses associated with such careers. The current training provided by the NMCI is in high demand internationally, but it also plays a crucial role in the long-term sustainability of the maritime industry in Ireland as set out under Conclusion 5. There is an ambiguity in the attitudes reported by industry participants who on the one hand criticise the NMCI for not providing wider courses, while on the other hand relying on returning graduates, and failing to facilitate the provision of berths for cadets to gain at-sea experience.

9.10 **Observation 2**: There is demand for a national maritime skills policy

Education service providers must develop their business plans based on an assessment of skills needs. The problems relating to data as identified under Conclusion 1 are a constraint in this regard. Education providers have no current "market" data.

Several of the interviewees highlighted the distinction between skills and education for the maritime industry as it exists today, and for a potentially expanded industry where the sector becomes a primary driver for growth in the economy. Examples where services could be provided on an international stage include legal, financial and insurance services, fleet management activities, light engineering, ICT and data.

A national maritime skills policy that addresses the potential demands and opportunities would provide a useful context for maritime education planning. Such a policy would benefit from the context that a national maritime economic sector strategy that extends beyond the scope of a ports focused strategy.

Section 10. **Recommendations**

In response to the conclusions and observations above, there are a number of recommendations which arise. While these are for the most part independent, any implementation of one is likely to reinforce others.

No.	Recommendation	Related conclusions/observations
1	An updated, quantitative, and replicable study of the current and future skills needs of the maritime economy (similar to "A Study of the Current and Future Skills Requirements of the Marine/Maritime Economy to 2020"[76]) should be commissioned, to include a methodology that allows for annual updates.	Conclusion 1: There are identifiable skills needs in the Irish Maritime economy. Conclusion 2: There is an absence of firm employment data for the maritime sector in Ireland.
2	A maritime Skillnet modelled on the Chartered Institute of Logistics and Transport (CILT) Mobility and Supply Chain Skillnet should be supported.	Conclusion 3: Specific Education and training gaps exist.
3	Irish Ports should be supported by the relevant Government Departments to advance an apprenticeship in Port Operations.	Conclusion 3: Specific Education and training gaps exist.
5	Greater precision should be provided for the number of potential deck officer roles required by the ORE sector and how many of these can be filled by retrained fishers.	Conclusion 4: Plans and ambitions for the ORE sector are currently dominating considerations for the future skills needs for the maritime sector. Conclusion 6: The Irish maritime sector has multiple distinct career paths and entry points.
6	A national maritime careers officer role should be established.	Conclusion 8: There is a need for promotion of maritime careers.
7	The feasibility of placing professional qualifications used in the maritime industry on the National Qualifications Framework should be examined by the relevant Government Departments.	Conclusion 8: There is a need for promotion of maritime careers.
8	Immediate attention should be paid by all to the need for digitisation skills required to support system integration activities related to ports and shipping, and this should be an area of focus for the careers officer role mentioned in Recommendation 6 above.	Conclusion 7: The influence of "mega-trends" will build over time.
9	A working group/study to progress a national marine skills policy should be established to include in particular consideration of the emerging roles in the areas of technology and automation.	Observation 1: The role and nature of the NMCI needs clarification. Observation 2: There is demand for a national maritime skills policy.

Appendix 1. **List of consultees**

The following took part in interviews or focus groups during the preparation of this report. The views and conclusions expressed in this report are those of the authors, and do not necessarily reflect the views of those consulted.

The following took part in interviews or focus groups during the preparation of this report. The views and conclusions expressed in this report are those of the authors, and do not necessarily reflect the views of those consulted.

Name	Employment
Karl Bonner	Killybegs Marine Cluster, Atlantic Technological University
Ronan Boyle	Irish Lights
Pat Brennan	Doyle Shipping
Glen Carr	Irish Rail / Rosslare Europort
Liam Curran	Enterprise Ireland
Emer Dennehy	Sustainable Energy Authority of Ireland
Alex Dowdall	Dept. of Further & Higher Education, Research, Innovation, and Science
Aidan Flynn	Freight Transport Association of Ireland
Colm Forde	Dept. of Enterprise, Trade, and Employment
Dermot Gray	Institute of Master Mariners
Anthony Gurnee	Ardmore Shipping
Paul Hegarty	National Maritime College of Ireland
Brian Hogan	Dept. of Transport (Marine Survey Office)
Stephen Hynes	University of Galway SEMRU
Ian Mannix	BIM
Paul Mason	BG Freight
Tristan McCallum	IDA
Caoimhe McCarthy	Wind Energy Ireland
Alessandro Muro	D'Amico Shipping
James O'Byrne	National Maritime College of Ireland
Giuseppe Oliveri	Irish Chamber of Shipping / D'Amico Shipping
Paul O'Regan	Port of Cork
Vincent Power	AL Goodbody
Ian Price	Dept. of Energy, Climate and Communications
Sinead Reen	National Maritime College of Ireland
Joseph Richardson	Institute of Shipbrokers
Ean Wallace	Dept. of Transport (Marine Survey Office)

