European Maritime and Fisheries Fund

Project: 863713-MarLEM

Maritime Logistics Engineering and Management

"Today, because of rapid economic and social change, schools have to prepare students for jobs that have not yet been created, technologies that have not yet been invented and problems that we don't yet know will arise." Andreas Schleicher, OECD Education Directorate, 2010.

End-User needs report

Deliver 2.1. - End-User needs specification

Version 1.0

31 March 2020

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Terms and Definitions

21st Century skills

A blend of content knowledge, specific skills, expertise and literacies which students need to master to succeed in work and life.

Assessment

The method of determining if a training need exists and, if it does, what training is required to fill the gap.

Behaviour change

Any modification in behaviour altering the way you act and react. The change may happen spontaneously and involuntarily without any intervention, or it may be systematic and prompted by conditioning.

Blue Growth

European long-term strategy to support sustainable growth in the marine and maritime sectors as a whole. Seas and oceans are drivers for the European economy and have great potential for innovation and growth.

Capacity building

Long-term, continuing process, in which all stakeholders participate (ministries, local authorities, non-governmental organizations and water user groups, professional associations, academics and others). In 1991 it was defined as a) the creation of an enabling environment with appropriate policy and legal frameworks; (b) institutional development, including community participation (of women in particular); and (c) human resources development and strengthening of managerial systems.

Competency

An observable behaviour supported by specific knowledge, skills, and attitudes. Each competency has a specific result or output.

Content Analysis

A procedure for organizing narrative and qualitative data into emerging themes and concepts. Usually associated with a quantitative form of analysis in which the themes are counted or measured.

European Skills Competences and Occupations classification (ESCO)

European multilingual classification of Skills, Competences, Qualifications and Occupations. ESCO works as a dictionary, describing, identifying and classifying professional occupations, skills, and qualifications relevant for the EU labour market and education and training.

Feasibility Analysis

A cost-benefit analysis completed prior to conducting training. It is an estimate of the cost of the training weighed against the possible benefits that could be achieved if training were conducted

Formal education

Education that is institutionalised, intentional and planned through public organisations and recognised private bodies, and in their totality constitute the formal education system of a country. Formal education programmes are thus recognised as such by the relevant national education or equivalent authorities.

Gap Analysis

Also called performance analysis; identifies the difference between current performance and the desired performance.

Gender balance

This term refers to the equal participation and human resources for women and men in all areas of work, projects or programmes.

Governance

It is the establishment of policies and continuous monitoring of their proper implementation, by the members of the governing body of an organization.

Interested party / stakeholder

person or organization that can affect, be affected by, or perceive itself to be affected by a decision or activity.

Interview

The process of asking questions to experts or performers to identify training needs.

Job Analysis

The process of identifying all the parts of a specific job; conducted before a task analysis.

Learning Objectives

Describes a specific behavior, conditions, level of achievement and is written from the learner's point of view.

Needs Assessment

Gathering of information about a specific work need that can be resolved by training. The types of needs assessment include performance analysis, target population analysis, sorting training needs and wants, job analysis, and task analysis.

Needs versus Wants Analysis

Discovers training needs that are related to the organization's work. Training is linked to the final outcome and providing appropriate training will benefit the individual as well as the organization.

Ocean literacy

The understanding of the ocean´s influence on you and your influence on the ocean.

Organization

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives.

Paradigm

Example or pattern; an outstandingly clear or typical example or archetype.

Paradigm shifters

Elements of fundamental changes in the basic concepts and experimental practices of a scientific discipline.

Pilot Experiences

Planned actions to test the addressing of Skills and Competence gaps.

Performance Analysis

Also known as gap analysis. Performance analysis looks at an official's current performance and identifies whether the official is performing as desired

Performance Deficiency

A difference with a negative connotation, implying that the official is not meeting a known standard for performance.

Requirement

Need or expectation that is stated, generally implied or obligatory.

Skill

The ability to do an activity or job well, especially because you have done it many times

Skills ecosystem

Clusters of high, intermediate or low-level competencies in a particular region or industry shaped by interlocking networks of firms, markets or institutions.

