



Project

EAPA-0008/2022 - BLUESKILLING INNOVATION

WP2 - Analysis of the existing training supply in
university and vocational training in the Atlantic area

(Global Report)

Joint Report on Training Supply in the Atlantic Area

Executive Summary

The Atlantic Area's maritime and shipbuilding industries represent a cornerstone of Europe's Blue Economy, driving economic growth, technological innovation, and regional employment across France, Ireland, Portugal, and Spain. However, the sector is undergoing profound transformation as it adapts to the dual imperatives of digitalisation and the green transition. These shifts are reshaping production systems, operations, and workforce demands, requiring new competences in sustainability, automation, and digital technologies.

This report, developed within the framework of the Blueskilling Atlantic Area project, provides mapping and analysis of current training provision in the maritime and shipbuilding sectors across the partner regions. It assesses the alignment of education and training systems with emerging industrial needs, identifies common gaps, and outlines strategic recommendations to support the creation of a cohesive and future-oriented maritime skills ecosystem across the Atlantic regions.

Across the four partner countries, the analysis reveals a robust and diversified training landscape encompassing both Higher Education (HE) and Vocational Education and Training (VET) institutions, with full coverage across the European Qualifications Framework (EQF 3–8). France and Ireland demonstrate strong higher education capacity and research driven training at EQF 6–7, while Spain and Portugal exhibit balanced systems with a solid VET foundation. However, technician level (EQF 4–5) provision critical for production, maintenance, and operational roles remains underdeveloped, creating skills gaps that threaten the sector's adaptability and competitiveness.

Sectorally, shipbuilding and offshore energy dominate the training offer, supported by growing specialisation in digital and renewable technologies. Traditional areas such as fishing and merchant shipping remain significant but require curricular renewal to embed green and digital modules. Emerging fields including maritime cybersecurity, circular shipbuilding, hydrogen systems, and digital twin engineering are gaining traction, particularly within higher education institutions aligned with EU innovation agendas.

Despite strong national frameworks, the report identifies key cross-regional challenges: limited integration of green and digital competences in VET programmes, insufficient modular and micro-credential pathways for lifelong learning, and weak transnational

coordination that limits knowledge exchange and mobility. Addressing these gaps requires enhanced cooperation between education providers, clusters, and industry partners, as well as improved visibility and mutual recognition of qualifications across borders.

To respond to these challenges, the report proposes the establishment of an Atlantic Skills Alliance a coordinated platform promoting collaboration, joint curricula, and shared standards for maritime education and training. Complementary actions include expanding technician level apprenticeships and dual programmes, integrating sustainability and circular economy principles into all maritime curricula, and scaling up lifelong learning through flexible, stackable qualifications.

The expected impact of these measures is the creation of a resilient, innovative, and inclusive Atlantic maritime workforce capable of meeting the EU's decarbonisation and digitalisation objectives. Strengthened transnational partnerships will enhance mobility, competitiveness, and innovation while positioning the Atlantic Area as a leading European model for sustainable blue skills development.

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Introduction

Context

The Atlantic Area is home to a dynamic and historically significant maritime and shipbuilding industry that has long been an engine of economic and social development across its coastal regions. This sector underpins much of the Blue Economy in the Atlantic countries, providing essential services, technologies, and infrastructures that support sustainable transport, energy, fisheries, and tourism.

However, the industry is undergoing a period of profound transformation. The twin transitions digitalisation and the green transition are redefining production systems, technologies, and skill requirements across all segments of the maritime value chain. The European Union's Green Deal, the Sustainable Blue Economy Strategy, and Horizon Europe's Cluster 5 objectives have all set ambitious goals for decarbonisation, innovation, and technological advancement. These goals require a workforce equipped with new technical, digital, and environmental competences to ensure the sector's long-term competitiveness and sustainability.

Despite its importance, the shipbuilding and maritime technology sector faces several common challenges across the Atlantic Area:

- Persistent shortages of qualified workers in design, production, and maintenance.
- Limited adaptation of existing staff to new digital and green technologies.
- Difficulties in attracting and retaining young professionals and women in maritime careers.
- Insufficient sharing and dissemination of successful training initiatives across regions.
- Intense international competition and the absence of a level global playing field, which together heighten the need for innovation and adaptability.

Addressing these challenges requires a coordinated transnational response that aligns training, education, and industrial needs throughout the Atlantic Area.

Project Rationale

The Blueskilling Atlantic Area project responds to these shared challenges by promoting cooperation between industry, research, and education stakeholders to enhance skills development within the shipbuilding and maritime technology sectors.

The project is built on the premise that high-quality, responsive training serves as a key enabler for industrial transformation. Improved skills not only increase individual employability and productivity but also drive companies' capacity for innovation, digitalisation, and environmental sustainability—creating a virtuous circle that benefits the entire maritime ecosystem.

Specifically, the project aims to:

- Compile and map the current supply of university and vocational training programmes relevant to the maritime sector in the Atlantic Area.
- Identify the skill needs and gaps faced by companies through consultation with maritime clusters and industrial associations.
- Facilitate the exchange of information and best practices among training institutions across the participating countries.
- Co-design new or updated training curricula, with particular emphasis on digital, green, and cross-sectoral (“Maritime”) skills.

This collaborative approach ensures that training provision evolves in step with the industry's needs, supporting the transition towards a sustainable, innovative, and resilient maritime economy.

Policy Alignment

The project contributes directly to several major European strategies and initiatives:

- **Atlantic Action Plan 2.0 – Pillar II: Blue Skills of the Future**, by addressing skill gaps, improving blue career intelligence, and strengthening cooperation between business and education.
- **Pillar III: Marine Renewable Energy**, through the development of new competences supporting offshore renewable technologies.
- **Pillar IV: Healthy Ocean and Resilient Coasts**, by training professionals capable of designing and implementing zero-emission and sustainable maritime operations.

It also supports the objectives of:

- The **EU Pact for Skills**, by fostering shared engagement between industry, education, and public institutions for up- and reskilling in strategic sectors such as shipbuilding and offshore energy.
- The **Sustainable Blue Economy Strategy**, by promoting circular economy principles, decarbonisation of maritime transport, and green port development.
- **Horizon Europe's Cluster 5** and **Waterborne TP's Strategic Research Agenda**, through the generation of skills that underpin research, innovation, and technological advancement in the maritime sector.
- The **Marine Strategy Framework Directive** and **EU Biodiversity Strategy for 2030**, by embedding environmental and ecological responsibility into new training curricula.