Appendix 2. **ICSO Skills Framework**

The generic characteristics of the ISCO major, major sub-group and minor groups provide a means to inform the profile of occupational skills across the five areas of interest in this scoping study, namely: Maritime Transport; Shipbuilding and Related Services; Energy (in particular Offshore Renewable Energy and Alternative Fuels); Marine Tourism; and Maritime Monitoring, Security and Surveillance. The profile is built around seven of the 10 major groups - Managers, Professionals, Technicians and Associate Professionals, Clerical Support Workers, Service and Sales Workers, Craft and Related Trades Workers, Plant and Machine Operators, and Assemblers and Elementary Occupations, with reference to the definitions and the work tasks in each major sub-group. The following extracts summarised from ISCO-08 clarify the profile of each occupational group and associated tasks in the maritime economy.

ICSO Skills Profiles

Managers

Managers plan, direct, coordinate and evaluate the overall activities of enterprises, governments and other organizations, or of organizational units within them, and formulate and review their policies, laws, rules and regulations.

Typical tasks

Tasks performed by managers usually include: formulating and advising on the policy, budgets, laws and regulations of enterprises, establishing objectives and standards and formulating and evaluating programmes and policies and procedures for their implementation; ensuring appropriate systems and procedures are developed and implemented to provide budgetary control; authorising material, human and financial resources to implement policies and programmes; monitoring and evaluating performance of the organization and of its staff; selecting or approving the selection of staff; ensuring compliance with health and safety requirements; planning and directing daily operations; representing and negotiating on behalf of the organizational unit managed.

Professionals

Professionals increase the existing stock of knowledge; apply scientific concepts and theories; teach about the foregoing in a systematic manner; or engage in any combination of these activities.

Typical tasks

Tasks performed by workers in this sub-major group usually include: conducting research, enlarging, advising on or applying scientific knowledge obtained through the study of structures and properties of physical matter and phenomena, chemical characteristics and processes of various substances, materials and products; advising on, designing and directing construction of buildings, systems, structures, as well as machines and other equipment; studying and advising on technological aspects of materials, products and processes, and on efficiency of production and work organization; preparing scientific papers and reports.

Technicians and Associate Professionals

Technicians and associate professionals perform technical and related tasks connected with research and the application of scientific concepts and operational methods, and regulations.

Typical tasks

Tasks performed by technicians and associate professionals usually include: undertaking and carrying out technical work connected with research and the application of concepts and operational methods in the fields of physical sciences including engineering and technology, initiating and carrying out various technical services related to trade, finance and administration including administration of government laws and regulations, and to social work; providing technical support for the arts and entertainment; participating in sporting activities; executing some religious tasks. Supervision of other workers may be included.

Clerical Support Workers

Clerical support workers record, organise, store, compute and retrieve information, and perform various clerical duties in connection with financial operations, travel arrangements, requests for information, and appointments.

Typical tasks

Tasks performed by clerical support workers typically include: word processing and data entry; Tasks performed by clerical support workers usually include: operating word processors and other office machines; entering data into computers; secretarial duties; recording and computing numerical data; keeping records relating to stocks, production and transport; passenger and freight transport; filing documents; carrying out duties in connection with mail services; preparing and checking material for printing; performing money-handling operations; dealing with travel arrangements; supplying information requested by clients and making appointments; operating a telephone switchboard.

Service and Sales Workers

Service and sales workers provide personal and protective services related to travel, housekeeping, catering, personal care, or protection against fire and unlawful acts, or demonstrate and sell goods in wholesale or retail shops and similar establishments, as well as at stalls and on markets. Competent performance in most occupations in this major group requires skills at the second ISCO skill level.

Typical tasks

Tasks performed by service and sales workers usually include: organizing and providing services during travel; housekeeping; preparing and serving of food and beverages; providing security services and protecting individuals and property against fire and unlawful acts; enforcing of law and order; and selling goods.

