

Analysis of the State of the Art for Upskilling and Reskilling Shipbuilding Workforce in Europe

2020



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Contents

1. Introduction to USWE Project	5
1.1 Summary of the project	5
1.2 Project Partners	5
1.3 Project's main tasks	5
1.4 Webpage	5
2. Work Package 01: State of the Art	6
2.1 Objectives	6
2.2 Activities	6
2.3 Deliverables	6
3. Approach and Methodology	7
3.1 Initial reflections	7
3.2 The Skills Management Model	7
3.3 Extra Data	8
3.4 Partial conclusions	8
3.5 Final Conclusions	8
3.6 Validation process & Questionnaire for experts.	8
3.7 Validation Report	8
4. Shipyards and Equipment Suppliers	9
4.1 Introduction	9
4.2 The Marine Equipment Providers	10
4.3 Shipbuilding inside the Maritime Industries	11
4.4 Shipbuilding and Ship Repair Sector's supply chain	11
4.5 Shipyards' and Equipment Manufacturing companies' initiatives regarding skills management:	11
4.6 Role of SEA Europe	11
5. Institutions	13
5.1 Introduction	13
5.2 DG Mare	13
5.3 DG Grow	14
DG GROW's Sectoral Studies:	14
5.4 DG Employment	16
5.5 Member States	16
5.6 OECD Working Party	18
6. Workforce	18
6.1 Introduction	18

6.2 The role of industrial Europe:.....	19
7. EU strategies and containing skills and training provisions and affecting the European Shipbuilding and Maritime Equipment sector	21
7.1 Leadership 2020	21
7.1.1 EESC's Report on LeaderSHIP 2020	22
7.1.2. Opinion adopted by the Committee of the Regions: A new European agenda to speed up the development of maritime industries.....	23
7.2. Making Europe's businesses future-ready: A new Industrial Strategy for a globally competitive, green and digital Europe.....	23
7.3 New Skills Agenda for Europe.....	24
7.4 Blue Growth.....	24
Report on the Blue Growth Strategy	25
7.7 Horizon Europe.	25
7.8 Strategic Research Agenda. Scenario 2050 for the Waterborne Sector.	25
8. Skills needs and gaps detection.....	26
8.1 Working at Sectoral Level.	26
8.2 Methodology for Detecting Skills Need.....	27
9. Skills Gaps Analysis	28
9.1 Introduction.....	28
9.2 Skills presentation	28
9.3 Skills analysis.....	29
9.4 Technical skills	30
9.5 Transversal skills	30
9.6 Digital skills	31
9.7 Green skills.....	32
9.8 Previous EU projects.....	32
9.9 Good practices: Third countries and International Organisations.	33
10. Curricula	34
10.1 The Competence Matrix.	34
10.2 The example of Metals Project.....	35
10.3 The Specialisation Courses' Structure. (Example from the Basque VET System).....	35
10.4 Curriculum Guidelines Framework.....	36
11. Training.....	36
Introduction.....	36
11.1 Training Offer.....	36
11.2 Training Providers.....	37

11.3 Equipment providers	38
11.4 Quality Training	38
11.5 Types of Training Provision (modalities)	39
11.6 Recognition of Certificates	40
11.7 Lifelong Learning	40
11.8 Validation of Prior Learning.....	41
12. Implementation	41
Introduction.....	41
12.1 Work environment	41
12.2 Technologies and Equipment. Digital Enablers (Virtual Reality)	42
12.3 Production Process management	42
12.4 Smart Manufacturing	42
12.5 Products customization. Flexibility.....	43
12.6 Collaborative Platforms. Real Time Information. Big Data.....	43
12.7 Roles Distribution	43
12.8 Skills needed. Digital and Green	43
12.9 Servitization.....	45
12.10 Shipyard 4.0.....	45
13. Tools and support	46
Introduction.....	46
13.1 Sectoral Forecasting and Skills Development.....	46
13.2 Understanding Skills.	46
13.3 The Skills Intelligence.	46
13.4 Matching Skills and Jobs around Europe.....	47
14. Regulations.....	47
14.1 General Labour and Working Conditions	47
14.2 Safety and Health Regulations	48
14.3 Environmental Regulations	49
15. Image.....	50
15.1 Identity.	50
15.2 Design.	51
16. Career Management Systems	51
16.1 Business setting	51
16.2 Possible institutional contributions to career management in their regions	52
16.3 Career Paths: Modes of engaging labour	52

16.4 Structure of Jobs	53
16.5 Level and type of skills training	53
17. Conclusions of the Report	54
Shipyards and equipment Providers	54
Workforce.....	54
Strategies.....	55
Detection	55
Analysis.....	56
Curricula	56
Training.....	56
Implementation.....	57
Tools and support.....	57
Regulations	58
Image	58
Management	58
Summary of conclusions: State of the art of skills supply, demand and management in the European shipbuilding, ship repair and maritime equipment industry	59
Bibliography.....	61
Linkography	66

List of graphs and figures:

Figure 1 USWE's Skills Management Model.....	8
Figure 2 Map of European Shipyards 2015	9
Figure 3 Economic value of European maritime tech sector (shipbuilding and equipment).....	10
Figure 4 SEA Europe's White Paper on LeaderSHIP2030	12
Figure 5 LeaderSHIP 2015 and LeaderSHIP 2020 EU sectoral strategies	15

1. Introduction to USWE Project

1.1 Summary of the project

- USWE project aims at detecting the skills gaps and future needs in the Shipbuilding Industry, including in the scope the several subsectors that make it up: manufacturing, repair, maintenance and conversion of vessels, equipment and other maritime structures such as the offshore platforms. The project will start analysing existing data previously collected by diverse agents of the sector through diverse initiatives. It will also review social trends in demography or migrations, and the challenges originated by Industry 4.0, the increasing digitalisation of the manufacturing processes and the new KETs regarding their potential impact on growth and employment in the sector.
- Based on the acquired knowledge and analysis, the partnership will elaborate an updated list of occupations and corresponding skills. Technical, transversal, digital and green skills will be the focus of this project.
- These profiles and skills will be validated by sectoral experts, focus groups and professionals. Once there is consensus on the final list of occupations and skills, they will be sent to ESCO, fed into the Skills Panorama and supported with further recommendations for stakeholders and policymakers.

1.2 Project Partners

- Tknika. Viceministry of VET. Department of Education. Basque Government.
<https://tknika.eus/en/>
- SeaEurope. Shipyards and Maritime Equipment Association of Europe (recognised sectoral social partner representing the employers at European level)
<http://www.seaeurope.eu/>
- IndustriAll European Trade Union (recognised sectoral social partner representing workers at European level)
<https://news.industrial-europe.eu/>
- Turku University of Applied Sciences
<https://www.tuas.fi/en/>

1.3 Project's main tasks

- Analyse of the State of the Art
- Forecast for Shipbuilding 4.0
- Identification of Skills and Profiles
- List of VET Profiles and Skills
- Recommendations for Stakeholders and Policymakers
- Management and Coordination
- Quality Assurance and Risk Management
- Dissemination, Exploitation and Sustainability

1.4 Webpage

<https://www.usweproject.eu>

2. Work Package 01: State of the Art

In this work package the State of the Art regarding the skill needs in the Shipbuilding and Ship Repair Sector will be analysed. This will serve as a base for the rest of the project work.

In order to do that, a Methodology for Detecting Skill Needs, fully aligned with the Cedefop guidelines will be developed by Tknika and agreed by the partnership. Tknika has a wide experience in this field and has developed similar tasks in previous EU projects.

Once the methodology is defined, Sea Europe will carry out the research on skill needs in two different levels: Desk research and field research.

All these different aspects will be compiled in a publication on the State of the Art.

2.1 Objectives

- Analyse the State of Art regarding the Skills Needs in the Shipbuilding and Ship Repair Sector.
- Develop a Methodology for Detecting Skills Needs.
- Carry out a research on the skills needs.

2.2 Activities

- Develop a **Methodology** for Detecting Skills Needs matching the requirements of the EU Skills Panorama.
 - The paper will provide the partnership with an understanding of “how” and “to what extent” the skills needs analysis should be conducted.
- **Desk Research** on policies, strategies, existing profiles in ESCO, current skills.
 - A research taking into account relevant documents and policies to detect what the main skill needs of the sector are and will be in the near future.
- Design **questionnaires** for a field research.
 - Questionnaires will be developed for the detection of skill needs in the shipbuilding industry.
- **Field Research** on current skills and profiles demand in the Shipbuilding sector.
 - A field research will be conducted to detect, from the point of view of the companies, the skill needs of the workers. In order to carry out this research, Turku University of Applied Sciences will prepare questionnaires.
- **Report on the State of the Art.** The document will provide a comprehensive analysis of:
 - How the skill needs should be detected.
 - The skills need of the sector according to documents and companies.

2.3 Deliverables

- Methodology for Detecting Skills Needs
- Desk Research Report (State of Art)
- Questionnaires for the Field Research
- Field Research Report (on current practices)
- Report on the State of Art

3. Approach and Methodology

3.1 Initial reflections

- Deliverable D1.1 which explains the methodology for the skills detection in the sector was elaborated and approved at the beginning of the project.
- At the first meeting in Tknika the approach to the Desk Research was discussed and approved as well. In there, the table of contents which are the index for this document was elaborated considering the different options and the characteristics of the sector.
- This deliverable, though initially under the responsibility of a partner, SeaEurope, was agreed to be elaborated among all members, contributing as long as we could, to the making of the document.
- The research on the State of Art has been organised along several steps:
 - a. Fixing the **scope** of the research: Getting to know which the sector and the subsector are involved.
 - b. Selecting the organisations or **bodies** which have a direct influence on the shipbuilding sector strategies.
 - c. Knowing which the strategies are been displayed in the sector nowadays.
 - d. Paying attention to all type of **data** on skills where we could get info for our research.
 - e. Limiting the research to the initially chosen **VET profiles** and classifying the info, sharing it with partners.
 - f. Make **drafts** to be approved by all partners.
- The main idea was that there is a lot of information available and relevant but scattered in different documents and formats, having been elaborated by different institutions. All we need to do was to put this information together, to process it, analyse it and turn it into relevant knowledge for stakeholders.

3.2 The Skills Management Model

USWE Project's model: A comprehensive approach to the skills management with three main areas: The elements, the routines and the culture.

- The elements: Shipyards, workers and institutions are part of a strategic triangle which enables, through the adequate strategy, the development of the skills management process.
- The routines / Process: Five different phases, detection, analysis, curricula, training and implementation, with relevant points of decision making, and linking the tasks of detection with the final objective of getting benefit from it, till being able to generate new changes which initiate the process again. A standard process which simplify the analysis of skills and avoid repetition of concepts and confusion.
- The characteristics / the culture: Four aspect, tools and support, regulations, image and management, which facilitate or complicate the flow of the previous mentioned process phases.

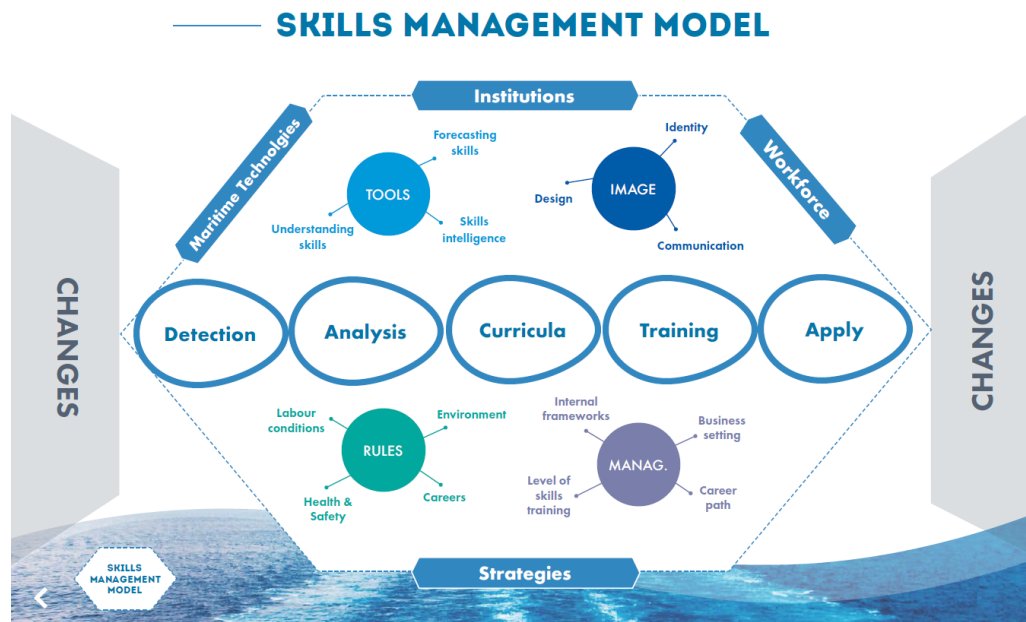


Figure 1 USWE's Skills Management Model

3.3 Extra Data

- To gather extra information from diverse sources in order to enrich the contents of the research:
 - Country by country info
 - Previous EU project
 - Third countries
 - International organizations: OECD
- Write the reflexions and most relevant fact from each topic.

3.4 Partial conclusions

- To summarize the main findings from each mentioned theme.

3.5 Final Conclusions

- According to the different topics of interest and the most relevant target groups or stakeholders

3.6 Validation process & Questionnaire for experts.

- On the different topics which have been presented to them

3.7 Validation Report

- Reflexions and conclusions on the feedback provided by respondents.

4. Shipyards and Equipment Suppliers

4.1 Introduction

The European Shipbuilding Industry is specialised in the design, production, maintenance, repair and conversion of some of the most complex and technologically advanced vessels in the market. Mainly passenger ships (cruises, ferries) other non-cargo vessels such as fishing vessels, offshore, dredgers, tugs, research vessels and others, and naval ships. , The industry also delivers products for the offshore energy industry and for military purpose.

The shipbuilding industry also includes a large and complex supply chain that manufactures technology, systems and equipment and supplies services for the building, conversion and maintenance of these ships and pieces of equipment. The European Shipbuilding and Ship Repair is a dynamic and competitive sector which is also linked to other sector including transport, security, energy, research and environment.

Shipbuilding is a strategic industry in several EU countries. Shipyards contribute significantly to regional industrial infrastructure and national security interest.

There are more than 300 shipyards in Europe.