Skills shortage

Refers to a useful understanding of what skills are in demand or may be in demand in the future for a particular job.

Target Population

The individual or group involved in a needs assessment or training program.

Task Analysis

Finds the best method and sequence of steps to complete a specific task.

Trainer

A term used in a corporate setting for a teacher. Also instructor.

Training Needs Analysis (TNA)

The process of identifying the gap between present training and needs of training. Training needs analysis is the first stage in the training process and involves a series of steps that reveal whether training will help to solve problem which has been identified.

VET Standards

This term refers to the key elements of lifelong learning systems equipping people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market. It responds to the needs of the economy but also provides learners with skills for personal development and active citizenship. VET contributes to enterprise performance, competitiveness, research and innovation and is central to employment and social policy.

Vocational Education Training

Sometimes simply known as vocational training, it is the training in skills and teaching of knowledge related to a specific trade, occupation or vocation in which the student or employee wishes to participate. Vocational education may be undertaken at an educational institution, as part of secondary or tertiary education, or may be part of initial training during employment, for example as an apprentice, or as a combination of formal education and workplace learning.

Acronyms and Abbreviations

A3ES – Agência de Acreditação e Avaliação do Ensino Superior

DGAM – Direção Geral da Autoridade Marítima

DGRM – Direção Geral dos Recursos Marítimos

EC – European Commission

EASME – European Agency for Small and Medium Enterprises

EMFF – European Maritime Fisheries Fund

ENQA – European Network on Quality Assurance

ISO – International Standards Organization

JRC – Joint Research Centre

MLEM – Maritime Logistics Engineering and Management

SOLE – Society of Logistics Engineering

TNA – Training Needs Analysis

TP – Target Population

History of Changes

Table 1 - history of changes

Version	Publication date	Changes
1.0	31.03.2020	Initial version for discussion
2.0	20.04.2020	Version thoroughly reviewed to be shared and publicised

Contractual aspects

Project: Maritime Logistics Engineering and Management (MarLEM)

https://grupoqualiseg.com/marlem

Deliverable – D2.1 – End-user needs specification

Work package: Wp2 – Situation Analysis

Task: 2.1 to 2.4 – End-user's needs, competence requirements, competence reviewing and competence gaps clarification.

Confidentiality: public

Version: 1.0

Contractual Date of Delivery to the EC: 29.02.2020

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Leader entity – Qualiseg.

Participant(s) – EN/Defesa and FCT/UNL

Collaboration – all consortium partners

Author(s): Manuel Carrasqueira and José Daniel (QUALISEG).

Legal Disclaimer

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Executive Summary

Objective

The main objective of this deliverable is to report the identification and assessment of the end-user needs in the field of the Port and Maritime Logistics Engineering and Management Competence Requirements, regarding the development of the training design specification.

Scope

The deliverable D2.1 – end-user needs' specification is related to the Tasks 2.1 to 2.4, which include the following activities:

- End-User needs establishment
- competence requirements definition
- competence reviewing
- competence gaps clarification

To reach the established objective and having in mind the aim of the MarLEM project to develop a joint-master course in Maritime Logistics Engineering and Management, relevant stakeholders have been involved in the design process to meet their requirements, in order to ensure the results in terms of the skills development and competence acquiring.

Finally, in the last phase of the Task 2.4 the competence gaps have been clarified in order to raise potential solutions, which have been properly dealt in task 2.5, regarding the development of the training design specification in task 2.6.

Introduction

The MarLEM approach is based on the principles of the Quality Management (ISO 9001 training requirements) in general and, in particular, on the requirements of the international standard on Training Management (ISO 10015). On the technical dimension, the 21st Century Skills / Learning framework and the OECD Conceptual Framework for Education for 2030, are the main pillars for the training design, development and validation, essentially from the soft-skills dimension. As can be seen in figure 1, MarLEM has its basis in the Skills' needs, thus the training situation analysis is the first step that will allow the training design, development, planning and implement.