Objectives

This report forms part of the project's analytical work on skills development and provides a comprehensive overview of the training supply available in the Atlantic Area for the shipbuilding and maritime technology sectors.

Its main objectives are to:

1. Map and document existing training programmes offered by universities and VET institutions relevant to the maritime and shipbuilding industries.
2. Analyse the degree of alignment between current training supply and the evolving needs of companies and clusters in the sector.
3. Identify training gaps and opportunities for improvement, particularly in relation to green, digital, and cross-disciplinary competences.
4. Provide recommendations and input for the subsequent development of joint curricula and training modules under the project framework.

Methodology

The analysis presented in this report is based on a transnational and collaborative methodology, combining quantitative mapping of training offers with qualitative insights from industrial and educational stakeholders.

Key steps included:

- Data collection from higher education institutions (HEIs) and vocational training centres (VETs) across the participating regions.
- Consultations with maritime clusters and industry representatives to identify skills needs and gaps.
- Comparative analysis of national and regional training systems to highlight areas of convergence and divergence.
- Exchange of best practices and successful experiences among partners to facilitate mutual learning.

This methodology ensures that the findings are representative of the diversity of the Atlantic Area while identifying common challenges that can be effectively addressed through joint actions.

Structure

The report is structured as follows:

- **Section 1** introduces the project, its context, and objectives.
- **Section 2** provides an overview of the training landscape in each participating country.
- **Section 3** analyses skill needs and gaps identified through stakeholder engagement.
- **Section 4** presents key findings, conclusions, and recommendations for future training development within the maritime sector.

Impact

By consolidating knowledge about existing training supply and identifying pathways for improvement, this report contributes to the creation of a shared Atlantic framework for maritime skills development. The goal is to foster a highly skilled workforce capable of supporting innovation, competitiveness, and sustainability in the shipbuilding and maritime technology industries.

Through strengthened cooperation between education providers, clusters, and companies, the project will help ensure that the Atlantic Area remains at the forefront of Europe's Blue Economy—driving the transition towards cleaner seas, smarter industries, and a more resilient future.

1. Overview of Training Supply in the Partner Regions of the Atlantic Area

Training Supply EQF levels

The analysis of maritime training programmes by EQF level and country highlights distinct national patterns in the structure and focus of maritime education across the Atlantic Area. France and Ireland demonstrate a strong concentration at EQF levels 6 and 7, reflecting robust higher education and postgraduate provision closely linked to research and innovation in shipbuilding, offshore energy, and maritime management. Spain presents a more balanced distribution across EQF 4 to 6, indicating an active VET system that supports both technician level and higher-level qualifications, while Portugal shows a smaller but diverse spread, with notable activity at EQF 5 to 7. The presence of “Other” non EQF programmes in some countries suggests growing engagement with short courses and micro credentials for targeted upskilling.

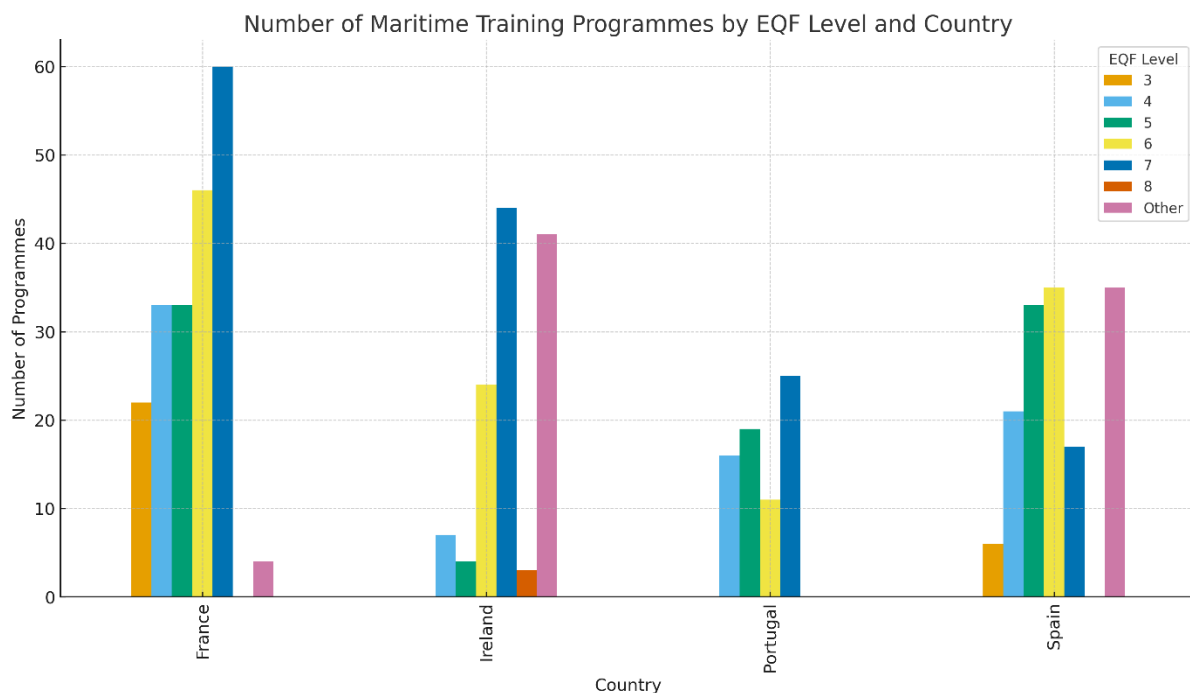


Figure 1

When examining training provision by sector, the results show that shipbuilding and offshore energy dominate in terms of the total number of programmes, spanning multiple qualification levels from technician (EQF 4–5) to postgraduate (EQF 7–8). Fishing and merchant shipping also represent a substantial share, though more concentrated at mid-level qualifications, supporting operational and vocational pathways. Emerging areas

such as renewable energies, digital technologies, and transversal maritime skills feature increasingly in higher EQF levels, aligning with EU priorities for the green and digital transition. Overall, the sectoral distribution underscores a comprehensive training ecosystem but also indicates the need for stronger pathways connecting vocational, higher, and lifelong learning routes across