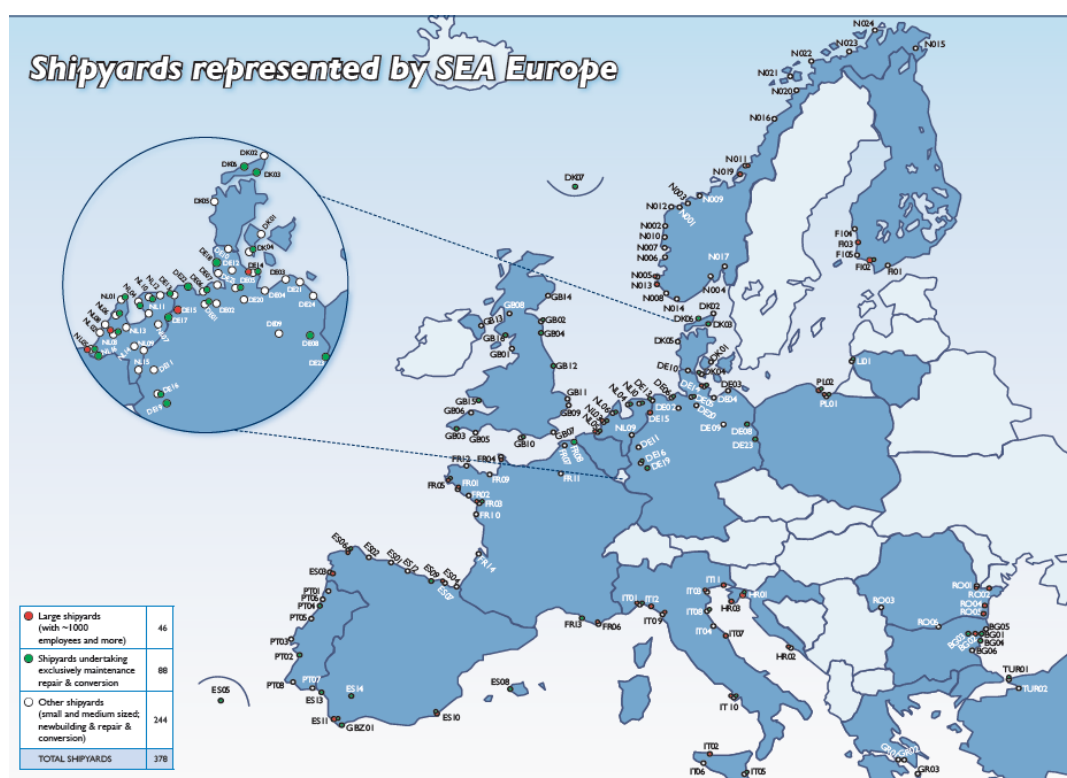


Figure 2 Map of European Shipyards 2015

- There is also a significant number of small and medium shipyards and suppliers
- The shipbuilding industry, including 1st and 2nd tier suppliers provides 600.000 direct jobs in Europe, and around 500.000 indirect ones. Around 330.000 people are employed by shipyards in Europe according to BALANCE Technology Consultant's statistics

- The European shipbuilding industry is the global leader in the construction of complex vessels, such as cruise ships, ferries, mega-yachts and dredgers.
- It also has a very strong position in the building of submarines and other naval assets. 6 European shipyards hold 85% of the export naval orderbook.

ECONOMIC VALUE OF EUROPEAN MARITIME TECHNOLOGY SECTOR

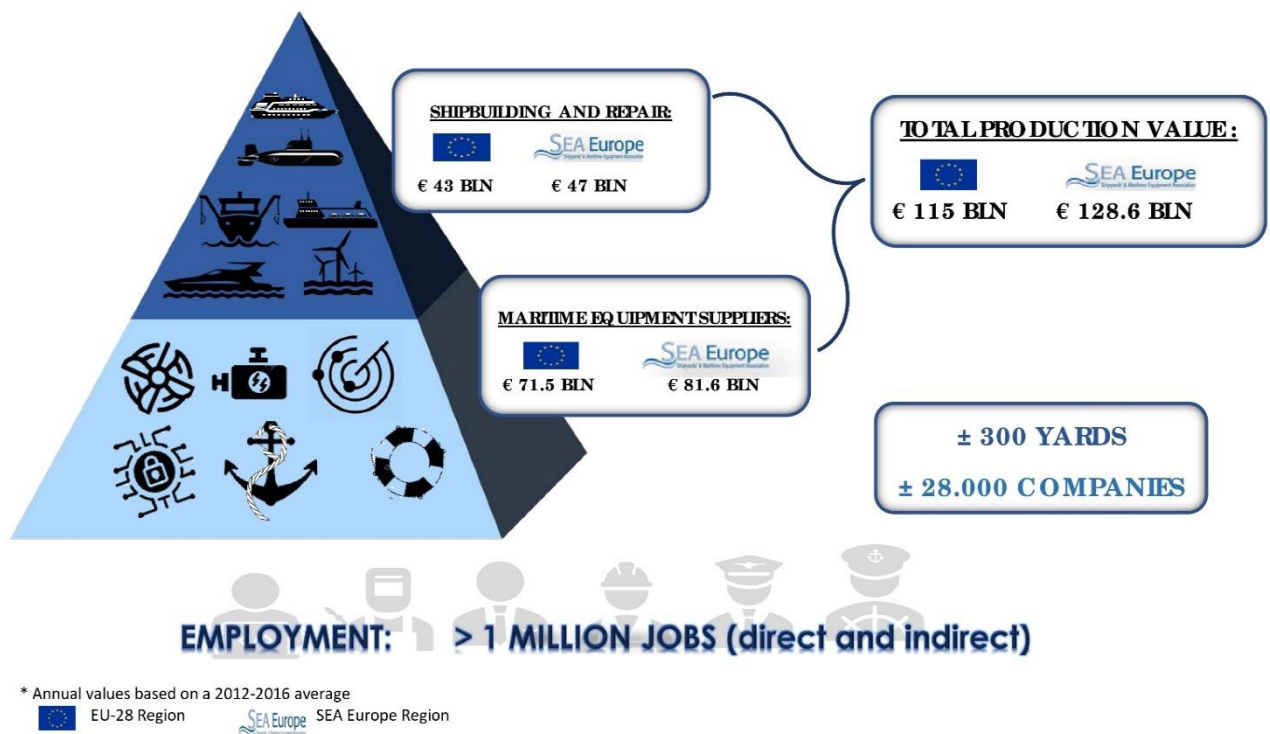


Figure 3 Economic value of European maritime tech sector (shipbuilding and equipment)

4.2 The Marine Equipment Providers

The production of vessels requires a wide range of equipment, materials and specialised services, provided by the marine supplies industry.

The EU Marine Equipment Industry is a world leader for a wide range of products ranging from propulsion systems, large diesel engines, environmental and safety systems, to cargo handling and electronics.

Well known marine equipment providers are ABS Group, ABB Group, Siemens, Wartsila, BAR Technologies, BLRT Group, Sener, Pemamek, Kranendonk, Kongsberg, Rolls Royce, Alfa Laval, Pon Power, MAN Energy Solutions, Becker Marine Systems.

At http://www.solarnavigator.net/marine_equipment_manufacturers.htm a whole list of marine equipment manufactures can be found.

The role of these marine supplies industries regarding the sea skills management is very relevant. On one hand, they supply technologies and equipment which foster innovation in the shipbuilding sector. On the

other, they are providers of training to customers and operators which updates and improves the workforce's technical skills and competences.

4.3 Shipbuilding inside the Maritime Industries

Shipbuilding and maritime equipment industries are interrelated with other Maritime Industries along with fisheries, tourism, transport of goods and people, etc. However, unlike the nature of these other maritime sectors, shipbuilding is a high-tech manufacturing industry.

In general policies and initiatives from the European Commission are trans-sectoral, sometimes oriented to the whole Maritime Sector, sometimes oriented to industrial sectors, etc. However, from the point of view of the skills management, the approach must be sectoral in order to be effective and tackle the actual needs.

4.4 Shipbuilding and Ship Repair Sector's supply chain

Considering the supply chain of the shipbuilding and ship repair activities, there are skills gaps and training needs in all the phases of the supply chain, but for the matter of our concern, the skills update of the vocational profiles, the focus has to be put on the assembly, outfitting, finishing phases. The design phase must be also taken into consideration since the impact of the new technologies, digital equipment and innovations seem to be reducing the traditional skills and raising the need for skills to design, read and interpret plans and interact with digital tools and applications.

4.5 Shipyards' and Equipment Manufacturing companies' initiatives regarding skills management:

- Policy on careers / talent management.
- Own in-house training academies or shipbuilding schools.
- Cooperation agreements with universities and VET centres.
- Internships, apprenticeship and dual.
- Corporate Image: tendency to very good designs to make it attractive for people.
- Most of them post vacancy offers and options on the web to join the shipyards.
- Provide professional progression possibilities for newcomers.
- High investment in innovation projects. A highly competitive and innovative sector.
- Analysis and anticipation of skills needs and gaps.
- Attention to the difficulties to find sectoral skills and workforce.
- Modernising the work environment also concerning safety, health and environment (HSE) matters. Green focus approaches.
- Several shipyards and equipment/technology providers (mainly the largest ones) are directly and proactively involved in SEA Europe's initiatives and some participating in the Social Dialogue Committee, and in the development of EU projects.

4.6 Role of SEA Europe

SEA Europe is the Shipyards and Maritime Equipment Association of Europe, representing the interest of the industry at EU and international level. The association represents more than 90% of the entire

European industry. The membership of SEA Europe is composed by the national industrial associations and corporate members which are shipyards and equipment manufacturers. Through its working groups and bodies SEA Europe involves in its daily activities large and multinational companies and SMEs which constitute the backbone of the EU maritime technology know how and industrial sector.

Its mission is to provide a wide range of services and activities internationally and in Europe for the benefit of the maritime civil and naval manufacturing industries. Leading role of SEA Europe on different matters, and among them, the skills management:

- Creating, by means of an EU project, the European Skills Council for the Maritime Technology Sector
- Generating Committees and Working Groups:
 - Sea Human Capital: Creating the adequate culture and image.
 - Sectoral Social Dialogue for the Shipbuilding Sector.
 - Sea RDI: For generating knowledge, innovation. Skills development for engineering and high education profiles.
- **Position paper** On the EU Commission proposal for the renewal of the Connecting Europe Facility Funding Programme. Asking for significant investment in research, development and innovation as well as in the deployment and uptake of new technologies and solutions.
- **Reports:** Shipbuilding market monitoring reports and SEA Market Forecast annual reports.
 - Monitoring market and trade developments at international level. In-house reports focused on the 1st half of the year and full year overview (2 reports/year)
 - Forecasting newbuilding requirements for each vessel type in the long term, based on demographic, market, societal and economic trends. 1 Report per year.
- **Press releases.** i.e. on SkillSea: New project to detect and meet future skills need in the Maritime Transport Sector: Technical skills needs are different from the ones needed for the Shipbuilding and Ship repair Sector but transversal skills maybe similar: Compare technological development with industry's skills needs: An example of what should be done.
- **Sectoral Social Partners' Manifesto (SEA Europe and industriAll Europe) on the Strategic Importance of the Maritime Technology Sector for Europe:** Lobbying to focus on the maritime Sector in order to care about workforce and its future.
- **White Paper:** Entitled "Maritime Technology in Europe: A Strategic Solution Provider for Major Societal Challenges". SEA Europe presents its Vision for 2030 and beyond. This vision is based on seven distinct pillars and four major messages:
 - The strategic nature of the sector for Europe.
 - Need for the EU to adopt a holistic and coherent dedicated sectoral strategy, with effective and concrete policies and financial tools.
 - Need for the European Commission to boost Europe's global leadership in complex shipbuilding and advanced maritime equipment manufacturing.
 - Need for the EU to enhance the political visibility of the maritime technology sector, either through a "European Maritime Coordinator" or through a coordinating European Commission service.
 - Stimulating employment, attracting competence and securing skills in a fast-changing (digital) world.



Figure 4 SEA Europe's White Paper on LeaderSHIP2030

5. Institutions

5.1 Introduction

Regarding the leadership deployed by the institutions, we can do an initial division between European institutions and other significant number of institutions acting at national, regional and local level at each European country.

At European level we can distinguish three main general directions acting on the field on the skills management: DG Employment, DG Grow and DG Mare. DG RTD is also introducing more and more the skills management perspective in their policy papers and Calls for proposals. On the other hand, DG Move is acting in the field of skills management in the maritime transport/shipping sector, therefore looking at the skills required by crews and operators of those ships of the future.

Regarding the skills related initiatives we have to, first, find those initiatives which directly impact on shipbuilding and equipment; second, we have to pay attention to all the other initiatives which if not directly for the sector, should also be considered because they can be of high interest.

5.2 DG Mare

Deals with Maritime Affairs and Fisheries and is concerned with skills and career development in blue economy sectors.

Coasts and seas have a great potential to deliver growth and jobs, and in order to get profit from this possibility, highly qualified and skilled professionals are needed. Aware of the increasing difficulties in finding the right employees in the Blue Economy sectors, DG Mare aims to fill the skills gap between education offer and labour market need, try to favour the communication and cooperation between education and industry, promote the attractiveness and awareness of career opportunities in the Blue Economy and improve ocean literacy culture.

The main actions put in place to tackle the skills gap are:

- a) Blue Careers in Europe call for proposals:
 - Blue Career projects
- b) Blueprint on Sectoral Skills Cooperation for the Maritime Technology Sector: A framework to develop strategies and actions at EU level and an action plan for rolling out the results at national and regional level.
- c) The Expert group and the Maritime Forum
 - Expert Group on skills and career development in the Blue Economy
 - The Maritime Forum: Aiming at improving communication among EU maritime policy stakeholders.
- d) Projects to boost Ocean Literacy:
 - Sea Change and ResponSeable
 - EU Atlas of the Sea.

5.3 DG Grow

Through DG Grow, in charge of EU policy on the single market, industry, entrepreneurship and small businesses, the European Commission promotes the industries' development and addresses the competitiveness issues they face.

- DG Grow considers the following facts: European shipbuilding being a dynamic and competitive industry of relevance from the economic and social perspective and is linked to other industries including transport, energy, research, security and environment.
- The European maritime equipment industry is a world market leader providing the most advanced and competitive technologies contributing to make European shipbuilding as well leader in complex ship types.
- The sector faces fierce international competition and has also suffered from the absence of effective global trade rules and from massive state support in non-EU countries

Since 2003 the Commission addresses the challenges of the shipbuilding and technology sector through a variety of **policy measures**, and through dedicated industrial policy LeaderSHIP 2015 and LeaderSHIP2020.

DG GROW's Sectoral Studies:

Some Studies commissioned or issued **by the EC about the Shipbuilding and Maritime Equipment sector that must be taken into consideration for the current research:**

- **LeaderSHIP 2020** (and previous LeaderSHIP 2015) industrial policies.

In 2003 the 1st European industrial strategy for the maritime technology sector was adopted: LeaderSHIP2015. The document was adopted by the European Commission and industry and supported by the Council.

In 2013 the industrial strategy was reviewed to adapt it and respond to the global economic and financial crisis and the sectoral stakeholders adopted LeaderSHIP 2020. The report outlines a strategic vision for the industry that is:

- innovative
- green
- specialized in high tech markets
- energy efficient
- capable of diversifying into new markets, etc.

To make this vision a reality, the report provides a series of recommendations for the short and medium term to generate sustainable growth and high-value jobs linked to maritime technologies. It outlines four priorities, one of those being "Employment and Skills".

The report emphasizes the importance of best practice for restructuring and improving the public's perception of the industry. It outlines ways to acquire new talent and skills, life-long learning projects, harmonizes certificates (or to validate non-certified skills), and facilitate mobility.

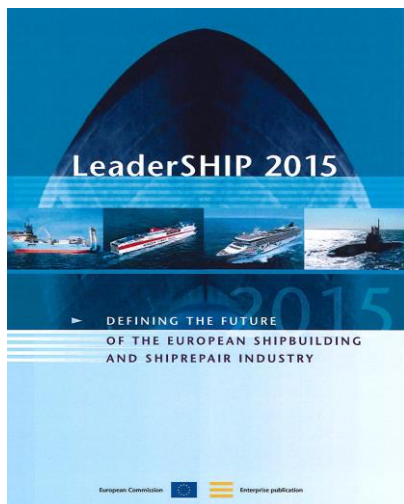


Figure 5 LeaderSHIP 2015 and LeaderSHIP 2020
EU sectoral strategies

- **Green Growth opportunities in the EU Shipbuilding Sector (2014)**

This report provides the main findings on the challenges and market opportunities for the shipbuilding and marine equipment industry. Eight greening trends are addressed, covering both market, regulatory and other factors. For each trend, the resulting market potential is estimated, along with barriers identified that may affect the reaping of this potential. It also elaborates the current state of green technology developments within each market identified and the role of EU and competitor industries in providing these technologies.