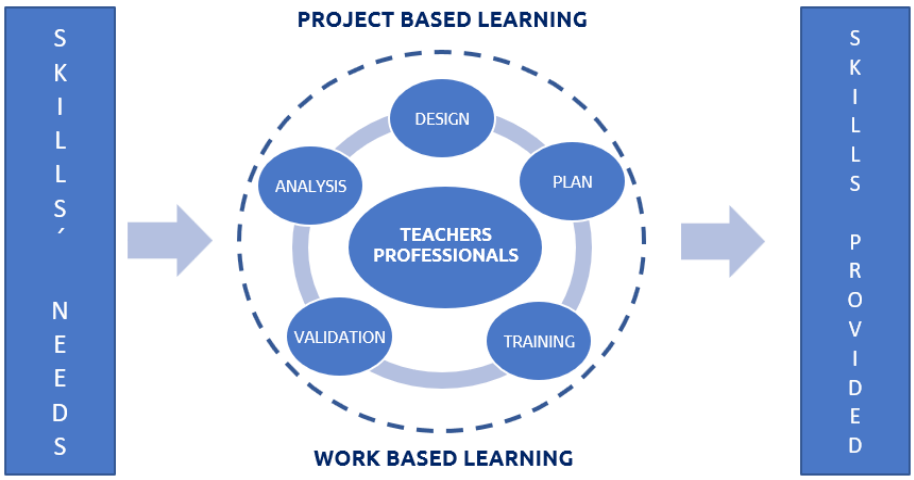

fig. 1 – The MarLEM approach to provide required skills

The purpose of this deliverable, as a technical output of the project, is to identify the relevant end-user needs regarding the development of the Design Training Specification. This deliverable describes the steps and actions performed in tasks 2.1 to 2.4 during the first four months of the project and can be considered as a key input for the Training Design and for the upcoming tasks in WP3 to WP6.

The skills needed to compete in today's global economy are arguably quite different from those upon which 19th and 20th Century education systems have traditionally focussed.

Economies, particularly in developed countries, have shifted from a basis of material goods and services to one of the information and knowledge (Lisbon Council, 2019).

Whereas the possession of detailed facts and figures was once a passport to a professional job or a university place, in present times the main emphasis relies on what people can do with the knowledge they can access and on interpersonal skills. Simultaneously, however, some employers and university tutors complain that new recruits arrive improperly prepared from previous learning stages. In this context, references to the so-called '21st Century skills' have been feeding many discussions over what and how today's students should learn, in order to become productive citizens.

The port-maritime framework in terms of skills and competence

In today's global economy, businesses in all parts of the world are interlinked by logistics chains. Particularly, maritime systems play a vital role in the intercontinental transportation of goods and a growing role in terms of energy and fresh water production. Simultaneously, recreation activities have grown noticeably with particular relevance to cruising activities.

At European level there are 70 000 km of coastline and more than 1200 commercial seaports across 22 Member States, with growing movement of cargo and passengers. The MarLEM intervention in the port and maritime domain at EU level in general and in the Mediterranean area in particular, specifically on the provision of aligned curricula, may assume noticeable relevancy.

As expressed, for example, in the Atlantic Action Plan discussion papers, the Blue Economy has the potential to deliver growth and jobs in the coming years, but an adequate supply of blue skills is mandatory. As can be observed in The Commission's Annual Growth Survey, there is a growing skills gap affecting particular knowledge intensive sectors, with a special relevance for:

- A skills mismatch between labour market needs and the output of educational institutions
- A lack of communication and cooperation between education and industry to efficiently align supply and demand.

This lack of (or misaligned) skills, is being emphasized in different studies. For instance, a recent study conducted in Ireland by Skills Ireland found that 2020 demand for blue skills will increase by 10,138 FTE jobs under the optimistic scenario. The largest expansion is expected to be in maritime transport, shipbuilding and services (4,928). In the LeaderSHIP's "The Sea, New Opportunities for the Future" report, the industry stakeholders have identified the characteristics required for a strong, sustainable and competitive European maritime

industry in 2020. This report emphasises that a large part of the current maritime industry is suffering from a noticeable lack of skilled professionals and this situation is causing a restriction on the blue growth.