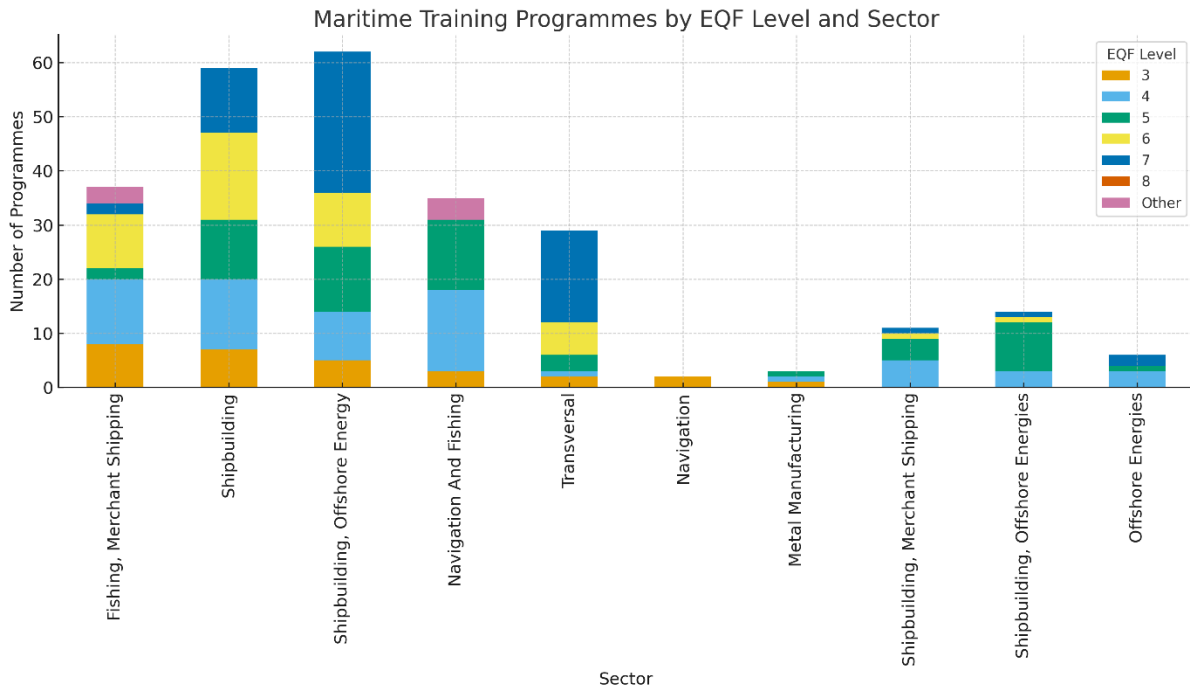


Figure 2

Spain Basque Country

Overview of the Maritime Eco System

The Basque Country hosts a robust and diversified maritime ecosystem, characterised by a strong industrial base, high innovation capacity, and a long tradition in shipbuilding, fishing, and marine transport. The region’s coastal provinces of Bizkaia and Gipuzkoa concentrate most maritime-related activities, including shipyards, ports, and a network of specialised vocational and higher education institutions. The Basque maritime economy also extends into emerging areas such as offshore renewable energies, digitalisation of shipbuilding processes, and sustainable marine technologies. Supported by regional strategies such as the Smart Specialisation Strategy (RIS3) and coordinated through clusters like the Basque Maritime Forum, collaboration between industry, training centres, and universities plays a key role in maintaining competitiveness and driving the green and digital transition of the maritime sector.

Higher Education Supply

Higher Education in the Basque Country provides a comprehensive and diversified offering for the maritime and industrial sectors, covering EQF levels 6 and 7. The University of the Basque Country (UPV/EHU) stands out for its degrees in Nautical Science and Maritime Transport, Mechanical and Electrical Engineering, and its Erasmus Mundus Master in Renewable Energy in the Marine Environment (REM PLUS). The University of Deusto complements this offer with engineering programmes in automation, industrial design, and computer science, as well as a Master's in Maritime-Port Management and Maritime Law. Mondragon Unibertsitatea contributes through innovative, dual-based engineering programmes in Mechatronics, Energy Engineering, and Ecotechnologies in Industrial Processes. Together, these institutions ensure a strong academic foundation for the region's maritime industries, with increasing emphasis on sustainability, advanced manufacturing, and digital technologies.

Vocational Education Supply

The Basque Country possesses a dense network of Integrated Vocational Training Centres (CIFPs) that cover EQF levels 3 to 5, providing essential technical skills for the maritime and shipbuilding industries. Centres such as CIFP Blas de Lezo (Pasaia), CIFP Nautika Eskola Bermeo, and Antiguako Ama Ondarroa Arrantza Eskola specialise in maritime-fishing, navigation, and underwater operations. CIFP Santurtzi and CIFP Usurbil offer industrial and energy-related programmes, including automation, renewable energies, and digital specialisations such as Artificial Intelligence and Big Data. These VET institutions often collaborate closely with companies through dual training models and professional internships, ensuring strong alignment between education and labour market needs. The predominance of public and publicly funded centres ensures accessibility and high-quality standards throughout the region.

Observations and Gaps

The Basque maritime training ecosystem demonstrates significant strengths, including comprehensive EQF-level coverage, solid industrial and academic cooperation, and growing attention to renewable energy and digital skills. However, several areas for improvement remain. There is a need to deepen the integration of green and digital competencies such as alternative fuels, maritime cybersecurity, and circular shipbuilding into traditional VET and maritime curricula. Training in new materials, automation, and shipbuilding 4.0 technologies should be reinforced, particularly at technician levels. Additionally, the development of modular and flexible learning

formats, such as micro-credentials, would enhance lifelong learning and reskilling opportunities. Strengthening visibility, coordination, and international collaboration among Basque training institutions and other Atlantic regions would further consolidate the region's role as a leader in maritime innovation and sustainable blue growth.

France

Overview of the Maritime Eco System

France's Atlantic maritime ecosystem is dense and multi-level, with Brittany as the principal hub and complementary nodes in Pays de la Loire, Nouvelle Aquitaine, and Normandy. Governance spans national ministries (Sea; National Education; Higher Education), France Competences (RNCP), and DGAMPA for STCW compliance, while regions co-fund VET and apprenticeships. Cluster actors (Pôle Mer Bretagne Atlantique, Bretagne Pôle Naval) and Campus des Métiers et des Qualifications (e.g., CMQ Industries de la Mer Bretagne) align training with shipbuilding, offshore energies, and port/logistics needs. The mapped database identifies 198 programmes across the Atlantic coast, with strong sectoral weight in shipbuilding (114) and offshore energies (80), plus offers for fishing & merchant shipping (37) and transversal skills (29) showing an ecosystem geared to both traditional operations and the green/digital transitions.