- **Competitive Position and Future Opportunities of the European Marine Supplies Industry – Final Report: Recommendations (BALance Technology Consulting) (2014)**

Maintain the knowledge base – enhance education and training – European marine supplies industries build their capabilities on a strong academic/educational framework with well-developed engineering skills, a strong general industry base and healthy competition in their markets. It is therefore strongly recommended that on the basis of existing programmes education and training in the marine disciplines are enhanced, maintained and if necessary adapted to the demand of new emerging markets and technologies. Industry and universities are requested to jointly develop adequate curricula and to offer related studies. This may also include maritime programmes to establish and support lifelong training measures and as inter European educational exchange programmes.

- **Study on new trends in globalisation in shipbuilding and marine supplies. Consequences for European industrial and trade policy (2017)**

The objective of this study is to create an overview of the global shipbuilding supply chain industry, covering basic economic and company characteristics, and including available products and services. It evaluates national competitive market positions and tries to identify new trends in globalization and the consequences for European Industrial and Trade Policy. The study also makes some recommendations for the support of the industrial sector. Amongst the policy recommendations:

- “Enable and maintain the knowledge base through enhanced education and training in order to facilitate preparation and implementation of technology driven innovation in products and processes through such initiatives as the IoT and Maritime 4.0. The European shipbuilding supply

chain industry builds its capabilities on a strong academic/educational framework with well-developed engineering skills, a strong general industry base and healthy competition in their markets.”

- “It is therefore strongly recommended that based on existing programs, education and training in the marine disciplines are enhanced, maintained and if necessary adapted to the demand of new emerging markets and technologies. Industry and universities are requested to jointly develop adequate curricula and to offer related studies. This may also include maritime programs to establish and support industry based lifelong training measures and as inter European educational exchange programs. “
- “Improve competitiveness in value chains based on the principles of smart transition to the Industry 4.0 concept – It is recommended that the maritime clusters in the different European regions are supported and encouraged to be more active in the '4th generation industry' initiative such as extension into the global spare part market of the shipping industry. This may involve thinking of new business models, creating advanced organizational models, enhancing skills and education and employing related research projects. Examples of particular interest include: Dealing with cyber-physical systems. Internet of Things. Big Data and Cloud solutions. i.e. those initiatives which strengthen the regional Industry 4.0 related capabilities for the broader European maritime industry.
It is recommended that ERDF and ESF be used to address the issues for improvement of the co-operation within the supply chain.”

5.4 DG Employment

Undertakes different actions to:

- Improve information and understanding of trends and patterns in demands for skills and job (skills intelligence) to enable people make better career choices, find quality jobs and improve their life chances.
- Make skills more visible and comparable.
- Improve the quality and relevance of training and other ways of acquiring skills.
- The most relevant action: **A new Skills Agenda for Europe**, which includes very relevant actions for the sector such as the Pacts for Skills.

Other DGs of the European Commission are also taking further **policy actions** in very relevant areas for the Shipbuilding Industry. Amongst others:

- Research & Innovation (mainly DG RDT, Waterborne Transport)
- Intellectual Property (managed by DG Grow and Trade)
- International trade (DG Trade)
- Mobility, safety (DG Move)
- Environment (DG Move, DG Clima)
- Defence (DG Defis)

5.5. Member States

Regarding institutional coverage at national level, the interests of shipyards and maritime equipment companies are usually taken care by the Ministries of Industry and in some cases the Ministry of Economic Affairs.

In some cases, where a Ministry of the Sea exists, this may also share the responsibilities with the Ministry of Industry. It is the case, for instance, of France, a Minister of the Sea was appointed in July 2020. Another example is Germany where it exists the figure of the Federal Government Coordinator for the Maritime Industry, depending on the Ministry of Economic Affairs and Energy.

National industry associations: All European countries with a relevant maritime technology industry count with a dedicated industrial association that brings together the sectoral companies in the country. Some of the national associations representing European shipyards and equipment providers are the following:

- Associazione Nazionale dell'industria Navalmeccanica (ASSONAVE) – Italy
- Groupement des Industries de Construction & Activités Navales (GICAN) - France
- Aedimar Cluster of the Galician Naval Sector (ACLUNAGA) – Spain (regional)
- The Basque Maritime Forum, Foro Marítimo Vasco – Spain (regional)
- Unión Española de Constructores Navales (UNINAVE) – Spain
- Associação das Indústrias Navais (AIN) – Portugal
- Norsk Industri – Norway
- Finnish Marine Industries – Finland
- Verband für Schiffbau und Meerestechnik e. V.- Germany
- Danish Maritime - Denmark
- Asociația Națională a Constructorilor de Nave din (ANCONAV)
- Netherlands Maritime Technology – THE Netherlands
- Forum Okrętowe – Poland
- Hellenic Marine Equipment Manufacturers & Exporters – Greece
- Hrvatska Brodogradnja - Jadranbrod d.d. – Croatia

Workers organisations: Some of the main national trade unions representing workers in European shipyards and equipment providers, which are members of IndustriAll Europe are the following:

- ACLVB/CGSLB - Belgium
- FGTB MWB - Belgium
- ACV/CSC METEA - Belgium
- CO-industri - Denmark
- IG Metall - Germany
- CC.OO industria - Spain
- UGT FICA - Spain
- Proliitto - Finland
- Sähköliitto SAK - Finland
- Teollisuusliitto - Finland
- CFDT FGMM Métallurgie - France
- CFE-CGC Métallurgie - France
- CGT FTM Métallurgie - France
- FO Métaux - France
- CGT FNTE - France
- TUC GMB – United Kingdom
- TUC UNITE the UNION – United Kingdom
- CGIL FIOM - Italy
- FIM-CISL - Italy

- UIL M - Italy
- GWU - Malta
- CNV - Netherlands
- FNV - Netherlands
- Fellesforbundet - Norway
- NSZZ Solidarnosc Metalowców - Poland
- KZZPwP - Poland
- SIMA - Portugal
- industriAll-BNS – Romania

5.6 OECD. Working Party

Working Party 6 of the OECD is an international platform for the exchange of information and the elaboration of economic and policy analysis on matters of concern for the shipbuilding sector. The WP6 aims to establish normal competitive conditions in the shipbuilding industry, notably by encouraging transparency and consulting with both non-OECD economies and relevant industry groups. It promotes an active role of governments in enabling a transformation of the labour market (e.g. through active labour market policies and skill re-training)

6. Workforce

6.1 Introduction

Workers in charge of applying the skills in the workplace. The majority of the workers in the shipbuilding industry are well prepared but suffering the impact of new technologies that are requiring more and more specialization every day. The ageing of the workforce is an added challenge requiring attention. The professional profiles are the way in which the different types of technical skills are structured.

The focus of this research is on the VET profiles: European Level 3, 4 and 5 according to the European Qualification Framework.

Due to local, popular terminologies, different management of skills and HR in different companies and to the evolution on the type of tasks traditionally developed by the different profiles, the nomenclature is very wide and complex, considering also the added variety of languages in Europe. The language issue in Europe complicates the recruitment processes, mobility and mutual understanding between actors from different countries. This is not the case for instance in China, USA, Canada.

USWE project has checked some examples of occupational profiles taken from the ESCO database, from the shipyards, from some EU countries and from 3rd nations too:

- **ESCO Database:** The current ESCO database contains quite a few of these profiles.
- **EU Shipyards:** Some examples have been taken from large EU shipyards' webpages (Damen, Meyer Group, Royal IHC, Chantier de L'Atlantique, etc. In there, the type of description varies among them and in relation with the ESCO database.
- **EU Countries:** We can show some other examples from specific countries: France
- **Best practices examples from 3rd Countries:**

- A Canadian booklet – **BC's Shipbuilding and Ship Repair Industry** - which is very attractive since it mixes information on the skills with an attractive design, aiming at offering a good image of the sector in order to attract people.
- **O*NET**, the American database of professional profiles. It offers an extensive description of each profile. (Part of the information offered in the application could be included in the basic designs of the subsequent training courses)

Mention must be made to the fact that the current lack of workforce for the EU shipyard is becoming a mayor concerns of the companies, social agents and policy makers, as expressed by several policy papers and in interviews with company experts and trade unions during the life of USWE project.

6.2 The role of industriAll Europe:

IndustriAll Europe is the federation of trade unions representing manual and non-manual workers in several sectors, one of them being the shipbuilding sector. IndustriAll Europe represents, and acts on behalf of, the workforce. Regarding the field of the skills, industriAll Europe has public positions on a variety of topics, some of which are relevant for this research: shaping the future of youth, change and the anticipation of change, political motions, becoming climate neutral, and workers in a digital world:

- a) **Shaping the future of Youth:** The Youth Working Group focuses on four policy areas: digitalisation and innovation, flexibility, internships and apprenticeships and mobility. They try to combat youth unemployment by working on labour market mismatches, inadequate skills, limited geographical mobility and inadequate wage conditions. The aim is to turn young people into a highly skilled labour force to be an asset to the sector's supply chain.
 - 1) Digitalization and innovation: the paradox is that digitalisation and innovation can improve working conditions, productivity and support environment friendly activities, but may cause a lot of low skilled labour disappear. Therefore, there is a need to:
 - Assess the impact of ICTs on employment and jobs: which jobs are disappearing, which are emerging etc?
 - Ensure a balance between professional and private life.
 - Encourage lifelong learning in the educational system in order to stay up to date with the technological change.
 - Regularly update VET training opportunities.
 - To support skills and the mindset for innovation.
 - 2) Flexibility: to protect newcomers with agreed working conditions for example a detailed job description.
 - 3) Internships and apprenticeships: to bridge the gap between school and the labour market:
 - To offer insights into the workplace.
 - To gain experience.
 - To enrich the qualification certification.
 - To ensure quality and provide "guidance".
 - 4) Mobility: an option for skilled workers:
 - Ensure no skills vacuum is left behind.
 - To establish similar condition across Europe.

- b) Change: anticipate the Change:** to mitigate the negative impact on workers originated by the economic and financial crisis, IndustriAll Europe calls for building mutual trust among employers, institutions and workers through **social dialogue and sustainable development strategies**.

Some of the measures they support relate to skills management and solutions include

- Addressing the issue of anticipating of skills needs.
 - Forward planning of employment and skills.
 - Promotion of ambitious lifelong learning policies.
 - Guaranteeing access to ongoing training.
 - Specific training and retraining for each worker, which includes upskilling and reskilling existing skills.
 - The validation and recognition of skills.
- c) Motions 2016-2020:** these political motions voted at the European Congress express clear positions in favour of improving the working conditions relating to occupational health and safety through training and retraining agreements based on the industrial policies that should be promoted by the European Commission.

- d) Climate neutral:** the new climate strategy promoted by the EU Commission demands:

- 1) Transformation to digitalise and circular economy.
- 2) New materials to replace the traditional ones.
- 3) Substitution of fossils fuels by electricity, hydrogen, renewable synthetic fuels and bio-waste.

The transition to a climate neutral economy will provoke structural changes and require ambitious industrial policies regarding, among others, the management of skills. Parts of the key requirements are linked to:

- 1) Time and resources to allow workers to adapt to the new paradigm of low-carbon economy.
 - 2) Smooth transition, for each worker affected, to new jobs.
 - 3) Investment in human capital:
 - a. Upskilling and reskilling
 - b. Lifelong learning opportunities
 - 4) Maintain or increase employability to ensure the necessary skills needed for the new clean technologies and processes.
 - 5) Anticipate changes.
- e) Workers in a digital world:** digitalisation entails, basically, the mechanisation and automation of industrial jobs.

On one hand:

- 1) It increases productivity and cuts production time.
- 2) It helps fight climate change.
- 3) It brings improvement on health and safety issues.
- 4) It (automatization of tasks) prevents and reduces the number of accidents in factories.

On the other hand:

The digital evolution creates disruption for industrial workers because it eradicates a significant number of industrial jobs and puts workers under great strain.

To fight this disruption process, industriAll Europe believes that:

- 1) The education system is at the root of the changing work landscape and should better:
 - a. Define the new skills needed.
 - b. Develop efficient education programmes.
 - 2) Increased coordination between employer and schools is key and should involve trade unions too.
 - 3) Providing lifelong learning opportunities to teachers is also important.
 - 4) Improving VET systems ensures that young people are adequately equipped for the future.
- f) **Updated objectives from IndustriAll Europe presented during the European Social Dialogue Committee for Shipbuilding Meeting in Brussels January 2020**
- Defend European labour market and create jobs for European Citizens
 - Advocate for the respect European labour standards in all Member States
 - Develop social dialogue (quality dialogue at all levels)
 - Respect Collective Bargaining
 - Ensure high levels of social standards
 - Posted workers - no undercutting of wages
 - **Skills:** identify skills needs and mismatches, invest in reskilling and upskilling, promote internal labour mobility and ensure that no worker is left behind.

7. EU strategies and containing skills and training provisions and affecting the European Shipbuilding and Maritime Equipment sector

7.1 Leadership 2020¹

The strategy, adopted by in 2013 is the result of a close co-operation between the industry, the trade unions, maritime regions, Member States and the European Commission.

The LeaderSHIP 2020 strategy's recommendations range from the wider use of EU instruments to foster new skills, competence and qualifications, to Public Private Partnerships for new maritime research, EIB funding opportunities and smart specialisation strategies in regional policy. The strategic vision for 2020 focuses on competitiveness and envisions a successfully restructured sector offering attractive long term employment opportunities for a highly skilled workforce, including younger workers. A workforce in manufacturing, R+D and servicing that is trained and prepared to work with a multitude of technologies.

One of the 4 Pillars for Action is Employment and Skills: Regarding the **New Skills and Lifelong Learning** it says that a systematic approach at EU level to map the activities versus employment needs in various regions and member states, addressing current and future skill/training needs would facilitate planning, coordination of skills, intra/inter-sectoral mobility and implementation of lifelong learning processes.

¹ https://ec.europa.eu/growth/sectors/maritime/shipbuilding/ec-support_en

Workers should be encouraged to take advantage of the specialization of the sector into new markets by “upskilling” and “reskilling” in order to meet evolving skills expectations.

The Leadership 2020 Coordination Group recommends a few measures in order to bring about the sectoral change needed and create a truly competitive and sustainable industry for 2020:

- **Employment and Skills:** The industry with the European Commission should undertake a skills mapping exercise on the basis of a study conducted by the regional clusters and provide input to the available EU programmes and projects aiming at improving the skills and competences.
- **Anticipation and Management of Change,** systematic consultation and coordination at EU, national and local level should become common practice in order to soften the social impact of adjustment of employment and unemployment.
- **Member States and regions** should explore with the European Commission how the “Poles of Excellence” initiative could foster regional networks.
- **EU Programmes** should be used effectively for funding individual projects with a focus on lifelong learning. Existing **tools** provided by these programme and initiatives (Shipbuilding Week – European Maritime Day) should be harnessed and effectively used to promote the European maritime technology industry and communicate the **image** of a high tech enabling industry. A study should be considered at EU level on the issue and creation of secondary **accreditation system** in order to give recognition to informal learning.

New skills and lifelong learning: There is a real risk of losing critical mass of skills and technological competences through downsizing and closures.

There is a need for a better transfer of competences between old and new generations to address the ageing workforce and the lack of new blood in the sector.