A report published by Matchtech, one of the UK's leading engineering recruitment specialists, entitled 'Mitigating the Skills Gap in the Maritime and Offshore Oil & Gas Market', discusses the outcomes of a group of key industry stakeholders involved in the blue economy, on the engineering skills gap in the UK. The report manifests that industry is not doing enough to sustain its future. By analysing current trends, future projects, recruitment forecasts and examples of industry best practice, the report summarises the key challenges facing industry, and advises on how individuals, industry, academia and governments can work together to get the blue economy growing again.

Stakeholders and User Groups

The identification of the potential stakeholders is the first important phase of a project, since once grouped according to well defined categories to constitute the Target Population (TP), they will be involved in the requirements elicitation process where business and user needs are identified and captured.

The success of a project such as MarLEM depends heavily on the ability to meet the needs and requirements of stakeholders throughout the entire training life cycle, from training design to training validation and improvement.

In the stakeholders' identification, all possible categories have to be considered, such as port operators, port and maritime authorities, and ship operators, in the context of the business and the proposed training solution. A stakeholder is any entity (individual or organization) with a legitimate expectation from the solution that is being proposed. In other words, the stakeholders are all those who may be influenced or who would be able to influence the solution in general. These stakeholders represent the source of the requirements during the requirements elicitation phase. The stakeholder identification activity is not a simple step and, naturally, unveiling their requirements and expectations is the most difficult part of the training needs assessment phase.

In accordance with the stakeholder analysis methodology defined by the PMBOK, in the stakeholder identification phase we have considered the following tools and techniques:

- Stakeholder analysis: Collection and evaluation of information to determine what interests should be taken into account for MarLEM
- Expert Rating: Technical and / or managerial expert judgment (provided by consortium members experts and advisory board experts)
- Meetings: Profile analysis meetings to develop an understanding of major project stakeholders.

The main stakeholders of the MarLEM platform have been identified, addressed and involved in the best possible way in a regular and continuous work that started a long time ago before the launch of MarLEM project, in the scope of Qualiseg activities with port and maritime companies and authorities. This relevant work will not end at this stage since, after the Training Design Specification, it is most important to come back to stakeholders in order to validate with them whether or not the achieved solution is capable of coping with their needs, requirements and expectations.

Thus, hereinafter, the more relevant stakeholders related to the port and maritime domain are presented grouped by typologies, as follows:

- Authorities
    - Port authorities
    - maritime authorities/port state control

- Port actors
    - Logistics company
    - shipping and transport companies
    - stevedoring companies
    - port employees, minority shareholders
    - port managers, board members
    - owners of ports e.g., government/port operator.

- Maritime actors
    - Inland and sea transport operators
    - ship employees/seaman/workers
    - ship managers, shipowners.

Methodology and Participation

In order to provide port and maritime workforce with appropriate skills and competencies, a needs analysis of the sector organizations and relevant stakeholders, in terms of the required competencies, has been conducted and competence-related issues have been recorded. The ultimate purpose of the needs analysis is:

a) define the gaps between the existing and required competence;

b) define the training needed by the workforce, whose existing competence does not match the competence required for the tasks; and

c) document specified training needs.

Moreover, the analysis of the gaps between existing and required competence should be conducted to determine whether the gaps can be closed by training or whether other actions might be necessary.

Methods used for reviewing competence included the following:

- interviews with human resource managers of the port and maritime organizations
- observation of the context and performed activities
- group discussions
- consultation with persons in key positions, and/or with specific knowledge
- review of relevant literature and related studies
- inputs from previous and ongoing projects.

In terms of the step-by-step methodology implementation, the training needs assessment allows the identification of individuals' current level of competency, skill or knowledge in one or more areas and compares that competency level with the required competency standard established for their positions and/or tasks to be performed. The difference between the current and required competencies can help determine training needs.

The employed methodology encompasses four steps:

Step 1: Business Need's identification

A training assessment is the first step to any successful training program and is also a critical aspect of successful planning. This analysis allows to focus the efforts on areas of training that is necessary for the workforce to successfully carry out the established goals, make optimum use of the available funds and motivate professionals by contributing to their career development.