Higher Education Supply

Higher education is the system's backbone: HE universities account for 49% of providers (97/198), with a further 4% HE private (8). Offers span EQF 6–7. Level 7 leads (60; 30%), then Level 6 (46; 23%) covering naval architecture, marine/ocean sciences, offshore energy, maritime law/management, and digital disciplines. Flagships include UBO (and IUT/BUT tracks), engineering schools, and ENSM (Le Havre, Saint-Malo) for officer pathways and advanced maritime studies. HE programmes increasingly integrate energy management, eco design, automation/robotics, and data topics, and CMQ initiatives seed new diplomas (e.g., naval mechatronics, ROV/drone O&M), reinforcing R&D links and regional specialisation.

Vocational Education Supply

VET and upper-secondary routes provide the operational pipeline: High Schools (lycées) 24% (47) and VET providers 23% (45) deliver EQF 3–5 CAP/Bac Pro/BTS/BUT, CFA/CFAI apprenticeships, AFPA/GRETA continuing training, and consular programmes. Lycées Maritimes (Etel, Le Guilvinec, Paimpol, Saint-Malo; Nantes; La Rochelle, Ciboure; Fécamp) supply fishing/merchant shipping roles. Shipyard/industrial needs are served

via welding, machining, composites, electrotechnics, automation, and maintenance diplomas. The Qualiopi/CPF framework supports lifelong learning and RNCP registered certifications, while regional CMQs and UIMM centres align workshop-based training to decarbonisation, digital shopfloor tools, and industry 4.0 practices.

Observations and Gaps

The offer is tiered and robust (clear ladders from EQF 3→7), but imbalance persists, and advanced skills dominate (EQF 6–7), while intermediate technician levels (EQF 4–5) critical for production/operations need expansion in decarbonisation, digital maintenance, maritime cybersecurity, data/AI, and shipbuilding. Offshore energy shows strong engineering, but thin production/operations training support services (logistics, compliance, digital governance) are underrepresented. Transition skills (decarbonisation, cybersecurity, data, AI/VR/AR) are concentrated in HE and scarce at VET levels. Priorities: (i) co-designed modular micro credentials and apprenticeships at EQF 4–5; (ii) embed green/digital modules across CAP/BTS/BUT and officer training; (iii) scale hybrid programmes bridging shipbuilding offshore and (iv) strengthen regional portability/recognition to accelerate workforce upskilling across the Atlantic Area.

Portugal

Overview of the Maritime Eco System

Portugal's Atlantic maritime ecosystem is nationally coordinated but regionally delivered, with activity concentrated around Lisbon/Setúbal in the southwest, Porto in the north, and key coastal districts and islands. It spans shipbuilding and its supply chain, merchant shipping and fishing, and the growing offshore energies sector. The WP2 mapping identified 71 education and training opportunities, with the South hosting 16 institutions and 56 courses, the North 6 institutions / 8 courses, the Centre 5 / 6, and the Islands 1 / 1 reflecting a south leaning cluster anchored by Lisbon. Provision types are balanced overall (VET 42%, HE 40%, micro-credentials 17%), signalling both established degree pathways and emerging short, targeted upskilling. Sectoral, courses are concentrated in Shipbuilding (42%), followed by Offshore Energies (34%) and Fishing & Merchant Shipping (24%), mirroring Portugal's industrial base and policy emphasis on blue growth and energy transition.

Higher Education Supply

Higher education is led by Instituto Superior Técnico (IST/ULisboa) and ENIDH (Escola Superior Náutica Infante D. Henrique), complemented by universities and polytechnics

such as Universidade do Algarve and Universidade dos Açores. IST delivers the full three cycle degree system in Naval Architecture & Ocean Engineering (BSc EQF 6; MSc EQF 7; PhD EQF 8) with three MSc profiles (Ship Design & Shipbuilding; Maritime Transport & Ports; Ocean Systems) and internationally recognised standing. ENIDH provides degrees in Marine Engineering, Nautical Science, and Port Management, aligning officer and shore-side pathways. Overall HE level distribution shows a strong tilt to EQF 7 (35% of courses), reflecting specialisation and research-led content (energy systems, offshore structures, digital ship design). Digital topics (data analytics, AI/VR/AR, cybersecurity) are increasingly embedded most visible at EQF 6-7 while green transition content is present but thinner.

Vocational Education Supply

VET provision (EQF 4: 23%, 5: 27%) supplies the operational and technician pipeline across mechanics, electrotechnology, automation, robotics, CAD/3D modelling, maintenance, and maritime operations. Production oriented roles are predominantly VET (no HE degrees for production were identified), underpinning hands-on skills and work-based learning. Operational functions are balanced (8 HE / 8 VET offers) in transport & logistics, admin, management, and energy operations. Support Services show the largest volume (26 offers) split across HE, micro credentials, and VET. Many VET items in IT, cybersecurity and IoT are cross sectoral but applicable to ports, shipyards, and fleets. Micro credentials at 17% add flexible, transition friendly routes into maritime and ORE sectors, supporting reskilling from adjacent industries and rapid upskilling for emerging tasks.

Observations and Gaps

Portugal's offer is broad and regionally anchored, with clear strengths at EQF 6–7 (engineering and specialist roles) and a solid VET base for operations and production. Yet three gaps stand out: (i) an underweight EQF 6 layer in Offshore Energies (few bachelor-level technical routes), (ii) limited green-transition depth, Decarbonisation appears in only 5 offers (sparse at EQF 6–7), and (iii) uneven spread of advanced digital skills beyond HE (while Data Analytics (12), AI/VR/AR (10), Cybersecurity (9) exist, many sit at higher levels). Priority actions should include the expanding of technician and apprenticeship pathways at EQF 4–5 targeted to O&M, composite fabrication, electrical systems for ORE, embed alternative fuels, energy efficiency, and condition-based maintenance into VET and CTeSP programmes. scale micro credentials for cross-sector conversion (IT, automation, safety with new fuels) and co-design HE and VET curricula with industry so digital and green modules are standard across shipbuilding, ports, and fleets.