7.1.1 EESC’s Report on LeaderSHIP 2020

In 2018 the European Economic and Social Committee adopted an Own-Initiative Opinion: **The LeaderSHIP 2020 strategy as a vision for the maritime technology industry: towards an innovative, sustainable and competitive maritime industry in 2020**

The EESC Report includes a dedicated section on employment and skills, as follows:

- “There is a strong need to rectify skills shortages, to upskill workers and to provide relevant training and retraining with the aim of maintaining a critical mass of expertise and know-how in the European maritime technology industry. Thus, it is important to support and continue the work initiated by the social partners with the Skills Council project. Moreover, it is essential that the social partners are involved and consulted by the European institutions in the policy making process and about any EU initiative affecting the sector and that the professional organisations representing employers and employees continue to be involved in dialogue, including in the context of the social dialogue.”
- “Workers must have appropriate training to be able to cope with the challenges of Industry 4.0 and future technological change (e.g. digitalisation). Future workers in the maritime technology industry will need to have skills enabling them to handle the opportunities and challenges of the blue economy”

- Efforts to improve the attractiveness of the sector need to be stepped up. Various career paths for workers in this sector need to be identified and brought together, and the mobility of students (i.e. Erasmus for the maritime technology sector) needs to be increased. The European Commission should continue to fully support the activities of SEA Europe and IndustriALL at European level within the framework of the social dialogue committee.”

7.1.2. Opinion adopted by the Committee of the Regions: A new European agenda to speed up the development of maritime industries

In plenary session of 27 June 2019, the CoR adopted this opinion urging policy makers to support for the maritime industries to ensure the success of their environmental and energy transition, together with their digital transformation and industrial revolution, and for the sector's careers to be made attractive again.

The CoR “recognises the importance of stimulating sectoral social dialogue and of organising the relationship between employment and training in the maritime industries; calls for specific platforms to fulfil these tasks not only in marine transport and bioresources but also in the manufacturing industry and shipbuilding”

7.2. Making Europe's businesses future-ready: A new Industrial Strategy for a globally competitive, green and digital Europe

A new industrial strategy was adopted by the European Commission in March 2020. The Strategy provides “special focus on sustainable and smart mobility industries” **identifies shipbuilding as one of those industries with “the responsibility and the potential to drive the twin transitions, support Europe’s industrial competitiveness and improve connectivity”**.

The Industrial Strategy rightly states that “a competitive industry depends on recruiting and retaining a qualified workforce. As the twin transitions gathers speed, Europe will need to ensure that education and training keep pace.

The document identifies digitisation, automation and artificial intelligence as game changers that will require new sets of skills, and that retraining and reskilling have to be a major part of our social market economy.

“In the global race for talent, Europe needs to increase investment in skills and life-long learning should become a reality. This will require **collective action of industry, Member States, social partners and other stakeholders through a new ‘Pact for Skills’** to contribute to up- and reskilling and to unlock public and private investment in the workforce. **The Pact will put focus on sectors with high growth potential for Europe or those undergoing the most significant change.”**

The industry strategy also points at the need to have a better balance between women and men in industry and encouraging women to study Science, Technology, Engineering and Mathematics, consider a career in technology and invest in digital skills, thus improving the gender balance in creating and leading businesses.

In this context, the industrial strategy foresees the following actions, all of them of interest for the maritime technology industry:

- An update of the Skills Agenda for Europe in 2030, including a recommendation on Vocational Education and Training.
- Launch of a European Pact for Skills.
- Communication on a European Education Area Strategic Framework.
- Digital Education Action Plan
- Implementation of the EU Gender Strategy.

7.3 New Skills Agenda for Europe

The European Commission adopted on 1st July 2020 the European Skills Agenda for sustainable competitiveness, social fairness and resilience. It sets ambitious, quantitative objectives for upskilling (improving existing skills) and reskilling (training in new skills) to be achieved within the next 5 years. Its 12 actions focus on skills for jobs by partnering up with Member States, companies and social partners to work together for change, by empowering people to embark on lifelong learning, and by using the EU budget as a catalyst to unlock public and private investment in people's skills.

The **New Skills Agenda has a strong focus on supporting the adaptation of skills for jobs in a green and digital economy** and on the adaptation to the changes arisen from the Covid-19 pandemic.

The Agenda foresees 12 “actions” to achieve its objectives:

- A Pact for Skills
- Strengthening skills intelligence
- EU support for strategic national upskilling action
- Proposal for a Council Recommendation on Vocational Education and Training for sustainable competitiveness, social fairness and resilience
- Rolling out the European universities initiative and upskilling scientists
- Skills to support the green and digital transitions
- Increasing STEM graduates and fostering entrepreneurial and transversal skills
- Skills for Life
- Initiative on Individual Learning Accounts
- A European approach to micro-credentials
- New Europass Platform
- Improving the enabling framework to unlock Member States' and private investments in skills

7.4 Blue Growth

The 'blue' economy represents roughly 5.4 million jobs and generates a gross added value of almost €500 billion a year. However, further growth is possible in a number of areas which are highlighted within the strategy.

Blue Growth is the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole.

Report on the Blue Growth Strategy

On the Final Commission Staff Working Document from 2017, it is declared, talking on the skills development, the need to better match available skills to labour market demand, which has been recognised for some time.

Several drivers require the promotion of new skills and the renewal of the skills of those who work in the maritime economy:

- a) The focus of shipbuilding on more specialised vessels.
- b) The growth in offshore renewables.
- c) The current downturn in the oil and gas industry.
- d) The evolution of new, innovative maritime businesses in many areas.

The Commission's Blue Careers Initiative will establish new platforms for cooperation between business, education and training at local, regional and transnational level to:

- a) Develop and implement concrete actions to close the skills gap.
- b) Tackle the unemployment challenge
- c) Raise the attractiveness of "Blue Careers"
- d) Increase Ocean Literacy.

7.7 Horizon Europe.

The European Union's new research and innovation framework programme will run from 2021 to 2027. The planned programme is structured around three pillars: open science, global challenges and industrial competitiveness, and open innovation. The first pillar includes funding for fundamental research and grants for research mobility and infrastructure. The second pillar groups research into five clusters: health; inclusive and secure society; digital and industry; climate, energy and mobility; and food and natural resources. The third pillar is designed to enhance Europe's innovation output.

7.8 Strategic Research Agenda. Scenario 2050 for the Waterborne Sector.

The Waterborne sector in Europe is determined to assume its responsibility in facing the challenges, goals and needs. The sector has jointly developed an ambitious scenario for the future, underpinned by cross-sectoral visions and missions. The Waterborne sector will make a significant contribution to the wellbeing and prosperity of EU citizens, while continuing to be worldwide frontrunner.

Among the vision of Waterborne TP, there are four main objectives which require a fast adaptation of skills in the shipbuilding and maritime equipment industry to the digital and green transformation:

- Safe, competitive and eco-friendly shipyards and production sites
- Green and clean waterborne transport
- Safe and secure waterborne transport
- Connected and automated waterborne transport

8. Skills needs and gaps detection

For this phase in the process of skills management, we are going to focus on three documents:

- Working at Sectoral Level.
- USWE Project Methodology for the Detection of Skills.
- Methodology for Detecting Skills Need.

8.1 Working at Sectoral Level.

This guide is a part of the ETF, ILO and Cedefop series of guides on skills anticipation and matching. The guides examine sectors as the key points where changes in skills demand occurs, the term sector being used to define specific areas of economic activity.

There are a few key sectoral approach steps. The **key steps** in any sectoral skills analysis involve:

- Clarifying the aims and objectives.
- Carefully defining the sector or sectors to be considered.
- Conducting a data audit.
- Consulting key stakeholders.
- Identifying the main target audiences.
- Clarifying the key questions to be addressed.
- Deciding how best to answer them. (choice of methodology)
- Executing the analysis.
- Disseminating the findings and implications.

Other considerations to be considered include the general and economic context and various constraints, financial and otherwise. Such **considerations** include:

- The general economic and political context. (market economy, centrally planned, mixed)
- The state of economic development.
- The political and cultural background.
- The involvement of the social partners.
- The institutional infrastructure, capabilities and capacity.
- The existing statistical infrastructure, including the existence of other research and related activities, as well as other surveys and relevant data sources.

Carrying out the analysis can involve many different **elements** and other characteristics:

- The presence or absence of primary data collection.
- The use of modelling or other foresight methods.
- The role of interviews and other forms of consultation.
- The classification and definition of the sector. (limitations and benefits of using standards systems of classification)
- A SWOT analysis.
- Technology scanning.
- Clusters.

- qualitative profiling;
- software (the use of standard packages such as Excel, SPSS, STATA or other more specialized software);
- industry value or supply chain analysis;
- Complementary research that can help inform the results.

Essentially this means:

- Establishing, based on solid evidence, where the sector is now as far as its skills needs are concerned.
- Thinking, in a consistent and transparent manner, about where it is going in.

8.2 Methodology for Detecting Skills Need

For detecting the skills need in Shipbuilding in USWE project, we select a methodology based on the previously mentioned Cedefop's guidelines.

Using this methodology, we combine 2 activities, the desk research and the field research. We research, firstly, the current situation, the state of art using for it a Skills Management Model. Secondly, we research the trends in demography or migrations and challenges originated by industry 4.0 which may have a strong impact on the shipbuilding and ship repair activities.

Following this method, we start analysing the broad picture, the general frame, that is to say, the sector as a whole and then we go deeper into the specific subsectors and more particular areas of the industry.

We will focus on the vocational skills and profiles, those usually provided by the vocational education and training systems, on the ones which are more frequent and demanded: welders, mechanic, fitters, painters, etc.

The results of the research done by project partners will be checked and validated by experts. Based on the acquired knowledge and analysis, we will elaborate an updated list of occupations and corresponding skills: technical, transversal, digital and green skills.

These profiles and skills will be enriched and validated by focus Groups – professional at successive phases. The final list of occupations and skills will be sent to ESCO and fed into the Skills Panorama.

Definitely, with this methodology we set up a learning process, for the project members, which will enable them to provide suggestions, recommendations and proposals for policy makers and stakeholders in order to support the efforts to tackle the initiatives and actions aiming at addressing the skills gap.

9. Skills Gaps Analysis

9.1 Introduction

There are different types of skills: Technical skills, transversal skills, digital skills and green skills. We are going to show the way in which these skills are presented by the shipyards, how they are presented in the ESCO Database, and also how they are presented in some EU nations, for instance, France.

From the international arena, we have a couple of examples: O*NET, the American database and the Canadian case taken from www.weareshipbuilders.com

Technical skills are classified according to the different profiles. This represents a problem because as there are many languages, many nations, the approaches vary a lot. A common nomenclature is needed. For scaling the skills in different levels, we can access the European Qualification Framework. ESCO has its own model to classify skills, based on the EQF model.

There are several references worth of attention for managing transversal skills. The AEGEE proposal, the UNESCO Framework, the ESCO approach and even some other proposals from a previous EU project called CompAssess Open Framework.

Transversal skills are frequently included in the description of jobs by shipyards when searching for workers and offering employment.

Digital skills can be managed in Europe by means of the Digi.Com Framework.

We haven't found any general framework to deal with green skills yet.

There exist some examples from 3rd countries: The O*NET database is the most attractive. The Canadian example puts together skills information and image promotion.

Some international organisations like ILO and the OECD can be consulted to find references on the skills management.

9.2 Skills presentation

- 1) **Shipyards:** Vacancy adds don't include a thorough descriptions of the skills needs, probably in consideration to the people they want to impact on. The descriptions focus mainly on the responsibilities. The shipyards usually mention their expectations, what they expect from the workers they are offering the job to. There is a mention also to what shipyards offer in return.
- 2) **ESCO:** The ESCO skills pillar distinguishes between "skills and competences", and knowledge. (There is no distinction between skills and competences)

The skills pillar of ESCO doesn't contain a full hierarchical structure but is organised in four different manners:

- Through their relationship with occupations, i.e. by using the occupational profiles as entry point.

- Through a skills hierarchy in the case of transversal knowledge, skills and competences.
- Through relationships indicating how knowledge, skills and competences are relevant to other knowledge, skills and competences
- Through functional collections that allows to select subset of the skills pillar.

ESCO first indicates the name of the profile and offer a description, naming different alternative labels. After showing the hierarchy, the database mentions some narrower occupations of the main profile. Then, they present the essential skills and essential knowledge. Some optional skills and knowledge are also mentioned.

- 3) **France: www.pole-emploi.fr ...:** This application also makes a definition of the profiles' general competences. It mentions the basic skills and the specific ones, and emphasizes some other aspects: access, work conditions and environment.
- 4) **O*NET:** There is a holistic information approach to the description of the profiles and extensive information on several aspects. It seems to gather the wish to describe profiles with hints on how curricula based on them should be developed. So, apart from describing knowledge, skills and abilities, they also mention the tasks to be realised, the type of tools to use, work activities are profoundly described, but there are also further details on work context, work styles, job zone, values, related occupations, wages and employment, etc.
- 5) The Canadian example: **www.weareshipbuilders.com** – On joining both aims, to offer information and promote the good image of the sector, this Canadian example describes the profile and offers the list of key responsibilities, but they also add a lot of other supplementary details: salary, benefits, how getting started, type of certification and a few other details on training providers, unions, career resources, etc.

9.3 Skills analysis

- 1) **European Qualification Framework.** In the context of EQF, skills are described as cognitive and practical (manual dexterity and use of methods, materials, tools and instruments) They classify the skills in 8 different levels:
 - Level 1 Basic skills – simple tasks.
 - Level 2 Basic cognitive and practical skills – solve tasks and routine problems using simple rules and tools.
 - Level 3 Cognitive and practical skills – accomplish tasks and solve problem by selecting and applying basic methods, tools, material and information.
 - Level 4 To generate solutions to specific problems.
 - Level 5 To develop creative solutions to abstract problems.
 - Level 6 Advanced skills – solve complex and unpredictable problems.
 - Level 7 Specialised problem-solving skills
 - Level 8 The most advanced and specialised skills and techniques
- 2) **ESCO:** The “skills pillar” provides a comprehensive list of skills that are relevant for the European labour market.

The skills pillars include knowledge, skills and competences that are defined as follows:

- **Knowledge:** The body of facts, principles, theories and practices that is related to a field of work or study.
- **Skill:** The ability to apply knowledge and use know-how to complete tasks and solve problems.
- **Competence:** The proven ability to use knowledge, skills and personal, social and methodological abilities in work or study situation and in professional and personal development.

While sometimes used as synonymous, the scope of the terms “skill” and “competence” can be distinguished. Skill refers to the use of methods or tools in a particular setting and in relation to defined tasks. Competence is broader and refers to the ability of a person, facing new situations and unforeseen challenges, to use and apply knowledge and skills in an independent and self-directed way.

As for the occupations, ESCO provides metadata for each concept in the skills pillar.

9.4 Technical skills

- **Profiles ESCO / USWE Project:** The initial list of occupations selected for the USWE project and considered to be the most relevant VET profiles in the Shipbuilding and Ship Repair Industry.
- **Nomenclature:** a set of VET profiles in English language and their corresponding translation in the different European languages. It can help to understand the way in which the skills are classified. The relation between the main profiles and narrower occupations. The lowest common denominator to be offered to shipyards as a reference and to be used by workers as a support in case of mobility.
- **Technical skills:** They are always shown classified through working profiles: Welding, machining, fitting, electricity, etc. For medium and small shipyards, welding and fitting are the relevant skills set. All the rest affect to services providers as the shipyards subcontract this type of activities, painters, carpenters, etc.