Step 2: Gap Analysis

Performing a gap analysis involves assessing the current state of the workforce performance or skills and comparing this to the desired level. The difference between the existing state and the desired state is the gap. There are many different methods for conducting a gap analysis. The method for identifying the gap will depend on the organization and the situation. In this specific situation, which is related to one sector as a whole instead of a single organization, the following gap analysis methods have been employed:

Individual interviews - Individual interviews have been conducted involving top managers, quality managers, safety and security managers, human resource managers, inspectors and auditors, all working in or with the port and maritime sector. The information gathered was very relevant to identify the existing gaps in the port and maritime sector.

Discussion groups - Unlike individual interviews, using discussion groups involving simultaneously different areas of management, such as those above mentioned, allows the development of a brainstorm about all the training needs they can think of and, above all, the potential training needs in the years to come.

Observations – Essentially, the application of this method to complement the gap analysis was based on the analysis of the way people are performing their functions, results normally achieved, non-conformities and improvement opportunities.

Step 3: Training Options assessment

The gap analysis allowed the clarification of the training needs regarding the better design of the training solution to be provided, in line with the goals and priorities of the sector, both currently and in the future.

Step 4: Report Training Needs and Recommend Training Plans

The last step of the methodology is to report the findings and conclusions from the training needs assessment, and make recommendations for short and long-term training actions to be developed.

This end-user needs report focuses on this step, reporting the relevant findings from the developed training needs assessment, showing the relevant conclusions and making recommendations. Moreover, this report is also the main input to the Training Design Specification, which will be documented in a specific report.

Competence in Logistics

Findings from main studies, projects and literature

Logistics Engineering and Management

Logistics, as defined by SOLE (2017), means: “Integrated design, management and operation of Human, Physical, Financial and Information Resources, during product, system or service life time”. Logistics, however, is a dynamic discipline that has been evolving over time, including more elements as a result of technological development. In fact, during the 60’s, only Maintenance, Personnel, Supply, Facilities, Warehousing and Transport were considered Logistics elements; after a couple of decades also Training and Information Systems have been considered Logistics elements. Nowadays, also Quality, Environment and Safety can be considered as Logistics elements. This fact means that Logistics is a dynamic and evolving discipline that, as time passes and reality changes, includes new areas in order to achieve its purpose: to guarantee the proper support to mission accomplishment.

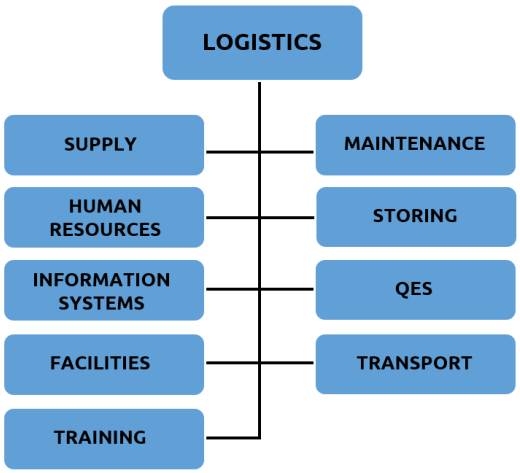

fig. 2 – Logistics and its main functions

Regarding the analysis of Logistics’ evolution, we have to consider its main dimensions: Strategic Logistics and Applied Logistics. Strategic Logistics is the

Logistics level where the whole process of planning, coordination and allocation of persons, materials and services, needed for product or service realization, take place. Applied Logistics considers two phases: Logistics Engineering, which includes the activities of planning and obtaining necessary resources before their use; Operational Logistics, which is oriented to the needed activities to keep systems operative.

In cultural terms, or the way to look at Logistics and its components, we may observe: Strategic Logistics – Strategic Thinking - someone that sees the global picture; Operational Logistics – reactive attitude or problem solving. Clearing up these two different phases as Heskett, Glaskowsky and Ivie explained a long time ago (1973), leads to significant gains of money and time.