Overview of the Maritime Eco System

Ireland's maritime ecosystem is anchored along its coastal regions and centred on major ports like Dublin Cork and Shannon Foynes. Maritime training is centred in Cork Harbour and key fishing ports such as Greencastle and Castletownbere. It spans merchant shipping, the fishing industry, naval service, and an expanding offshore renewable energy (ORE) sector. National coordination and quality assurance are provided through the Department of Education and QQI, with sectoral agencies (e.g., BIM) and higher education partners aligning provision to labour market needs. The ecosystem increasingly emphasises safety, sustainability, and digitalisation supported by simulation, sea survival facilities, and industry partnerships positioning Ireland to meet energy transition goals while sustaining traditional maritime activities.

Higher Education Supply

Higher education provision dominated by the National Maritime College of Ireland (NMCI/MTU) accounts for many identified programmes (EQF/NFQ Levels 6–8). NMCI delivers degree pathways for deck, engineering, and electrotechnical officers (e.g., Nautical Science; Marine & Plant Engineering; Marine Electrotechnology) alongside STCW and progression courses (OOW, Chief Mate/Engineer). Postgraduate and micro-credential offers linked to ORE and maritime operations are growing, with research and specialist training supported through collaborations (e.g., HALPIN, MaREI, Skillnet/SOWA). Overall, the HE sectors supply is strongly aligned with advanced technical and managerial roles, digital operations, and the green transition.

Vocational Education Supply

Vocational and professional training is led by BIM's National Fisheries College of Ireland (NFCI) at Greencastle and Castletownbere, complemented by mobile coastal units. Provision spans QQI Levels 3–6 and industry certifications in navigation, engineering, radio, firefighting, sea survival, and commercial diving, all benchmarked to STCW and Marine Survey Office approvals. While numerically smaller than HE, VET offers targeted, hands-on pathways for fishermen, vessel crews, and port/sea-going technicians, with growing content in safety, sustainability, and operational efficiency. Emerging ORE aligned short courses and micro credentials supplement this offer and support upskilling for transition into offshore roles.

Observations and Gaps

Ireland's maritime training landscape is robust and coastal-centred, with clear strengths at higher EQF/NFQ levels (6–7) and strong ORE alignment. However, technician and entry-level pathways (EQF 4–5) are underrepresented relative to industry demand, particularly for production/maintenance roles and shore-side technical functions. Digital and green competencies are expanding (cybersecurity, automation, data analytics, decarbonisation) but remain uneven AI/VR/AR, maritime cybersecurity specialisation, and circular shipbuilding are still in the early stages. Ireland currently has no ship building capabilities though there is a large shipyard in Northern Ireland (Harland and Wolf) located in Belfast. Priority actions include expanding VET apprenticeship and modular micro credentials strengthening cross sector conversion routes into the maritime sector deepening industry co-design of curricula and ensuring regional balance so Cork/Donegal hubs continue to serve national needs while supporting Ireland's 2030 ORE targets.

Summary of key findings

Overview

Across the Atlantic Area, the maritime education and training ecosystems of Spain (Basque Country), France, Portugal, and Ireland demonstrate strong industrial traditions, comprehensive institutional capacity, and increasing alignment with green and digital transitions. Higher education and vocational systems together provide full EQF coverage (Levels 3–8), but significant challenges persist at technician levels (EQF 4–5) and in embedding cross-cutting competencies such as cybersecurity, decarbonisation, and advanced digitalisation. Strengthened inter regional collaboration and mutual recognition mechanisms are essential to build a cohesive Atlantic maritime skills space.

Spain – Basque Country

- Strengths: Diversified, innovation driven maritime industry anchored in shipbuilding, fishing, and logistics. Strong collaboration between universities (UPV/EHU, Deusto, Mondragon) and VET centres (CIFPs).
- Gaps: Need for deeper integration of green and digital competencies (alternative fuels, cybersecurity, circular shipbuilding) and expansion of modular and micro credential formats to support lifelong learning.

France (Atlantic Regions)

- Strengths: Dense, multi-level ecosystem with clear progression from EQF 3–7; strong regional governance and specialised clusters. Leading expertise in shipbuilding and offshore energy.

- Gaps: Imbalance favouring higher education technician level (EQF 4–5) training in digital maintenance, decarbonisation, and cybersecurity remains limited. Need for modular apprenticeships and enhanced cross regional recognition.

Portugal

- Strengths: Nationally coordinated, regionally delivered system with balanced provision (VET 42%, HE 40%, micro-credentials 17%); strong hubs in Lisbon/Setúbal and Porto; growing specialisation in offshore renewable energies (ORE).
- Gaps: Underrepresentation of EQF 6 bachelor level technical routes in ORE; limited green transition content and uneven diffusion of digital skills beyond HE. Priorities include expanding EQF 4–5 technician pathways, embedding green/digital modules, and scaling micro credentials for reskilling.

Ireland

- Strengths: Coherent coastal ecosystem centred on Cork and major fishing ports; strong national coordination (QQI, BIM) and growing focus on offshore renewables.
- Gaps: Technician and operational pathways (EQF 4–5) are underdeveloped. Digital and green competencies (AI, VR/AR, circular shipbuilding, cybersecurity) remain uneven. Priorities: expand apprenticeships and modular training, enhance industry co-design, and ensure regional balance to support 2030 ORE targets.

Cross-Regional Insights

Shared Strengths

Across the Atlantic regions, several shared strengths were identified within the maritime education and training landscape. The partner countries demonstrate comprehensive coverage across the European Qualifications Framework (EQF) and benefit from strong higher education research capacity that supports innovation in the sector. Well-established VET networks and the growing implementation of dual and apprenticeship models contribute to a robust pipeline of skilled professionals. Additionally, active cooperation between industry and academia, supported by cluster-based coordination, fosters alignment between training provision and labour market needs. Finally, there is a clear and increasing emphasis on sustainability and digital transformation, reflecting the sector's commitment to supporting the green and digital transitions across the Atlantic Area.

Programs Recorded by Partners

The four partner countries share a rich maritime heritage and are modern EU Member States with robust education systems that underpin a highly skilled and educated workforce.

The assessment of training provision revealed the presence of strong and well-established maritime training ecosystems across all countries. These systems offer a broad range of complementary and overlapping programmes that collectively address the evolving skills needs of the maritime sector.