9.5 Transversal skills

- **Introduction:** There are quite a few common terms to refer to transversal skills: (*see graphic*) life-oriented and work-oriented skills.
- **European Shipyards:** They present, summarizing this issue, the transversal skills mixed with communication and digital skills. They mixed skills, competences, attitudes and behavioural aspects. (*see example on the excel file*)
- **ESCO Database:** Transversal skills and competences are organised in a hierarchical structure with the following five headings: Thinking, language, application of knowledge, social interaction, and attitudes and values
- **AEGEE:** Transversal skills and competences for lifelong learning. As a measure against the changing context and its influence on the lives of young people, the European Parliament and Council set out a recommendation on the key competences for lifelong learning. In the

recommendation they defined 8 key competences that are considered important for every European to develop and update throughout their lives to be able to adapt to change. They are based on the need for personal fulfilment and development, active citizenship. Social inclusion and employment:

- Communication in mother tongue and in foreign languages.
 - Maths, science and technology (STEM)
 - Digital competence
 - Learning to learn
 - Social and civic competences
 - Sense of initiative and entrepreneurship
 - Cultural awareness and expression
- **UNESCO:** There are different understandings and conceptualizations of transversal skills across countries but in general, transversal skills refer to a number of important competencies that can be learned and that everyone requires to successfully adapt to changes and to lead meaningful and productive lives. Discussions are ongoing with regard to competencies that fall under the umbrella of transversal skills and terminology used to refer to them. (*see table of skills classification*)
- **CompAssess Open Framework:** It is a framework elaborated a couple of years ago by CompAssess project members, led by Aalborg University and Università Libera de Bolzano. In this model, transversal skills are classified in seven different groups:
 - Teamwork
 - Sense of initiative and entrepreneurship
 - Communication
 - Critical thinking
 - Problem solving
 - Social competences
 - Learning to learn

The model was elaborated with the conviction that focusing on some of them would be beneficial for the rest, as one characteristic of transversal competences is that they trigger each other. The concept behind the Open Framework is that the focus of the training process should be put on the evolution of these skills, and not on the assessment.

9.6 Digital skills

The European Digital Competence Framework for Citizens, also known as DigComp, offers a tool to improve citizens' digital competence. DigComp was developed by the JRC as a scientific project with intensive consultation of stakeholders, initially on behalf of the DG EAC and more recently, on behalf of DG Employment. DigComp has become a reference for the development and strategic planning of digital competence initiatives both at European and Member State level. In June 2016, DigComp was updated, and currently these are the areas of competences:

- Information and data literacy
- Communication and collaboration
- Digital Content Creation
- Safety
- Problem solving

9.7 Green skills

Green skills are high-level analytical and technical know-how related to the design, production, management and monitoring of technology.

The European Union promotes a less polluting model of sustainable construction, more responsible with the environment and able to optimize the consumption of energy or implement the use of renewable sources. This new model requires specialised tasks and a prepared workforce with updated training and experience to tackle these challenges.

Updated skills and specialization in sustainable construction, new material, insulation, sanitation, energy saving or rehabilitation with sustainable criteria, among other fields, can be considered as green skills.

9.8 Previous EU projects

Regarding the task of analysing the state of art of the skills management in European Shipbuilding and Ship Repair Industries, we have also looked at other previously developed European projects, to see at the state of the skills from the perspective of people which have also done research on the topic. We have selected various EU projects:

- 1) **Creating a European skills Council for the Maritime Technology Sector.** The sectoral social partners (IndustriAll Europe and SEA Europe) partnered in this project and elaborated a report recommending some actions to policy makers and stakeholders. Amongst them the establishment of the Sectoral Skills Council and timely anticipation of employment and skills need coupled with reskilling and upskilling programmes.

Other recommendations were in line with the promotion of lifelong learning, transfer of skills between junior and senior staff, dual system and apprenticeship and review the curriculum of training centres.

- 2) **Demographic change and Skills Requirement in the Shipbuilding and Ship Repair Industry.** (Study of the sectoral social partners in 2008). It focused on the need for technical employees in the sector. It considered aspects like retirements and migrations to conclude that the shipbuilding technical workforce had to grow significantly.

They reflected upon the education trends in shipbuilding and give some examples of good practices like the Dual System in Germany. The shipbuilding image was another of its concern and encouraged to develop campaigns at local and regional level too.

Further recommendations were made, considering aspects of interest like:

- Development of European Maritime Design Academy.
- Development of a European VET system.
- Proactive approach towards lifelong learning.
- Tax benefits for shipyards involvement in “on the job training”.
- The gender factor: Attract women to work in technical professions and in shipbuilding.
- Financial support for the development of shipbuilding training centres.

- 3) **Ortze-CV Project. R+D in highly efficient technologies and reduced emissions on power systems in coastal vessels** It lists a number of technologies and systems, energies which will be significantly relevant in the future shipbuilding activities.

- 4) **Smartyard project.** It focused on the needs of small and medium sized shipyards, highlighting the fact that due to limited personnel resources, lacking skills of the personnel, limited access to information and cooperation networks, they had low ability to use innovative technologies and to tackle activities in research and development. For Smartyard project members the smart technologies areas were:
 - Design methods and tools.
 - Production preparation and planning.
 - Accuracy control and shaping.
 - Welding and assembly.
 - Coating materials and processes.
 - Outfitting and SMRC techniques.
 - Innovative materials and their assembly.
- 5) **Ramlab.** A project on the advantages of 3D printing. They manufactured a 3D printed ship's propeller.
- 6) **The Energy Observer.** Aiming for the energy autonomy and zero greenhouse gas emissions. They transformed a race boat into a first hydrogen vessel, powered by electric propulsion thanks to a mix of renewable energies and a hydrogen production system that produces carbon-free hydrogen on board using seawater.
- 7) **Samensterk.** A reflexion about the future skills need. Due to automation and flexibilization, the required skills for a job will be increasingly less well defined. Skills that stood us in good stead for more than thirty years will now only be useful for 5 years. Employees must therefore be permanently flexible as far as their career expectations are concerned and must respond quickly to changes: lifelong learning will no longer be just an aspiration; it will have become a reality. The so called 21st century skills.
- 8) **Mentor Project.** It classifies the technical skills and list a set of behavioural competences. (*see table*)
- 9) **Marinem Project.** Design of a Tree of Blue Growth to analyse the sector from a comprehensive approach.
- 10) **Fibership Project.** An R&D H2020 project which attempts to develop a new market focused on the design and construction of large-length commercial vessels in composite materials.
- 11) **Navais Project.** A H2020 project for developing a platform-based modular product family approach supported by the 3DEXPERIENCE® integrated business platform.

9.9 Good practices: Third countries and International Organisations.

- a) **The O*NET database:** The US Department of Labour / Employment and Training Administration has developed O*NET, the Occupational Information Network which is the nation's primary source of occupational information. Valid data are essential to understanding the rapidly changing nature of work and how it impacts the workforce. From this information, applications are developed to facilitate the deployment and maintenance of a skilled workforce. The data have proved vital in helping people find the training and jobs they need, and employers the skilled workers necessary to be competitive in the marketplace.

The conceptual foundation of O*NET is the Content Model which is a framework that identifies the most important types of information about work and integrates them into a theoretically and empirically sound system. (*see infographic of O*NET*)

The list of occupations in O*NET linked to the shipbuilding sector are welder, boilermaker, rigger, tool and die maker, fibreglass laminator, painter, pipe fitter, tinsmith.

- b) **Maritime Training Services.** A platform offering courses on topic linked, among others, to shipbuilding, covering safety, regulatory and generational topics.

<https://www.maritimetraining.com>

- c) **The Naval Shipbuilding College.** Australia. Commencing in 2018 to build capacities and annual throughput at existing education and training facilities around Australia. It delivers naval shipbuilding career awareness programmes. They will focus on increasing key entry level trade qualifications, reflecting the greatest demand expected in early years of the construction projects for trade qualified workers in structural and outfitting occupations.

- d) **Australian example:**

- Taxonomy of shipbuilding and ship repair skills categories. (*see table*)
- Don Bosco Maritime Academy. Australia...

- e) **Canadian example.** Get on board: www.wearebuilders.com.

10. Curricula

10.1 The Competence Matrix.

For elaborating the curricula of the training activities through which we would like to transfer the new competences detected in the previous phase, an interesting proposal could be to follow the ECVET / ICARE project, where we can find guidelines for the elaboration of the “Competence Matrix”. A tool useful to describe the structure of content of a course we would like to design.

The Competence Matrix is a tool of ECVET projects. After having selected a profession or a professional domain, we have to develop a competence matrix. It describes a profession domain according to a list of competences (or “key activities” or “work core tasks”. The aim of the segmentation is to enable the development of “Learning Units” matching with the corresponding competences.

The Competence Matrix is therefore the foremost implementation of the output-oriented model of vocational education and qualification promoted by ECVET and pivoting on learning outcomes.

Consequently, it is a cornerstone of ECVET projects for two reasons:

- It becomes the framework of reference for the description of professions according to the ECVET approach.
- The assessment of competences is based on it, and this is the reason why the matrix should be elaborated in a very careful way.

The matrix provides a set of core competences; it does not describe them all. The main steps to develop a Competence Matrix are three:

- Identifying the core competences of a profession or professional domain.
- Providing a clear-cut description of the competences
- Elaborating the grid.

A competence matrix must have the following features:

- Be based on empirically derived complex core tasks.
- Varying number: to identify around 10 core competences, maybe divided into minor sub-competences.
- Possibly for responding to change: the list of competences may change with the evolution of an occupational field.
- Balance between general and detailed formulations; avoid specifying the competence in a too general or too narrow way.

The competence concept does not only refer to the description for a competent behaviour but also includes the visibility of the professional competence itself.

Competence is meant as expertise, which also becomes apparent – as performance – in a person's actions. The description of professional competences should therefore also refer to the professional action itself.

Some suggestions in formulating the competences are:

- To describe the competence in relation to the work context.
- To write them with complete sentences, using: He/she is able to...
- To use examples (*if the competence refers to working tools, mention some of them*)
- The whole competence matrix should not cover more than one or two pages, to be easy at hand.

10.2 The example of Metals Project.

An example of a course on Additive Manufacturing for the Tool Machine Sector, elaborated according to the described methodology. See examples on:

- Table on Skills Needs: Emergent technology: Additive Manufacturing.
- Process for Detecting Skills Needs at Sectoral level. (USWE example)
- Process for Elaborating Specialisation Courses

10.3 The Specialisation Courses' Structure. (Example from the Basque VET System)

The Specialisation Courses, aiming at matching the training needs for innovative skills in the regional industrial tissue, are structured in the following way:

- a) Identification data: Denomination and duration
- b) Professional profile: General Competence. Professional field and skills
- c) Training: Learning environment and learning outcomes.
- d) Degree associated.
- e) Economic sector and demanders.

- f) The requirements of the teacher and mentor.

10.4 Curriculum Guidelines Framework.

EASME has recently published an Interim Report about the “Curriculum Guidelines for Key Enabling Technologies and Advanced Manufacturing Technologies”. Starting from a holistic approach, the report aims at promoting an analytical framework which covers a broad spectrum of dimensions when designing and implementing new curricula. Specifically, they promote the following eight **dimensions**:

- a) Strategy
- b) Collaboration
- c) Content
- d) Learning environment
- e) Delivery mechanisms
- f) Assessment
- g) Recognition
- h) Quality

11. Training

Introduction

In this phase of the process, we must analyse the offer of training available in the sector, we have to know the type of providers, VET centres, shipyards and equipment providers offering training services too.

There are certain aspects which impact the effectiveness and the quality degree of the training offer that need to be reviewed too. The kind of environment, the methodologies and technologies being used by the providers of training, for instance, have a significant role at the time of determining the quality standard of the training provision.

The different training types (modalities): on-line offer, training platforms, the WBL possibilities: Internships, apprenticeship and Dual System.

The acknowledgement and awards, given acquisition when finishing the acquisition of learning outcomes, are very relevant aspect to be considered too, as they impact fully on the worker’s mobility opportunities.

Upskilling and reskilling inside a broader context of lifelong learning need to be discussed as they are schemes which can contribute to solve the lack of skilled workforce.

Finally, the Validation of Prior Learnings is another possibility which provides chances for raising the qualifications of shipbuilding workers.

11.1 Training Offer

General training courses are obviously provided by state or private VET centres included into the general training offer of the respective national or regional VET systems. We can mention the case of the Basque

VET system whose VET training offer can be spotted at the IVAC-EEI webpage: <https://ivac-eei.eus>. So, for instance, in the case of those skills required for shipbuilding and repair, we can check the system of qualifications, the professional groups (*or families*) the training cycles (EU levels), the modules, didactic units, etc.

Short training courses are also provided by academies and through the on-going training schemes. (Training for workers and unemployed people) This type of training offer focused on some concrete technical skills, (new welding techniques) on transversal skills, languages and on aspects linked to regulations on safety and environmental requirements.

11.2 Training Providers

VET Schools and Academies: Several training providers are in direct relation with shipyards, some of them are also members of SEA Europe.

Large Shipyards: Quite many shipyards provide training to their own workforce and to young students who wish to join the business. We can mention some examples:

- **Fincantieri:** Over the course of 2018, they put in place specific measures to increase and define the expertise of internal resources in terms of skills related to the technological solutions being used. The goal was also and above all to train and increase cross-functional skills related to the management and promotion of innovation, change management and project management, as well as soft skills such as shared leadership, emotional intelligence and advanced communication: Fincantieri Corporate University, ISDM Project.
- **The IHC Training Institute:** It provides a full range of high-quality courses in the field of dredging for operators, technicians, project engineers and managers.
- **Chantier de l'Atlantique:** it is a training centre which aims at sustaining some specific skills at the shipyards. They offer a skills training course on metal carpenter, welder or pipefitter jobs.
- **Damen Services:** Damen Services has a professional and experienced team of in-house trainers, who provide world-class standardised as well as tailor-made training programs. The tailor-made training programmes maintain the right balance between theoretical and practical skills. There are in-house training courses on: Vessel familiarisation & maintenance, Technical & operational skills, Safety & environment, Shipbuilding, etc.
- **Navantia:** Regarding the provision of courses, based on their Annual Training Plan, Navantia offers different types of seminars: Basic or specialised, certified or customised: Mechanical vibrations, Predictive maintenance, etc.
- **Meyer Turku Shipbuilding School** provides training courses for students and workers in a wide variety of topics. From interpreting drawings and plans, safety and other technical skills to transversal skills such as management of change, negotiating or languages.
- **Campus des Industries Navales - CINAV:** The Naval Industries Campus is the result of a collective public/private initiative launched in November 2017 by 16 founding partners under the joint impetus of Naval Group and the Brittany region. It brings together today:
 - 5 western coastal regions: Normandy, Brittany, Pays de la Loire, New Aquitaine and the South.
 - 5 naval prime contractors located in these regions: Constructions Mécaniques de Normandie, Piriou Group, Chantiers de l'Atlantique, Naval Group, Eca Group.
 - 4 ministries: National Education, Higher Education, Transport and Labour.
 - 3 professional unions: Bretagne Pôle Naval, GICAN and UIMM.

- On 1 January 2020 the Southern region and the company ECA became partners of the Campus des Industries Navales. Occitania and Hauts-de-France should also join the structure.

11.3 Equipment providers

Equipment companies are also offering training courses for the use of their technologies. These courses are directed to customers and operators. Moreover, large companies also provide in-house training to employees in order to cope with the technological change and skills needed. Examples of this statement can be seen in Wartsila, Kongsberg, ABB.