Most recent transformation efforts have been designed to achieve savings, improve effectiveness, and deliver agility. Remembering, for example, the timeless words of Sun-Tzu, Napoleon and General William Pagonis, this one after Operation Iraqi Freedom, our ability to manage logistics more effectively is crucial to the operations' success. In General William Pagonis words after the Gulf War, the integration of the broad dimensions of Logistics it is possible, desirable and necessary, leading to better levels of effectiveness and efficiency.

For conventional organizations, challenge means to develop a Logistics capacity that can help to satisfy the main requirements of their customers at an optimized cost. However, leading organizations in their sectors already learned that both design and operation of a logistic system is a competitive advantage. The analysis of these authors goes further, concluding that organizations gaining strategic advantages supported on Logistics competences define the competition paradigm in their sectors.

From main studies and projects

Previous Projects

MarLEM has a strong basis on previous and ongoing projects, with particular relevance for **Mates,** considering that four of its partners (**WEGEMT, University of Strathclyde, CERTH and Frum Oceano**) became involved in MarLEM.. This involvement provided a strong basis in assuring that MarLEM is being developed in line with the best strategy for education and training in Maritime Logistics. **Qualiseg** (represented by mr. Manuel Carrasqueira, MarLEM's coordinator) is also involved in Mates, working on its **Advisory Board, specifically in the Sea Training Innovation Management** domain.

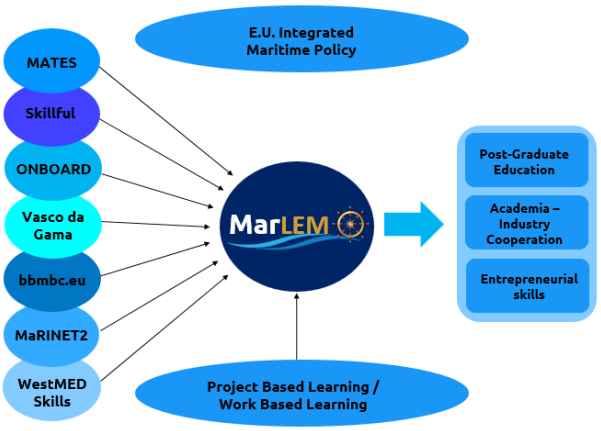

fig. 3 – Previous projects imputing MarLEM

Main relations and interactions with relevant projects are as follows:

- **MATES** - works on the development of a skills strategy and an action plan, addressing the main drivers of change of the maritime industry and aiming to increase the attractiveness of the maritime industry. The Mates project contributes to MarLEM since it provides an identification of future skills and competence needs and an alignment of industry needs and occupational profiles with training and curricula, as well.

In its essence, MATES, following a practical approach, aims to produce a comprehensive but also feasible and demonstrable skills strategy supporting further growth in the two sectors targeted and strengthening the global competitiveness of European industries. Some of the Mates' lines of action in the shipbuilding sector are:

- Training, reskilling/upskilling the workforce in the use of digital and data driven technologies (big data, Internet of Things, cloud computing, 3D printing, artificial intelligence)
- Training, reskilling/upskilling the workforce in the use of automation and robotics as well as in the human –robot interactions (automation/autonomous ships, mechatronics, augmented reality)
- Training, reskilling/upskilling the workforce in the use of technologies for minimising environmental impact in shipbuilding (sustainable practices, reduction of polluting emissions, construction materials and antifouling systems).

- **Onboard** – works on designing, implementing and validating an apprenticeship's model for ports and logistics, supporting the development of new VET profile and curricula; this is an important input, specially at Logistics' Operational Level, adding value to MarLEM post-graduate course design and development.

  The Onboard project was designed to answer the three main challenges that the ports and logistics sector is facing in Europe (as in Onboard exploitation strategy):

  - Digitalization of the sector and the consequent need of endowing the workforce with the necessary knowledge and competences to adapt to this new reality;
  - The mismatch between the training offer and the needs and trends of the ports and logistics sector;
  - The lack of young qualified workers due to the ageing of the current workforce of the sector. Having these challenges as a starting point and the work-based learning as background (in particular the apprenticeships), the Onboard partnership defined a methodology and approach for the development of resources addressed to organisations and professionals from the sector, allowing them to successfully overcome these challenges.