Both Higher Education (HE) and Vocational Education and Training (VET) institutions contribute significantly to this landscape, delivering courses that span multiple thematic areas identified in the maritime skills framework. Together, they ensure comprehensive coverage of technical, digital, and green skills critical for the sustainable development of the Atlantic maritime industry.

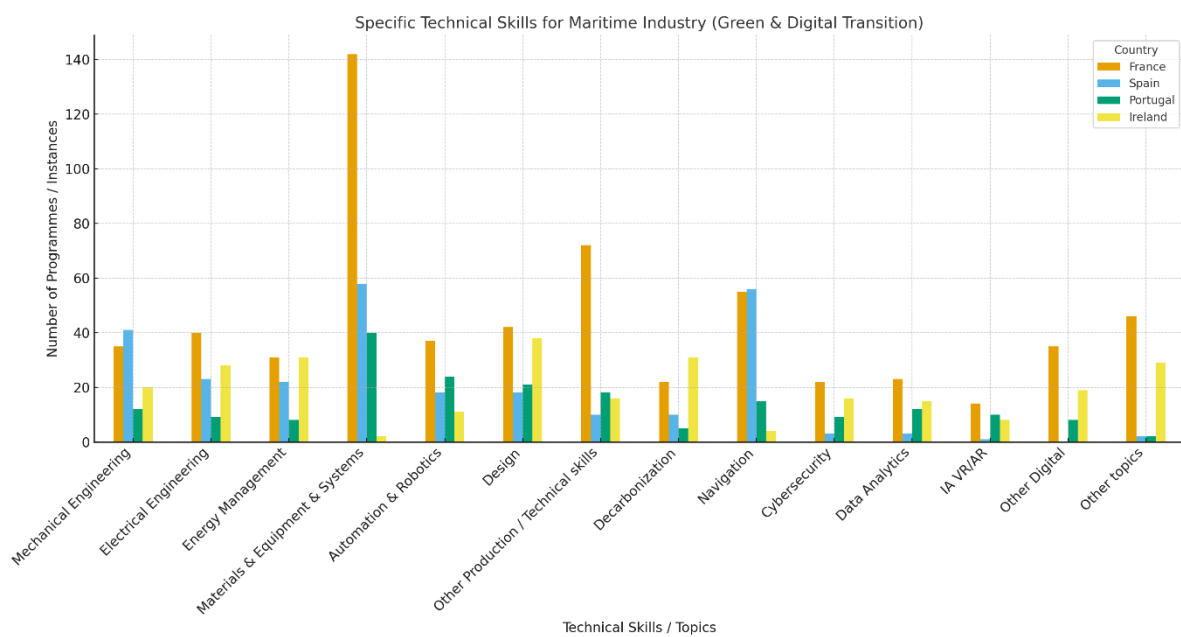


Figure 3

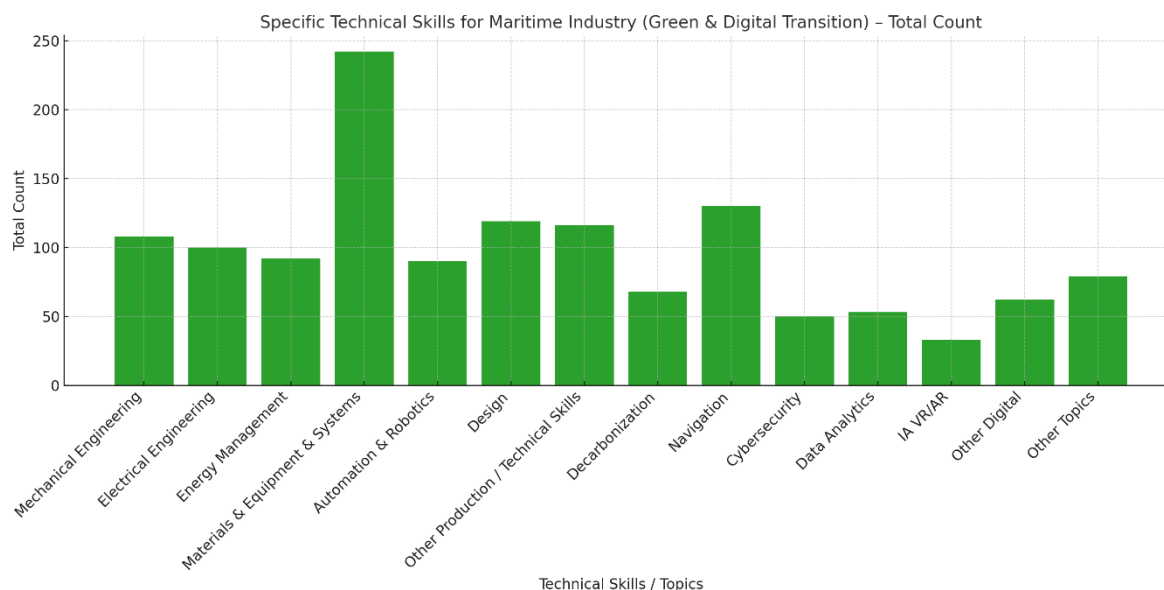


Figure 4

Common Gaps

cross the partner countries, several common gaps were identified in the maritime skills landscape. There is limited provision at technician level (EQF 4–5), particularly in production and maintenance roles, which constrains the development of practical, hands-on expertise. The integration of green and digital modules within existing curricula remains fragmented, limiting the alignment of training with emerging industry needs. Additionally, opportunities for lifelong learning are hindered by the insufficient availability of modular and micro-credential pathways that would support flexible upskilling and reskilling. Finally, weak interregional visibility and coordination among Atlantic actors reduce the potential for shared learning, collaboration, and strategic development across the maritime education and training ecosystem.

Strategic Priorities for the Atlantic Area

To address these gaps, several key actions are recommended. Strengthening cross-border cooperation among maritime education and training providers will enhance knowledge exchange and foster a more integrated Atlantic skills ecosystem. Collaborative efforts should focus on the co-design of modular micro-credentials targeting green and digital competencies, enabling more flexible and responsive learning pathways. Promoting mobility at the technician level (EQF 4–5) and ensuring mutual recognition of qualifications across regions will further support workforce adaptability and career progression. In parallel, embedding decarbonisation and circular economy principles across all curricula will align maritime training with the EU’s sustainability and energy transition objectives.