Craft and Related Trades Workers

These workers apply specific technical and practical knowledge and skills in the fields to construct and maintain buildings; form metal; erect metal structures; set machine tools or make, fit, maintain and repair machinery, equipment or tools; produce metal and other articles. The work is carried out by hand and by hand-powered and other tools The tasks call for an understanding of all stages of the production process, the materials and tools used, and the nature and purpose of the final product.

Typical tasks

Tasks performed by craft and related trades workers usually include: constructing, maintaining and repairing buildings and other structures; casting, welding and shaping metal; installing and erecting heavy metal structures, tackle and related equipment; making machinery, tools, equipment and other metal articles; setting for operators, or setting and operating various machine tools; fitting, maintaining and repairing industrial machinery, engines, vehicles, electrical and electronic instruments and other equipment.

Plant and Machine Operators

Plant and machine operators, and assemblers operate and monitor industrial and agricultural machinery and equipment on the spot or by remote control; drive and operate trains, motor vehicles and mobile machinery and equipment; or assemble products from component parts according to strict specifications and procedures. Competent performance in most occupations in this major group requires skills at the second ISCO skill level. The work mainly calls for experience with and an understanding of industrial machinery and equipment as well as an ability to cope with machine-paced operations and to adapt to technological innovations.

Typical tasks

Tasks performed by plant and machine operators and assemblers usually include: operating and monitoring industrial machinery and equipment for processing various metal and chemicals; operating and monitoring production machinery and driving and operating vehicles; operating and monitoring mobile industrial machinery and equipment; assembling products from component parts according to strict specifications and procedures.

Assemblers and Elementary Occupations

Elementary occupations involve the performance of simple and routine tasks which may require the use of hand-held tools and considerable physical effort.

Typical tasks

Tasks performed by workers in elementary occupations usually include: cleaning, restocking supplies and performing basic maintenance, offices and other buildings; washing cars and windows; helping in kitchens and performing simple tasks in food preparation; delivering messages or goods; luggage and freight handling; packing and unpacking produce by hand and filling shelves and stores; stocking shelves; collecting and sorting refuse; performing simple tasks connected with construction and manufacturing; guiding vehicles to transport passengers and goods.

Summary of ICSO Skill Levels

Skill Level 1

Level 1 Skills typically require the performance of simple and routine physical or manual tasks. Employees may require the use of basic hand held tools, and may also require physical strength to undertake the tasks. This may include carrying materials by hand, cleaning, digging and the operation of non-motorise vehicles. In some cases there may also be a requirement for employees to possess basic literacy and numeracy, but these would not form a major part of the job. Full competency in the role may require the completion of first stage of basic education (ISCED Level 1) and a period of on-the job training.

Skill Level 2

Typically employees at this level operate machinery and electronic equipment; drive vehicles; maintain mechanical and electrical equipment. maintenance and repair of electrical and mechanical equipment; and/or manipulate, order and store information. They need to be able to read essential information relating to their job and most would also be required to provide written records and perform simple arithmetical calculations. Occupations at this level may require relatively advanced literacy and numeracy skills and good interpersonal communication skills. The knowledge/skills required in at this level result from completion of the first and second stage of secondary education including specialised vocational education and on-the-job training. (ISCED Level 3).

Skill level 3

Occupations at Skill Level 3 typically involve the performance of complex technical and practical tasks which require an extensive body of factual, technical and procedural knowledge in a specialised field, a high level of literacy and numeracy, and highly developed interpersonal communication skills. These occupations generally require the ability to understand complex written material, prepare factual reports and communicate effectively. The knowledge and skill in these occupations usually stem from study at a higher educational institution for a period of 1 – 3 years (ISCED Level 5b) following completion of secondary education, extensive work experience and prolonged on the job training: occasionally this may substitute for formal education. Examples of skill level 3 occupations include laboratory technicians, commercial sales representatives and computer support technicians.

Skill level 4

Occupations at Skill Level 4 typically involve the performance of tasks which require complex problem solving and decision making based on an extensive body of theoretical and factual knowledge in a specialised field. The tasks performed typically include analysis and research to extend the body of human knowledge in a particular field, imparting knowledge to others, the design of structures or machinery and of processes for construction and production. Occupations at this skill level generally require excellent literacy and numeracy, sometimes at a very high level, and excellent interpersonal communication skills. These skills and core knowledge result from study at a higher educational institution for a period of 3 – 6 years leading to the award of a first degree or higher qualification (ISCED Level 5a or higher). In some cases, experience and on the job training may substitute for the formal education. Appropriate formal qualifications are an essential requirement for entry to many occupations.

Notes

Notes