The Onboard project aims at providing methods and 'good practice' "to achieve high-quality training that is relevant to the sector's needs, and allowed to encourage a relationship of proximity between different companies in the sector with apprenticeships activities, to reinforce the VET-Business partnership, and to open opportunities to improve work-based learning".

- **Skillful** - provides a review of existing, emerging and future knowledge and skills requirements of workers in all transport areas; this particular Skillful output is relevant, once transport is an element of the Strategic Logistics;
- **BBMBC** - The Blue Biotechnology Master for a Blue Career, focused on blue biotechnologies, is an interesting element of benchmarking, providing useful information concerning course design and dissemination;
- **MaRINET 2** - offers training on specific technical skills and essential generic and transferable skills relevant for Oceans Renewable Energy, to both academia and industry. In this specific area, this project provides some inputs to MarLEM in terms of the gap analysis and trainees involvement.
- **Vasco da Gama** – This project worked on the development of Education and Training (including a Master on Maritime Safety) of persons employed in the European shipping, regarding skills improvement and contributing to maritime safety and environmental protection. Its results constitute an important input for MarLEM, particularly in the project specific dimension.
- **Sea Change** - is an EU H2020 funded project that aims to establish a fundamental "Sea Change" in the way European citizens view their relationship with the sea, giving a basis to MarLEM, particularly in the soft skills dimension to be provided.
- **Sea of Experience** - is a regionally-oriented project that aims at establishing a training/mentoring network, the Eastern Mediterranean Regional Network (EMReN), for professionals and youngsters related to maritime transport, shipbuilding and ship repair, ports and the cruise industry. The training scope is to develop common training programs for Blue Economy industries (maritime transport, shipbuilding and ship repair, port and the cruise industry) for apprenticeships/traineeships.

From related studies and NGO's perspectives

European Commission perspective and actions

The European Commission's LeaderSHIP 2020 initiative establishes the vision and strategy of the shipbuilding industry to ensure long-term prosperity in the market. It was adopted in 2013, in response to the effects of the economic crisis, and provides a number of short to medium-term technology recommendations for the European maritime sector in order to support high value sustainable growth and cope with the social challenges of Europe.

Based on the strategic vision for 2020, the EC is striving to make the industry innovative, competitive and international, and one of the four pillars of action for business success identified by the European maritime actors is Employment and skills. In anticipation of the short supply of qualified personnel in the sector, the strategy seeks to improve the image of the marine industries as a sector of the future with a view to making it more attractive in the labour market. It also proposes mobility promotion and harmonisation of the different systems and professional accreditation levels to meet market needs and improve employability, both in formal training (including graduate and post-graduate studies), as well as in non-formal training and experience.

In the EC perspective, the marine and maritime sectors that make up the 'blue economy' have (forecasted at that date) the potential to provide 7 million jobs in Europe by 2020. These jobs will be found not only in emerging sectors, such as offshore renewable energy, but also through revitalising traditional maritime industries.

Related to port and maritime sector, the Blue Economy Report (2019) published by the European Commission notes that the "EU's Blue Economy is indispensable to our future welfare and prosperity". It recognises that it is a major source for food, energy, transport or leisure, and is a driver for new jobs and innovation.

In terms of the Digital Skills applicable to port and maritime reality, the EU JRC research is focused on how to make better use of ICT for rethinking learning, for innovating education and training and for addressing new skills requirements (e.g. digital competence) to generate growth, employment and social inclusion. More than 20 major studies have been undertaken and more than 100 different publications released.

JRC research, co-related to port and maritime, is structured around three main strands:

- 21st century Skills and Competences
- Innovating and modernising Education and Training
- Open Education.

JRC's Learning and Skills projects cover a wide range of studies: On citizens and learners (micro), on teachers and educators (professionals), and on educational organisations (meso) and societies (macro).

21st century Skills and Competences

Creativity, entrepreneurship, learning-to-learn, digital competence and other 21st century skills and competences are emerging as more and more important for innovation, growth and participation in a digital society and economy. The key challenge for research and policy is to make sure that supply and demand for new skills and competences are matched: How can or should these new skills and competences be defined, described, thought, acquired and recognised?