2. Skills Gaps and Needs Analysis

Overview of current Challenges

Across the Atlantic maritime regions, the shipbuilding and marine technology industries face a set of common challenges affecting human capital development. The most recurrent issues identified include:

Ageing workforce and talent attraction

A significant challenge facing the maritime sector is the ageing workforce, with a large proportion of skilled professionals in shipbuilding and marine engineering nearing retirement. This demographic trend threatens to create a substantial skills gap in the coming years. At the same time, younger generations often perceive maritime careers as traditional or less appealing compared to rapidly evolving high-tech industries. This perception makes talent attraction increasingly difficult. Furthermore, gender imbalance persists across the sector, with particularly low levels of female participation in technical and engineering related maritime roles, limiting the diversity and innovation potential of the workforce.

Limited adaptation to digitalisation

The maritime industry's transition to digitalisation remains uneven, particularly among small and medium-sized enterprises (SMEs). Many companies and workers still lack proficiency in essential digital tools such as CAD/CAM systems, simulation software, and data analytics platforms. The adoption of Industry 4.0 technologies including robotics, artificial intelligence (AI), the Internet of Things (IoT), and additive manufacturing varies considerably across the value chain. Compounding this issue could be a shortage of qualified trainers and educators with the expertise needed to teach these emerging digital competencies effectively.

Green transition and sustainability competences

Meeting the EU's environmental and decarbonisation goals requires a new generation of skills related to energy efficiency, alternative fuels, circular economy principles, and lifecycle design. However, many traditional maritime training programmes still provide limited exposure to sustainability practices and environmental management. Expanding awareness and embedding these topics across both vocational and higher education curricula are essential for preparing the workforce to meet the demands of the green transition and to support sustainable growth within the Atlantic maritime sector.

Mismatch between training supply and industrial needs

There can be a notable disconnect between current training provision and the evolving needs of the maritime industry. Education and training programmes, can lag behind technological developments, resulting in graduates whose skills do not fully align with industry requirements. Communication between companies and education providers is sometimes limited, which hinders the co-design of responsive and relevant training programmes. Additionally, there is a scarcity of short term and flexible upskilling opportunities that would allow workers to adapt quickly to emerging technologies and changing market demands.

Weak transnational knowledge transfer

Despite the presence of strong regional initiatives, the transfer of knowledge and good practices across the Atlantic Area can be weak. Innovative training approaches and successful models developed in one region are not always replicated or scaled up in others. The absence of harmonised qualification frameworks across countries further restricts worker mobility and cross border cooperation. Strengthening transnational collaboration, knowledge exchange, and mutual recognition of qualifications would enhance the resilience and competitiveness of the maritime skills ecosystem across the Atlantic regions.

Cross Cutting Skills Needs

From the analysis, several priority skills areas have emerged as essential for the future competitiveness of the Atlantic maritime sector. These can be grouped into four main clusters:

Digital and Technological Skills

Digital and technological competencies are fundamental to the adoption of Industry 4.0 and the development of digital shipyard concepts. These skills encompass the use of computer aided design and manufacturing (CAD/CAM) tools, robotics and automation systems in production and maintenance processes, and the ability to apply data analysis and digital twin technologies for real time monitoring and optimisation. They also include expertise in cybersecurity and IT systems management to safeguard critical maritime infrastructure, as well as proficiency in simulation and modelling for the design and testing of ship systems. Additionally, smart port and logistics management skills are increasingly important for ensuring efficiency, safety, and interoperability in connected maritime operations.

Green and Sustainability Skills

Linked to the European Green Deal and blue transition goals:

Green and sustainability skills are central to meeting the objectives of the European Green Deal and supporting the blue transition within the maritime sector. These competencies include knowledge of alternative and low carbon fuels such as hydrogen, ammonia, and biofuels, as well as expertise in technologies that improve energy efficiency and reduce emissions. They also involve the application of lifecycle analysis and eco design principles to promote sustainable shipbuilding practices. Furthermore, skills related to waste management, circular economy approaches, and the recycling of ships and offshore structures are becoming critical. Finally, the ability to conduct environmental monitoring and ensure compliance with international sustainability standards is essential for the sector's transition to a greener future.

Transversal and Soft Skills

Key for innovation, collaboration, and resilience:

Transversal and soft skills are increasingly valued in the maritime industry as enablers of innovation, collaboration, and organisational resilience. Workers must be able to think critically and solve complex problems, often in fast changing technological and environmental contexts. Strong project management and teamwork abilities are crucial, particularly when working in cross sectoral or interdisciplinary environments. Effective communication across multilingual and multicultural teams supports international cooperation, while an entrepreneurial and innovative mindset fosters creativity and competitiveness. Continuous learning and adaptability are equally vital, enabling professionals to remain agile in the face of rapid industry transformation.

Sector-Specific Technical Skills

Related to traditional but evolving maritime and shipbuilding competences:

Sector-specific technical skills remain a cornerstone of maritime and shipbuilding excellence, even as traditional competences evolve in response to digitalisation and decarbonisation. Core areas include naval architecture and structural design, alongside advanced welding, fitting, and materials technologies that comply with new industry standards. Maintenance and retrofitting skills are increasingly important for adapting existing vessels to operate on green energy systems. Moreover, technical expertise in the operation and maintenance of offshore renewable energy infrastructure such as wind, wave, and tidal systems represents a growing area of demand within the broader blue economy.

Management and Leadership Skills

In addition to technical proficiency, management and leadership skills are vital for driving transformation and ensuring effective coordination within maritime organisations. Professionals must possess the ability to lead multidisciplinary teams, oversee complex projects, and implement strategies that integrate digital innovation and sustainability

objectives. Strategic planning, change management, and stakeholder engagement are crucial to align workforce development with evolving policy and industry priorities. Furthermore, leaders in the maritime sector must foster inclusive and forward looking organisational cultures that support talent attraction, gender balance, and continuous professional growth across all levels of the workforce.

Skills Landscape Overview

Although the challenges and needs are largely shared, each country presents distinct features in the skills landscape.

Country	Key Strengths	Main Skills Gaps	Emerging Priorities
Spain	Strong VET & HE tradition and industrial training infrastructure.	Integration of digital and green modules in VET programs should be increased.	Advanced manufacturing, green ship technologies, digital design.
Ireland	Excellent HE and industry collaboration and innovation ecosystems.	Limited VET-level maritime pathways.	Offshore renewable energy skills, mechatronics, digital operations.
France	Well-coordinated HE system and cluster engagement.	Few modular or short-term reskilling programs for workers.	Eco-design, circular economy, lifelong learning structures.
Portugal	High quality engineering education and growing maritime innovation hubs.	Integration between HE and VET systems; lack of practical upskilling routes.	Cross-sectoral curricula linking shipbuilding, renewables, and digital tech.