- **Wartsila Land and Sea Academy** offers training and support, ensuring that the personnel know managing the assets at all times. Their global training solutions cover all aspects of management, operation, maintenance, safety, availability, reliability and performance. The courses and programmes are delivered either on board, on site, or online. They offer customized and customer tailored courses.
- **Kongsberg**: They have a network of global training centres and develop the skills of around 2000 people every year.
- **ABB – Marine Academy**: Their courses deliver a system-wide knowledge to give a holistic view of the ship as a system, rather than a group of products bolted inside a hull. This creates a training path for the students.
- **Rolls Royce – Marine Training Centre (now Kongsberg)**: Their open, onsite courses are designed to give the customers the opportunity to book one single or several seats on the different course dates depending on the various shift workers. E-learning modules are designed as a first step, a basic introduction to a system or product and are normally a precursor to attending a classroom or on-board course.

11.4 Quality Training

Environments: Learning and Cyber Physical Spaces: Shipyard 4.0

Considering the new spaces in which the acquired skills are going to be executed, at the time of generating spaces to learn, to transfer new skills, we should be aware of the need for modernising the learning spaces too. An example of this concept is the programme [Ethazi](#), currently being implemented in the Basque VET system.

Particularly relevant for the Shipbuilding and Ship Repair Sector is the fact that trying to accelerate the transition to the Industry 4.0 technologies, the so called Cyber-Physical Spaces should also be considered as they represent a new scenario where relations between humans and robots become regular, and it will demand a new type of skills that can only be matched with intensive periods of training. The large shipyards are already developing, partially at least, the Shipyard 4.0 concept

Methodologies

Linked to the previous section comments, we have to mention the need for changing and adapt new learning methodologies – Collaborative Learning Methodologies – to improve the transference and acquisition of skills by the students (*see Ethazi example*)

Teaching technologies:

New technologies are available for improving and fastening the knowledge and skills transfer.

Some of these technologies refer to the design phase, where new applications can facilitate the design tasks and improve the quality of the teaching materials greatly.

Other technologies, mainly **simulators**, affect the way in which new contents are offered to the students and to the type of elaborations expected from them. Simulators are being more and more popular at training providers' places. Other technologies like Virtual Reality, Augmented Reality and Artificial Intelligence are quickly being introduced into the learning scenarios of some large shipyards or equipment providers: Fincantieri, Wartsila, Damen.

11.5 Types of Training Provision (modalities)

- **Online courses**, offered by diverse training platforms, are an option. The use of videos is a very usual resource.
 - **Marine Training Platform:** The Marine Training Platform course and programme catalogue is a growing searchable repository of Marine and Maritime topics offered in Europe.
- **Work Based Learning (WBL)** is a type of training very usual among large shipyards in Europe too. There are different possibilities: Internships. Apprenticeship and Dual System. Let's see some examples:
 - **Fincantieri:** An **internship** with Fincantieri is an opportunity to become part of a dynamic, ambitious, international Company that offers new professionals and future managers all its know-how to enable them to grow.

During their internship with Fincantieri, interns receive continuous support from a Company Tutor to help them develop the skills and knowledge set out in the Training Project. During this time, interns will get feedback and have discussions with their Tutor and the Talent Acquisition team to check if the training objectives have been reached.

- **Meyer Werft Academy:**
 - School work experience **placements** offer an opportunity to get to know the possibilities for vocational training, while student interns gain an insight into the various departments and the activities of our company.
 - An **apprenticeship** at Meyer Werft means to be actively involved in the construction of a cruise ships and are up close when a steel block turns into a swimming luxury hotel. The Meyer Werft Academy provides numerous exciting and technologically demanding training places, from construction mechanic to materials tester and IT specialist.
 - The Meyer Werft Academy offers young people the opportunity to study in the framework of a **dual study programme** and at the same time work in a practical way. The interdisciplinary study offers an ideal linking between theory and practice.
- **Damen General Traineeship:** The traineeships are tailored to the talents and developmental challenges of each individual. During the traineeship they focus on various key competencies and skills including decisiveness, initiating improvement, taking ownership and planning & organizing.
- **Naval Group: Training and apprenticeship:** Acquiring a first professional experience while being a student and learning from senior staff is a fundamental step for young graduates. This is why Naval Group support both apprenticeship and training courses.

- **Navantia:** Navantia offers young people the possibility of being part of the working world and provides them with knowledge and skills needed to enter the sector.
- **Other training provision types** can also be found:
 - **Damen:** Training evenings at Damen. Boys and girls who are interested in an apprenticeship or training at Meyer Werft are cordially invited to attend the Training Evening to find out all about the exciting working world at the shipyard, looking at it from many different angles

11.6 Recognition of Certificates

The key point in here is the need for harmonisation of certificates and titles so that mobility can be powered. In the EU there is already a System of Automatic Recognition of professional qualifications for seven sectoral professions. There should be agreements for implementing this mutual recognition of EU degrees in the Maritime Technology sectoral professions. A first step should be to include the sectoral professions in the **Regulated Professions Database** by DG Grow – Internal Market. Leadership 2020 supports this idea in its Pillar 1 – Employment and skills.

11.7 Lifelong Learning

A paradigm which is getting stronger every day in Europe as long as we see ourselves involved in dealing with new changes and challenges which forecast the arrival of new ones, and due to the complexity they imply to get to the point in which we all will be ready to get benefit from them, the reinforcement of lifelong learning schemes become the lever we have to execute to start dealing with the complexities we are aimed to deal with in future years.

The **upskilling and reskilling** concepts are a way to highlight and reinforce the traditional on-going training programmes. In that sense, there are some positive aspects to be considered but also some efforts that must be done to reach them.

Positive:

- The lack of new workforce and the difficulties to find new well skilled workers can be, in part, solved with the upskilling and reskilling initiatives.
- Organizational learning will be easily maintained.
- Learning processes will be shorter.
- Transversal skills giving way to corporate values will be easily transferred.

Difficulties:

- Small and Medium shipyards have it difficult due to lack of resources. They need to collaborate with VET institutions.
- They ask for a strong commitment of shipyards on training, on people and careers.
- It implies to open new business areas: Hire adequate staff, technologies, equipment and spaces.
- It demands expertise in its management.

Craft to Draft Program in **BAE Systems** Glasgow: It can be considered as a good practice which has been running for years, as it offers opportunities for Blue Collar workers (Electrician, Pipefitters, Fabricators and Sheet Metal Workers) to become detail designers, detail planner or quality engineers.

11.8 Validation of Prior Learning

A measure to promote education and vocational training, that has been ratified in the summits of the European Union, is to promote the recognition of professional skills acquired through work experience or non-formal training. All this, in order to facilitate the employability of citizens, mobility, promote lifelong learning and promote social cohesion, especially those groups that lack a recognized qualification.

The procedure for evaluating and accrediting professional skills is understood as the set of actions aimed at evaluating and recognizing the skills acquired through work experience or non-formal training.

EU policies on this respect can be found at <https://epale.ec.europa.eu/en/about>. EPALÉ is funded by the Erasmus+ programme. It is part of the European Union's strategy to promote more and better learning opportunities for all adults.

This is a not very exploited possibility yet, but there are examples from other sectors than can be a reference to be considered by the Shipbuilding and Ship Repair Industries.

12. Implementation

Introduction

The last phase of the skills management process is the implementation, the moment when you have to execute tasks based on the knowledge and skills acquired through the training activities or through previous experience.

To be able to apply the skills (technical, transversal, digital and green) to the real work and get benefit from the investment done on their detection, analysis and transference, an adequate work environment is necessary. A workplace where the concern for innovation is permanent and where new technologies, materials, equipment, processes and systems or concepts are continuously changing the space and improving the efficiency in performance.

In here, we can mention a few aspects which are related with the production process, with the technologies and the digitalization, connectivity, but also with the roles distribution along the work development process. Ideas that when combined generates emergent Shipyards 4.0

12.1 Work environment

- **Ulstein Verft.** shipyard with excellent facilities to secure best possible qualities on every process in the outfitting. Integration and finishing of new builds, ship repairs and conversion. Assets at walking distance from the yard administration offices.
- **Meyer Werft:** Numerous investments in new machinery and equipment as well as a profound reorganization. The automatic CNS controlled Pipe Machining Plant and welding robots, which are

sharing the work with the experts by means of sophisticated methods, are at the core of the Pipe Machining Centre.

12.2 Technologies and Equipment. Digital Enablers (Virtual Reality)

- **Ulstein Werft:** X-Connect, a universal digital platform for marine **automation**, control and monitoring. The platform is an effective tool for any system integrator working with marine automation. It gives dozen opportunities to customize products to any specific job.
- **Meyer Werft:** In order to further improve and simplify the quality of the construction and production, the **Virtual Reality** is used by the shipyard's experts. Thus, before a structural element or a room is built, it can be examined from all sides.
- **Navantia:** The Spanish company uses **additive manufacturing** at RDI level and already plans to incorporate this technology into its commercial production.
In Cádiz, Navantia has manufactured the first piece created in 3D installed on a ship under construction. They apply this technique to different pieces, such as for example the ventilation grilles of the boats. This technique provides design flexibility, lightens the pieces, and reduces costs and production time.

12.3 Production Process management

- **Meyer Werft:** The first Compact Shipyard in Europe and one of the most modern shipyards in the world. The modern manufacturing plants and the concept of short distances ensure the shipyard's success. Innovation and the newest technologies characterise the shipyard's daily routine.

Modern computer technology is used everywhere, be that the first layout or the design of the ship or the production process. Construction drawings are hardly found. They are replaced by simulations by which the shell plating of the ship is designed, to name but one example.

Almost the whole production process has been digitalised. A lot of projects can be planned and saved in the virtual worlds and assembly processes can be tested. 3D simulation allows planning with a high degree of anticipation.

12.4 Smart Manufacturing

- **Royal IHC.** A state-of-the-art Laser-cladding Machine is used to clad steel or stainless-steel piston rods for hydraulic cylinders, and is faster, more accurate and more environmentally friendly than the conventional cladding methods.
- **Fincantieri.** There are a few areas of interest for improving the design and production stages of future smart yards. Aiming at improving safety and productivity, computer models, virtual products methodologies, additive manufacturing, cobotics, logistics and quality control procedures will drive the evolution of the shipyard within Industry 4.0. Innovative and cost-effective production techniques and methods will be developed, with a particular focus on welding and joining procedures.

The Internet of Things (IoT) and smart devices are pervasive across shipbuilding industry. The development of sensors, monitoring systems, support systems for navigation and on-board activities help increase the added value of the whole ship product and improve global safety.

Design and operational solutions to reduce the frequency of accidents will increase safety across the board.

Implementing technologically advanced solutions will enable process optimization and automation and reduce operating costs. One of the most interesting challenges for the shipbuilding industry is to develop autonomous ships of significant size for use in any operational scenario. Highly smart or autonomous ship will require highly advanced IT safety studies.

12.5 Products customization. Flexibility.

- **Meyer Turku.** Tailor-made cruise vessels and ferries according to the customer's need. Ship known to be safe, environmentally friendly, comfortable, reliable and energy efficient.

Flexibility. Latest machine vision-based robotic technologies being used in welding. Hull production performed by a flexible facility, specialised in hull blocks of different shapes, sizes and weights. Highly modular solutions that minimize the amount of work needed in ship assembly. Development of production processes, applying Lean Manufacturing methods.

12.6 Collaborative Platforms. Real Time Information. Big Data.

- **Ulstein Verft.** Cloud services give access to important and valuable ship data. Easy access, efficient bandwidth and encrypted connection make this a secure and economical investment. Bringing live ship data to shore new opportunities are opened. By transmitting data to land, the ship can be operated smarter and more efficiently. By retrieving the data from the cloud services, the ship owner can either access signals directly from one ship or get the operational management system up and running for the whole fleet. By analysing data to support decision making, there stands a better chance of getting the best out of the ship's capabilities.

12.7 Roles Distribution

A smart shipyard will be operated by people who need to be trained at the educational centres for the new requirements, among them, the one of work with the robots, letting them do the heavy and repetitive work.

In this universe of intelligent people, facilities and products, all the components, human and cybernetic are interconnected and constantly talk to each other. The Internet of Things is born. Conventional jobs will be destroyed; new jobs will be created for people who already have to start being trained for it.

12.8 Skills needed. Digital and Green

The digital and green skills are linked in smart processes. Smart industries seek to increase productivity, improve efficiency and decrease waste. Linked and automated technologies provide information on real time and avoid, through the adequate decision tacking process, unproductive times and movements of materials, minimizing stocks, reducing consumption of raw material and lowering energy consumption.

Digital skills: Industry 4.0 requires workers with high level digital skills to intervene in the process. So, users must have skills to:

- Identify technologies and solutions.
- Interact with the machines, tools and equipment.
- See, gather and analysis data on which to base subsequent decisions.
- Manage stocks at the warehouse, controlling consumption, orders and supplies.
- Plan and execute the required maintenance of the equipment.

A Shipyard 4.0 will include Augmented Reality, Big Data, IoT, Cybersecurity, Robotics and Connectivity; so that it will become a **Learning Cyber Physical Space** where digital skills will be addressed by planning, launching, executing and monitoring complex activities.

Green skills: People in the Shipyard 4.0 must have an ecological mindset, in line with the UN 2030 Agenda for Sustainable Development and with the EU Sustainable Development Goals, in order to be able to skilfully manage new productive processes such as: Additive Manufacturing. Chemical mechanics. Refrigeration system without oil. Heat recovering.

Workers should seek to

- Reduce energy consumption and use renewable energies
- Save raw materials and expenses in order to have a lower environmental impact.
- Properly manage waste and reduce pollution in three areas: Air - Land - Water
- Improve recycling and boost circular economy

The Shipbuilding Sector provides the technologies to meet the environmental and safety agenda of their industries and to develop environmentally friendly activities.

Green solutions already offered by shipyards:

- Cost-effective solutions for ballast water management.
- SOx Scrubbing
- Reduce exhaust gas emissions by means of innovative automated transport system.
- Reduce emission averting traditional diesel fuel and instead opting for using biodiesel.
- Saving energy and resources, decrease energy consumption.
- Regulation of air conditioning and ventilation systems.

Other important skills: Wherever something changes, skills need changes too. Some new skills will be required. For that, we have to understand the effect of Industry 4.0 on the VET sector (*See Effects of Industry 4.0 on VET by ITA / ÖAW*):

- Work in teams.
- Inter and transdisciplinary collaboration.
- Deal with the unforeseen.
- Think systematically.
- Act confidentially.

- Link concrete and digital aspects, material and abstract concepts.
- Soft, creative and entrepreneurial skills.

12.9 Servitization

- **Damen:** Services tailored to clients' needs: a range of building assistance – from construction to management – guaranteeing a safe and efficient production process. Provision of training programmes offering valuable transfer of skills to the local workforce. Worldwide service network providing solutions for every possible field of expertise, including:
 - Technical survey
 - Maintenance
 - Class assistance

12.10 Shipyard 4.0

PI Marine EU: The conference organised by PI Marine in January 2020 in Hamburg was an excellent opportunity to see how shipbuilding activities are being transformed through model-based digital integration, smart manufacturing, lifecycle management and a set of other new technologies and solutions conducting to the Shipyard 4.0. We can mention some examples of that:

- **Navantia:** The process of digitization involves the use of technologies in industrial processes such as the following:
 - Digital Platform: Integration of information systems.
 - Collaborative Robotics: Automation of heavy and repetitive jobs.
 - Additive Manufacturing: 3D Printing
 - Virtual and Augmented Reality. Visual presentation of information in its digital equivalent.
 - Internet of Things. Digital integration of products, facilities and people which come together in the digital mock-up.
 - Cloud computing. Suppression of storage and information management boundaries.
 - Cybersecurity. Protection of digital information.
 - Modelling and simulation. Ship modelling and process simulation.