Future orientated Skills (2030 Horizon)

The maritime industry's shift toward digital and sustainable systems will intensify over the next decade. Based on foresight studies and partner input, the following emerging competences are expected to gain prominence:

Emerging Maritime Skill Areas

Emerging Skill Area	Description	Relevance
Digital Twin Engineering	Integration of real-time data and modelling for ship design and monitoring.	Core to Industry 4.0 shipyards.

Hydrogen and Alternative Fuels Engineering	Design and maintenance of systems using low-carbon fuels.	Key to decarbonisation goals.
Automation and AI in Maintenance	Predictive maintenance using AI and sensor data.	Improves efficiency and safety.
Circular Shipbuilding and Recycling	Lifecycle-based design and sustainable decommissioning.	Supports EU circular economy targets.
Maritime Cybersecurity	Protection of digital infrastructure and operational systems.	Increasingly critical with digital ports and vessels.
Blue Entrepreneurship	Creation of innovative maritime start-ups and SMEs.	Drives competitiveness and job creation.

Summary of Key Findings

Skills shortages are structural and transnational. They affect all Atlantic regions, particularly in digitalisation and green technologies.

Traditional technical skills remain vital. However, they must be upgraded with digital and sustainability dimensions.

Training supply is abundant but fragmented. There is a need for greater coordination, modularisation, and cross-border recognition of qualifications.

Clusters play a critical bridging role. Their engagement ensures that training is demand-driven and aligned with industrial needs.

Transnational cooperation is essential. Joint curricula and mutual learning among Atlantic partners can address gaps more efficiently than isolated actions.

3. Key Findings Conclusions and Recommendations

Summary of Key Findings

The analysis of maritime education and training across the Atlantic Area reveals a robust and diverse ecosystem that collectively provides full EQF coverage (Levels 3–8). The region benefits from strong higher education and vocational training systems, active industrial clusters, and growing engagement with the digital and green transitions. However, imbalances persist between countries and qualification levels. Higher education institutions dominate provision at EQF 6–7, particularly in France and Ireland, while technician level training (EQF 4–5) remains underdeveloped in several regions, constraining workforce adaptability and operational capacity.

Sectorally, shipbuilding and offshore energy represent the largest share of training provision, spanning the full qualification range. Fishing and merchant shipping continue to provide important mid-level pathways but face challenges in modernising curricula and integrating sustainability competences. Emerging domains such as renewable energies, digital engineering, and transversal maritime skills are expanding, particularly within higher education, reflecting the growing influence of EU priorities around the twin digital and green transitions. Across all countries, there is clear recognition of the need to strengthen interconnections between VET, HE, and lifelong learning, improve modular and micro credential pathways, and enhance cross border cooperation to foster a coherent Atlantic maritime skills space.

Strategic Conclusions

1. Workforce Renewal is Urgent. The ageing demographic of maritime professionals and limited attractiveness of the sector to young talent, especially women, risk undermining future competitiveness.
2. Technician Level Skills are a Critical Gap. EQF 4–5 qualifications are insufficient to meet the needs of shipbuilding, offshore energy, and port operations. Expanding dual and apprenticeship models can address this.
3. Digital and Green Competences Must be Mainstreamed. Decarbonisation, circular economy principles, automation, and cybersecurity must become core elements across all training levels.
4. Fragmentation Hinders Efficiency. Despite strong national systems, limited coordination and recognition across borders reduce mobility and shared innovation potential.
5. Clusters and Partnerships Drive Alignment. Collaboration between industry, clusters, and education providers is essential for ensuring that training provision remains responsive to evolving technologies and market demands.

Policy Level Recommendations

- Develop an Atlantic Skills Alliance to promote mutual recognition of maritime qualifications and foster joint curricula across the Atlantic regions.
- Align training with EU Green and Digital Agendas by integrating decarbonisation, renewable energy systems, digital shipyards, and maritime cybersecurity into both HE and VET curricula.
- Invest in Technician Level Pathways (EQF 4–5) by supporting new dual training programmes, apprenticeships, and modular certifications for production, maintenance, and offshore operations.
- Promote Gender and Youth Inclusion through targeted initiatives that attract underrepresented groups into maritime careers, enhancing diversity and innovation.
- Support Lifelong Learning and Micro Credentials to encourage flexible, stackable qualifications that enable upskilling and mobility across maritime sub sectors.

Institutional Recommendations for Education Training Providers

- Embed green and digital modules across all existing courses to ensure future readiness.
- Strengthening industry co design through structured collaboration with clusters and companies.
- Expand micro credentials and short courses targeting specific competences such as hydrogen fuels, automation, AI, and maritime data analytics.
- Enhance transnational partnerships by sharing teaching resources, simulation tools, and online training content across the Atlantic Area.
- Build continuous professional development pathways linking VET and HE programmes to promote lifelong learning and workforce progression.

Industrial and Cluster level Recommendations

- Co create training content with education providers to ensure curricula reflect operational realities and technological change.
- Support apprenticeships and on the job learning, particularly in shipbuilding, offshore maintenance, and digital manufacturing.
- Invest in cluster led training hubs that integrate innovation, testing, and skills development functions.
- Encourage knowledge transfer and international collaboration, leveraging best practices from leading maritime regions.
- Facilitate workforce transition from adjacent sectors such as automotive, energy, and IT into maritime roles through targeted conversion programmes and micro credentials.

Expected Impact

Implementing these measures will strengthen the resilience and competitiveness of the Atlantic maritime sector. A better aligned training ecosystem will support the green and digital transformation of shipyards, ports, and offshore industries, ensure a sustainable talent pipeline capable of meeting decarbonisation and innovation goals, enhance cross border mobility and cooperation, and consolidate the Atlantic Area as a model for blue skills development in Europe. Furthermore, it will foster inclusive growth, providing new opportunities for young people, women, and workers transitioning between industries.

4. References

WP 2 Report France

WP 2 Report Basque Country

WP2 Report Portugal

WP2 Report Ireland

WP 2 Training Data Collection Sheet France

WP 2 Training Data Collection Sheet Basque Country

WP 2 Training Data Collection Sheet Portugal

WP 2 Training Data Collection Sheet Ireland