The integration of products, processes and people will allow creating new business models in naval industry.

- **Damen:** Damen and VSTEP Simulation have established a laboratory to explore innovative new simulation solutions. The new laboratory will also explore the potential to create Digital Twins. That is, virtual representations of existing vessel types that can then be manipulated to establish how they might perform in roles or conditions that they have yet to experience. That information will then be applied to optimising the designs to allow them to operate effectively in new markets.

13. Tools and support

Introduction.

Having reliable information on skills is very relevant for the following stakeholders and target groups:

- **Workers:** To make choices on employment opportunities and learning, especially when moving to other companies or to other countries.
- **Employers:** to find skilled workers to cope with the new technologies.
- **Policy Makers:** To make evidence-based decision when setting priorities or adapting education, employment and other policy areas to future challenges.
- **Training institutions:** To design curricula and provide training that matches the needs of the labour market.
- **Career Guidance professionals:** To support individuals on choosing their careers.

In that sense, instrument like the Sectoral Social Dialogue Committee of the Shipbuilding and Ship Repair Sector can be considered as the necessary initiative to deal with the management of sectoral skills.

13.1 Sectoral Forecasting and Skills Development.

To forecast the change and challenges in a specific sector is the best way to anticipate future needs and meet them. The European Commission sponsors the following initiatives:

- **Blueprint for Sectoral Cooperation on Skills.** It sets out specific measures to satisfy short and medium-term skills.
- **Sector Skills Alliances (Erasmus+ Programme):** A programme which calls for transnational projects to tackle the skills gap by identifying needs for the occupational profiles and involving vocational systems too.
- **Cedefop Guidelines for detecting skills at sectoral level.** The methodology to apply at the time of detecting professional skills at sectoral level.

13.2 Understanding Skills.

To analyse detected skills and classify them adequately is a necessary step which will enable subsequent initiatives and decisions. At European level we have:

- **The European Qualification Framework.** The EQF is aiming at making qualifications more transparent and comparable and, so, portable across borders, to help workers, learners and employers.
- **The European Skills, Competences, Occupations and Qualifications.** It is a reference terminology that describes skills classified by profiles: ESCO

13.3 The Skills Intelligence.

To master the management of skills in a sector, you have to register them, classify them and compare them with existing demands, so that they can be renewed and updated.

- **The EU Skills Panorama.** It is an online tool providing central access to data, information and intelligence on skills needs in occupations, sectors and countries.
- **ECVET - ICARE Project.** It is a methodology to assess competences and to elaborate curricula.

13.4 Matching Skills and Jobs around Europe.

- **Europass:** it is an EU service that helps people communicate their skills, qualifications and experience in most European countries, using standardized documents that are available in 27 languages.
- **Euroguidance:** A European network of national resources and information centres which supports Lifelong Guidance and international mobility.
- **Erasmus + Mobility for students around Europe.**
- **European Social Fund +:** The ESF+ will be the main EU instrument for the 2022-2027 period, investing in policy and systems reforms to enhance the skills and education levels of people, including digital skills that would equip them for the changing labour market

14. Regulations

As a global industry, shipping is regulated by a series of international regulations. These conventions have been agreed in international forums such as the International Maritime Organisation (IMO), the World Trade Organisation (WTO) or the Organisation for Economic Co-operation and Development (OECD). They are ratified by the signing parties, to establish, among others, the rules and regulations in: technical matters; maritime safety and security; marine pollution; and liability and compensation.

14.1 General Labour and Working Conditions

European shipbuilders comply with the highest social standards in the market. The industry is strongly regulated, and companies and workers representatives do their best to continuously improve the Health, Safety and Environmental standards.

The industry still suffers from the old vision of dirty, dangerous work. However, the reality is that the sector has developed into a much more innovative workplace that offers career opportunities to designers, engineers, project managers, etc and which invests heavily in HSE. However, this evolution or modernisation is implemented at very different speeds in different companies.

- **European Sectoral Social Dialogue Committee - Joint Statement on Social Standards**

Adopted in 2013, this joint document collects the existing sectoral regulations and standards in Europe.

The European Sectoral Social Dialogue Committee (SSDC) for shipbuilding invites and encourages all companies in the European Shipbuilding and Ship Maintenance, Repair and Conversion Sector to negotiate and further develop basic elements of common social standards.

The common social standards shall not affect the autonomy of the social partners, especially the right to negotiate and conclude collective agreements in accordance with national law and practices while respecting prevailing European law.

Compliance with the agreed social standards and the prevailing legal provisions shall be respected in every shipyard, in accordance with the specific national labour law framework for collective bargaining, industrial relations and the labour market.

14.2 Safety and Health Regulations

- **ILO - Safety and health in shipbuilding and ship repair**

Introduction. The ILO Code of practice on safety and health in shipbuilding and ship repair was adopted by a Meeting of Experts held in Geneva in January 2018.

The good spirit of cooperation among all participants paved the way for developing consensus on a new, comprehensive and practical code that will help to raise the profile of safety and health issues in shipbuilding and ship repair in all parts of the world, and contribute to the health, morale and **well-being of workers** in the industry. It must be highlighted that European shipbuilding industries' standards are much higher than those established in the ILO Code of practice. European representatives participated in the adoption of this Code in order to encourage 3rd countries to raise their standards at least to the levels established in this Code.

Competence, education and training. The **necessary OSH competence** requirements should be defined by the employer based on the provisions of national laws or regulations. Appropriate training arrangements should be established and maintained to ensure that all **workers are competent** to perform the safety and health aspects of their present or planned duties and responsibilities.

Qualification and training for workers

Workers should be assigned and only perform work for which they have the required level of skills, knowledge and training. Employers should ensure that all workers are:

- Sufficiently educated and trained in the tasks they are assigned to and possess the relevant skills certificates.
- Suitably instructed in the hazards connected with their work and environment, as well as trained in the precautions necessary to avoid accidents and injuries to health.
- Made aware of the relevant laws, regulations, requirements, codes of practice, instructions and advice relating to prevention of accidents and diseases.
- Informed of their individual and collective responsibility for safety and health.
- Sufficiently instructed in the correct use and effects of PPE and its appropriate care, and have training made available to them, as appropriate.

- **OSHA - Shipyard Industry Standards (OSHA 2268-11R 2015)**

Criteria. The employer shall ensure that each **designated competent person** has the following skills and knowledge:

1. Ability to understand and carry out written or oral information or instructions on occupational safety and health.
2. Knowledge of the standard.
3. Knowledge of the structure, location, and designation of spaces where work is done.
4. Ability to calibrate and use testing equipment and to interpret accurately the test results of that equipment.
5. Ability to perform all required tests and inspections which are or may be performed by a competent person.
6. Ability to inspect, test, and evaluate spaces to determine the need for further testing.
7. Ability to maintain records required.

Training. The employer needs to ensure that each employee is provided with effective training.

Employees must be trained so that they are able to assist in protecting themselves and other employees. While many OSHA standards do set forth training requirements, it is important that employees who may be exposed to workplace hazards for which there are no standards or no training requirements are provided with training. Training is meant to generally educate employees about workplace hazard awareness and prevention.

Effective training is not “one size fits all.” The ways and mechanisms used by employers to provide training are likely to vary significantly.

- Some employers may develop and provide their own training while other employers may rely on contractors to train their employees.
- Some employers may utilize formal classroom training every year while other employers rely on regular meetings for safety and health information.
- Some employers may provide specific safety and health training while other employers integrate safety and health issues into other employee training sessions.

Safety and health training is often most effective when incorporated into other training such as training on job performance requirements and job practices.

Such training should at least cover hazard identification methods, job analysis methods, control implementation and evaluation, and problem solving.

14.3 Environmental Regulations

- **2018 Market Forecast Report -Impact of Environmental Regulations**

The impact of recent environmental regulations at global and regional level is a fundamental factor to consider in the coming decades.

Shipping has come under serious pressure over the last decades due to its environmental impact:

- As a result of the current fuel used to power ships, they generate emissions (sulphur oxides, oxides of nitrogen, particulate matters and carbon dioxide) that can have a negative impact on the population's health.
- The introduction of invasive marine species into new environments by ships' ballast water or attached to ships' hulls has been identified as one of the greatest threats to the world's oceans.

Increasingly stricter regulation of emissions is expected to continue and be an important game changer in future years. Shipping's greenhouse gas emissions and the associated climate impact are subject to intense debate within the International Maritime Organisation (IMO).

- **The European Union and the Green Deal**

New and increasingly demanding requirements of reducing the environmental impact of all types of ships and waterborne operations, along with regulatory institutions like the new "**Green Deal**" of the European Union, leads to the development of a series of regulations, which will immediately affect both the owner and the builders worldwide.

It is important to highlight that the most recent regulations result in the incorporation of all these new environmental requirements in the Contractual Specifications of the new shipbuilding practices.

Since this new environmental regulatory framework will have an impact on the design of the new vessels, shipbuilding as a globalized industry has to respond efficiently to this new scenario, turning what most would consider "a problem" into a **business opportunity**.

- **EMSA, European Maritime Safety Agency**

This agency states that its purpose is to ensure a high, uniform and effective level of maritime safety, maritime security, prevention of, and response to, pollution caused by ships as well as response to marine pollution caused by oil and gas installations and, where appropriate, to contribute to the overall efficiency of maritime traffic and maritime transport so as to facilitate the establishment of a European Maritime Transport Space without Barriers.

- **IMO and the Environment.**

IMO is the United Nations specialized agency charged with developing and adopting global regulations on the safety, security and efficiency of ships and on the protection of the environment from shipping operations. IMO's vision for the industry is to eliminate, or reduce to the barest minimum, all adverse environmental impacts from ships.

The significant reductions of pollution generated by ships have been achieved by addressing technical, **operational and human element** issues and those reductions are more noteworthy when account is taken of the simultaneous and equally significant growth in the world's shipping industry.

IMO is continuously pursuing a proactive approach to enhance implementation and enforcement of its global standards. Key to this is the building of capacity in Member States – through institutional and **human resource development** – to improve their ability to comply with and enforce these international regulatory requirements.

15. Image

Image as a concern inside the Shipbuilding and Ship Repair Sector was already present as a strategy to be promoted in the LeaderSHIP 2020 document. Image and career path were some of the points highlighted by the Pillar on Employment and Skills and, as there is a growing difficulty to recruit people, an effort must be made to attract and retain them. Social agents, SEA Europe and industriAll Europe, through their meetings and communication, are currently raising awareness among their stakeholders and plan to undertake initiatives aimed at improving the image that the sector is conveying to young people, the potential sectoral workforce. Social agents foretell a need to appeal to talented young people with the right image of the sector. It needs to be presented as a high-tech future with long-term positive perspectives. It is important to provide for lifelong career prospects. In this field, three relevant factors to be considered are identity, design and communication.

15.1 Identity.

The identity of shipyards needs to be considered in two dimensions: Inside the company and outside the company. Inside the company, the structure and the strategies are be focused on improving the working

environment. Outside the company, actions and communication plans are designed and launched aiming at improving the social impact.

A **European Maritime Technology Week** was organised in the past by the social partners at EU level. This can be considered as the type of event which contributes to raise the positive perception about the shipbuilding sector.

Gender perspective: In general terms equality is a basic principle to be included as a business objective in the management of human resources. There are plans within the industry which aim at promoting the principle of equal opportunities at work as well as developing practices for promoting conciliation of work, personal and family life of employees. Other relevant measures pretend:

- To achieve a balanced representation of women in the field of the company.
- To promote and improve the chances of women to positions of responsibility.

Generational renewal: Aware of the need for ensuring the adequate generational renewal, shipyards are promoting upskilling and reskilling chances on one side and supporting schemes like internships and apprenticeships or on the other.

An example of how some shipyards show concern for the company's identity is Fincantieri. To reinforce its identity, value and principles, Fincantieri has its own **Group Conduct Agreement**, declaring its commitment with a set of values: People, Safety, Integrity and Customer Focus. Fincantieri guarantees that all the initiatives are aligned with the commonly accepted standards on the matter.

15.2 Design.

- **Identity and communication support.** High quality standards can be found in this respect: Webpages, reports, brochures are transmitting the image of a powerful sector, being very competitive and producing high quality vessels.
- **Social networks.** Youtube. Different kind of information is available on Youtube, videos on shipyards' skills and technologies. And training courses or videos are also at a click reach in Youtube: Le Canal des Métiers (France)
- **Training supports,** materials, courses and videos: Examples can be found where the quality of the production is high, reinforcing a powerful image of the sector from the first glimpse. (Pôle employ – France.

16. Career Management Systems

Efforts made at European, national or regional level, on trying to improve the sectoral skills would not be efficient if there is a lack of concern regarding the relevance of skills and career management at the shipyards. Aware of that fact, many shipyards are tackling this issue at internal level and a reflect of this concern can be found on their websites. To manage careers at a shipyard is a complex process which includes several interrelated aspects. In here we can mention some of them.

16.1 Business setting

- Maintain company-values.
- Create the conditions for experiences that will allow employees to learn about the different business processes and the various production and design fields in the kind of multicultural setting that extreme internationalization and rapidly evolving scenario typically generate.
- Broaden employees' skills, implementing systemic approaches and gaining an overall view of the core business, employees become aware of the interconnections that drive markets and organizations.
- The company approach towards career management must take into consideration the person's expectations and motivations, as well as the performance goals, growth potential and **training needs** that guarantee the best concurrence of professional goals and corporate needs.
- To present complex challenges and requirements to the people involved to work in interdisciplinary teams regarding technical innovations, new design concepts and assembly methods.
- Focus on cooperation to achieve ambitious goals together.
- To offer opportunities to grow and develop: to nurture personal qualities and talents.
- Provide adequate remuneration, good working conditions and appropriate training.
- Be aware of working on a state of art high technology products and services, complex and sophisticated.

16.2 Possible institutional contributions to career management in their regions

- Facilitate environments for working on people's personal and professional development: Establish training and education in cooperation with shipyards and/or supporting academies at the shipyard.
- Introduce procedures to evaluate the potential of people with the aim of capitalizing on and developing of skills. To set individual development plans.
- The procedure is a crucial opportunity **to map skills** in order to put together effective development plans in terms of short/mid-term training activities, coaching and mentoring, and planning career paths and job rotation.
- To embrace formal career paths that enable employees to progress within the organization by gaining the experience and the skills they need to hold key professional positions.
- Continuous improvement policies.
- Offer motivating framework conditions to employees promoting measures that contribute to health and satisfaction.

16.3 Career Paths: Modes of engaging labour

- Welcoming applications from anyone with the qualifications, skills and experience to contribute to the success of the group.
- Entry level: Internships are an opportunity to become part of the company.
- Job vacancies: The Job portal.
- Job offers – Registering – Entry – Apprenticeship and Dual system.

Fincantieri has an initiative called **Invest in People**. Over the course of the years, Fincantieri has built up and strengthened its internal talent management process in order to extend the range of its employees' skills, to develop career plans and to assess the performance of resources, making sure that they are in line with corporate strategy guidelines and the Company's skills model:

- Training Programme
- Performance Appraisal
- 360° Assessment
- Development Centre

- People Development

This example can be an inspiration for other shipyards. In a time where there is not only a high demand for skills but also growing obstacles for recruiting the right people, **internal skills management system and processes** must be promoted and improved.

16.4 Structure of Jobs

At the time of offering jobs, attracting or recruiting people, the process of describing a professional profile and its peculiarities, should focus on including the following aspects:

- Job title
- Location
- Role objective
- Role responsibilities
- Desired experience
- Company description
- Benefits
- Salary range
- Work hours, travel requirements
- Compliance with legally required information

Taking care of the employment vacancy adds contributes to transmit a better image of the company and to provide potential workforce with a better service.

16.5 Level and type of skills training

- Courses of various types and length: From General Development Courses to those focusing on Specific Professional Capabilities.
- Traineeship / Course of two-years duration
- Internship: Committed to the implementation of good practices of training to improve employability.
- Agreements for university internships, dual training and on-the-job training.
- Including advice from coach / mentor to find the best suitable role.

17. Conclusions of the Report

Shipyards and equipment Providers

- Regarding workforce's skills, large, small and medium shipyards are facing the pressure of challenges and changes in different way:
 - In large shipyards there is a strong concern on facing the skills mismatches to maintain competitiveness and there are a lot of initiatives and good practices being promoted in different areas: strategies, training, apprenticeship, working environment, career paths management, implementation of regulations, promotion of positive image, etc. These initiatives require large investments from the company.
 - Small and medium shipyards may have more difficulties to cope with the requirements of the new technologies, with current social and economic trends, with the ageing of the workforce or the need for adapting to new safety, health and environmental requirements due to a shortage of resources to put in place their own initiatives and training.

In the management and updating of their worker's skills the industry should get the support of training authorities and institutions.

The role of equipment and technical solution providers is key, being the speed of the innovation partially in their hands and in their capabilities, their involvement with training and guidance increases, and the quality of their products, equipment and instruments impacts on the periods of training needed by workers to adapt to and get benefit from them in terms of efficiency, effort or safety.

Both large companies and SMEs are strongly investing to:

- Create adequate working conditions according to the highest levels of European standards
- Manage the green and technological transition and qualification challenges.
- Attract and train talent to the industry.
- Ensure the knowledge transfer between generations.
- Keep up with global competition.

Workforce

- Being regarded as a well-prepared workforce, workers at the shipyards are suffering the impact of the new technologies. Them and their representatives, IndustriAll Europe, are claiming for understanding of employers and institutions in order to launch support measures and schemes that will reduce the skills gap and shorten the periods of training and adaptation: Anticipate the changes, improving the working conditions relating to occupational safety and health, upskilling and reskilling opportunities, coordination between employer and schools, and trade unions, to fight disruption caused by digitalization, etc.
- A few complementary obstacles like the ageing of the population, the fact of being a traditionally male-orientated sector, and difficulties to attract young people and specially women are increasing the weight of the load on the workforce.
- The unclear classification of the occupational profiles remains as an unsolved obstacle yet. The variety of languages, approaches and the many working habits strengthen by geographical and historical differences represent a barrier for progressing on the way to achieve various of the EU objectives for the sector: acknowledgement of titles and certifies, mobility of workers and students, lifelong learning opportunities to all.
- It is urgent to tackle the danger of traditional professions disappearing.
- Fight the shrinking number of employees and the decline of the sector relevance in Europe

- Employees should take control of their own development

Strategies

- Policy and strategic recommendations can be found once and again, repeated, in all types of reports, studies and position papers. However, the **sectoral social partners and other stakeholders complain about the fact that several institutional initiatives are put forward without a proper involvement of workers and industry representatives.**
- In the case of LeaderSHIP 2020, there are several position papers which consider that the implementation of its recommendations has not been adequately followed up and calling for a dedicated and updated sectoral strategy looking towards 2030. This is the case of the following policy and position papers:
 - European Sectoral Social Partners' Manifesto. Maritime Technology, a strategic sector for Europe (October 2018)
 - European Economic and Social Committee's Report on LeaderSHIP (April 2018)
 - Position paper of the Conference of Peripheral Maritime Regions, CPMR: LeaderSHIP 2030 - Towards a new European (March 2019)
 - The Committee of the Regions adopted an opinion on A new European agenda to speed up the development of maritime industries (June 2019)
- Specific policies and strategies from DG Employment, like the EU Pacts for Skills which are launched to support industry and workers in sectors specially affected by the corona crisis should be build together with the sectoral social partners.
- Awareness of the European national strategies for the development of the skills in the shipbuilding and ship repair sector is recommendable, as they can be a source of inspiration too. More repeated concepts are: Face the skills mismatches, anticipate needs, undertake skills mapping, revise profiles, foster career guidance, promote WBL and transfer between generations.
- It is of utmost importance to:
 - Reinforce two relevant conditions: Social dialogue at company and sectoral level and strategic collaboration with training providers.
 - Maintain the Social Dialogue in the sector.
 - Launch more concrete projects of cooperation.
 - Share the view of the sectoral strategic relevance for Europe.
 - Defend the influence of the shipbuilding market.
 - To strengthen VET at all levels.
 - Keep Europe at top in this sector: Sustainability, profit and employment hand to hand.
 - Coordinate the collective efforts on the set goals.
 - Put order and concentrate the bunch of activities launched by different actors, establishing the competitiveness of the shipbuilding sector as the key priority. Concentrate efforts from sectoral stakeholders and educators.
 - Elaborate long-term strategies for managing labour skills at sectoral level.
 - Demand a real implementation of the EU Industrial Policy to the sector
 - Analyse the possibility of giving greater levels of autonomy in developing solutions, at sectoral and national level.
 - Recognise the shipbuilding sector as a Strategic European Industry.
 - Establishment of Sectoral Employment and Competence Councils at European level.

Detection

- Detection of changes and challenges and subsequently of new skill needs is an activity undertaken by different stakeholders through regular research initiatives, studies and reflection events. There is not a specific body in charge of managing the skill needs or a specific methodology, framework to organize

the data from the detection practices. The guidelines promoted by Cedefop represent an opportunity to improve the results of the detection process.

- It is important to look for new solutions to the emerging changes.
- Need to improve the knowledge on the sector in terms of skill and new profiles need: sectoral social partners are key for this task.
- It is key to be able to respond in time to the identified skills gaps.

Analysis

- Large shipyards, European institutions and national authorities launch support measures to do the sectoral skills analysis. The differences in the approaches and the lack of standards turns the skills understanding more difficult and is an initial barrier that hampers the implementation of policies on the acknowledgement of titles and certifies, and workers' mobility. ESCO Database is currently the institutional reference in Europe. Good practices from third countries, as the American O*NET Database, represent a learning opportunity.
- Transversal skills, digital skills and green skills are becoming more and more relevant for the professional curriculum of shipbuilding workers. In spite of it, a task of clarification is needed in this regard, since the mixture of soft skills, attitudes, behaviours and responsibilities cause a feeling of confusion. Existing models and frameworks for transversal or digital skills, as DigComp, will improve the results of sectoral investments and activities in this field.
- The review of previous or existing EU projects or the good practices from 3rd countries can generate a lot of valuable information and reinforce the knowledge acquired in the process of analysing the sectoral skills.
- In order to analyse the skills gaps it abroad range of aspects must be considered: demography, economic trends, social and psychological factor, image of the sector, education.
- Industry and social partners together with education institutions should establish a European Sectoral Observatory as a permanent sectoral body, aiming at analysing data and anticipate skills and training needs.
- In this regard there is a need for developing a monitoring methodology and the processes aimed at managing the information obtained.

Curricula

- In order to facilitate the official recognition of individual competences and qualifications acquired thorough the high variety of training schemes, the Competence Matrix favoured by ECVET / I CARE project means a step ahead for the sectoral skills intelligence.
- It is of utmost importance to renew the existing sectoral curricula to be used and company and VET level.

Training

- General vocational training is being provided by VET school. There are various recommendations to improve the quality of training they offer and to bring it closer to the needs of the sector.
 - On one hand, from DG Employment, based on the priorities declared in the Riga Conclusions from 2015, there are many initiatives, the latest one being the launch of the Platforms of Centres of VET Excellence.
 - On the other, the request from the shipbuilding and ship repair sector to the training institutions should be more precise, so that both, industry and education could agree on what the solutions may be.

- Online training offer is getting wider every day and some examples of sectoral online Training Platforms are emerging too.
- Other types of skills transfer in the field of WBL, internships, apprenticeship and dual scheme, highly demanded by stakeholders, are being adopted by the shipyards, which in several cases already have long tradition with these learning experiences.
- New teaching technologies, simulators are an example of it, are being adopted by shipyards, and equipment providers to improve the quality transfer and shorten the learning periods. VAR, Virtual and Augmented Reality, is considered as a promising technology that may open new possibilities and bring benefits for the sector, as it may link the design, maintenance and learning processes.
- To exploit the full potential of new technologies in the learning process, new environments and new methodologies are being implemented in some training systems. Challenge-based Collaborative Learning is an interesting option increasingly accepted and with a great potential for the sector.
- Further concepts linked to the training process, such as acknowledgement of qualifications and the validation of prior learning are supported by institutional strategies that need stronger implementation. It can be favoured by the quality of the results achieved in the previous phases of the process. Qualitative performance on the detection and analysis of skills plus a professional didacticization and transference will strengthen the possibilities to regulate and normalize the recognition processes as well.
- Lifelong learning opportunities focused on the upskilling and reskilling proposals are regarded as the finest approach for the sectoral workforce in the future and it is a permanent request from the workers representatives.
- Extend upskilling and reskilling opportunities which already exist in some EU regions.
- The recognition of qualifications issued by a state training system is a right way forward to increase competitiveness of the shipbuilding sector.
- Validation of Prior Learning is a task that must be done at national level: systems of recognition of equal qualification from other countries. Doubts about how to do it, who must do it.
- Renew training and reinforce the role of training providers

Implementation

- In the way to become shipyards 4.0, various technologies are being introduced in their production systems. Changes don't occur eventually, but they are happening all the time. The production time is also a relevant moment to detect and analyse technological challenges and skills needs, adjusting the working environments and doing an adequate distribution of roles and responsibilities: good practices of this performance can be spotted mainly in large shipyards.

Tools and support

- The European Sectoral Social Dialogue in Shipbuilding can be regarded as the necessary instrument to deal with the management of the sectoral skills. Through diverse initiatives it supports the generation of a collaborative culture which favours the adequate decision-making process and supports the launching and management of new projects aiming at facing the skills shortages in the sector.
- Tools promoted by DG Employment for forecasting, understanding, managing skills to subsequently matching them with jobs are not being fully applied in the sector. Maybe due to the complexity they imply. These tools seem to require a high level of expertise and professionalism. A reduction of the complexities in applying, developing and reporting, and a closer adequacy to the real situation of the sector will speed up their utility.
- More dedicated support solutions by the EU bodies for the sector, legal and financial, are necessary to enable the pace of Industry 4.0.

Regulations

- Increasing legal requirements in the area of safety, health and environment are demanding from shipyards significant investment in digital and new equipment and technology. The trend of bringing the business into a climate neutral economy is also impacting on the structures, on the jobs and the skills, so that further training efforts must be made to shorten adaptation period to the new paradigm.
- The occurring transformations and the scarcity of workers will increase the need for workers mobility.

Image

- To convey a positive image of the sector is an assignment on which there is a high degree of consensus. Stakeholders seem to be committed to favour it and good practices abound regarding designs and communications. Being the objective that of attract people, talent, to the sector, we can't forget that a good image of the sector's identity goes hand in hand with improvements in the working conditions, safety and health, and career prospects.
- The gender perspective and the generational change have already become a prior concern of sector strategies and measures. Positive results must be achieved in order to be up to the image we want to convey.

Management

- The concept of Skills Ecosystem or the idea of shipyards becoming skills-oriented businesses convey that sectoral skills management is increasingly gaining attention from institutions, employers and workforce's representatives. To attract and retain skilful workers, beside the tasks of detecting, analysing and training, other factors need to be taken into consideration. Shipyards appear to be aware of the need for managing vacancies and job offers, registering and entry levels. They are taking steps to improve the career paths management, increase expertise in the jobs and profiles definition and in supporting the training opportunities, courses, apprenticeship and dual system, upskilling and reskilling their workforce. This effort should also be supported by all stakeholders.

Summary of conclusions: State of the art of skills supply, demand and management in the European shipbuilding, ship repair and maritime equipment industry

- Favourable atmosphere among sectoral stakeholders to tackle the challenge of the sectoral skills.
- Different speed of change between Large and Small & Medium Shipyards. However, the need of embracing **4.0 technologies** is key for the competitiveness of all companies.
- Clear policies and strategies at European and regional level recognise the need of monitoring the sectoral skills, identifying gaps and delivering actions to match industry needs and skills supply. These policies and strategies are fragmented but agree on a lot of different ideas on the need of detection, on the workforce's right to enjoy upskilling and reskilling opportunities, etc.
- There is not a **Skills Observatory** or similar body in charge of the sector skills management. And, so, there is no methodology, no processes defined for it. The sectoral social partners at European level (SEA Europe and industriAll Europe) would be in the best place to carry out the creation of this body.
- There is a need for elaborating a clearer **taxonomy** of profiles in order to facilitate mutual understanding across Europe and **mobility of workers**.
- Need to better analyse the real impact of new technologies on occupational profiles. Analysis are being carried out at company level, based on each company's needs and strategies, but a European analysis is useful to help companies in this process, including medium and small ones
- Increasing relevance of transversal skills.
- **ESCO** is the European multilingual classification of Skills, Competences, Qualifications and Occupations that works as a dictionary, describing, identifying and classifying professional occupations, skills, and qualifications relevant for the EU labour market and education and training. ESCO contains information about occupations and skills in the shipbuilding sector, however, the sectoral content needs to be updated and completed. The same happens with the **EU Skills Panorama**, the EU tool that turns labour market data into accurate and timely intelligence to offer new insights into skill needs in the EU.
- **Validation of Prior Learnings** and recognition of non-formal education would be beneficial to facilitate the mobility and employability of workers in the sector. This possibility should be further explored by sectoral stakeholders, including VET providers.
- A lot of **good practices** can be found across the sector in Europe regarding several topics: training opportunities provision, variety of training types, career path, skills management environments, transmission of positive image.
- The industry needs to send clear messages to training providers regarding the need of improvement of the training offer: curricula, contents, levels, technologies, type of skills and competences, duration, etc.
- Involve **training institutions** in the skills management and training process is key.
- There are several good recommendations from previous projects such as the Skills Council project, the sectoral social partners should monitor their degree of development
- A few educative aspects are not yet fully implemented: Acknowledgement. Validation. Mobility. Lifelong Learning.
- Shipyard 4.0 is giving way to **new business model** and to new possibilities yet unknown .
- Due to the specificities of the shipbuilding and ship repair sector, there are some cultural factors with a strong impact on the sectoral skills management which must be taken into consideration: Environmental regulations, sector's identity and image, managing tools and funding programmes at disposal, etc.
- Tools from DG Employment are not being used at the moment: ECVET. EQF. But EU standards and a sectoral qualification framework should be implemented in the sector progressively.

- Existing EU funding tools, are very complex and demand expertise to get benefit from their utilisation.
- **Image:** There is still a lot of work to do to improve the image and attractiveness of the sector in several countries/regions in Europe. Raising the awareness on seas and ocean matters is also a very important and complementary task where the broad range of maritime stakeholders should cooperate.
- Further development of the **Skills Ecosystem Concept:** Attention to the demand for skills and its role in supporting employment and economic growth. How skills are used in the workplace and how businesses engage with the local skills ecosystem.

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