Current JRC research covers the following projects: Digital Competence for citizens (DigComp), Digital Competence for Consumers (DigCompConsumers), Entrepreneurship Competence (EntreComp) and an exploration of Computational Thinking that might become as fundamental as numeracy and literacy (CompuThink). Past studies looked at Creativity and Innovation (ICEAC) and the use of ICT for the Assessment of Key Competences (COMPASS).

Innovating and modernising Education and Training

Innovating and modernising education and training are key priorities in several flagship initiatives of the Europe 2020 strategy, in particular Agenda for New Skills and Jobs, Youth on the Move, the Digital Agenda and the Innovation Union.

The key challenge for research and policy is to make sure that the full potential of digital technologies is used for learning and that effective digital-age learning is made possible through systemic and holistic change. Progress to move towards full integration of digital technologies in E&T is still needed in many European countries.

Current JRC research is focussed on digitally competent organisations (DigCompOrg), on educators' digital competence (DigCompEdu), on policy reforms towards integration of digital technologies in Education (DigEduPol) and on exploring Learning Analytics. See for past studies on Innovating Learning and Teaching: NMSeL; LEARNCOM; Learning & Ageing Society; Learning 2.0; 1:1 Learning; TeLLNet; SCALE CCR. See also for studies on the Future of Learning: eLFut; FutLearn; MATEL; Horizon Report Europe.

Open education

Open education has the potential to make educational systems more innovative and efficient. In addition, Open Education allows individuals to engage in new and more flexible ways of (lifelong) learning.

These two components turn the integration of Open Education into EU education systems a policy objective, as argued in the September 2013 Opening Up Education Communication and the renewed priorities of ET2020 to provide "open and innovative education and training, including by fully embracing the digital era" (November 2015).

Current JRC research is focussed on two complementary approaches: the supply side of OE (Higher Education Institutions) and the demand side (MOOC learners): open education policies, MOOCKnowledge, MOOCs4Inclusion. See for the OpenEdu framework for Higher Education Institutions and recent studies on open education: OpenCases, OpenCred, OpenSurvey. Earlier work relates to OER (OEREU) and Science 2.0.

The OCDE vision

The OECD (2016) report: “The Ocean Economy in 2030” analyses the economic perspective of the ocean economy while meeting the goals of a more sustainable development, and provides policy recommendations to support such national and international efforts. This report explores the growth prospects for the ocean economy, its capacity for future employment creation and innovation, and its role in addressing global challenges. Special attention is devoted to the emerging ocean-based industries in light of their high growth and innovation potential. In fact, some of the ocean industries manifest clear indications of rapid growth and quite dramatic rates of innovation; for example, shipping and port activities are moving increasingly to highly sophisticated levels of automation.

The report also examines the risks and uncertainties surrounding the future development of ocean industries, the innovations required in science and technology to support their progress, their potential contribution to green growth and some of the implications for ocean management. Finally, and looking across the future ocean economy as a whole, it explores possible lines of action that could boost its long-term development prospects while managing the use of the ocean itself in responsible, sustainable ways, putting forward a number of recommendations to enhance the sustainable development of the ocean economy, from which “the build more capacity for ocean industry foresight” deserves our attention in this state of the art.

The European Marine Board vision

In accordance with the site of European Marine Board (https://marineboard.eu/marine-graduate-training) dedicated marine science programmes account for less than 10% of higher educational (degree) programmes in Europe, at the time when the EU promotes a Blue Growth Strategy. The Working Group on Marine Graduate Training outlines the context of European marine science education training, and identified recommendations / ways to improve the capabilities of the next generation of marine scientists and engineers to work at

a systems level, applying multi-disciplinary knowledge to address complex marine issues which cut across scientific, environmental and social systems.

The workforce for tomorrow's marine and maritime industry, policy and research fields will be drawn from a pool of graduates who are currently receiving training in higher education institutions. In order to facilitate the anticipated growth and job expansion envisioned by the EU Blue Growth initiative, a skilled workforce will be required, comprised of graduates from many different levels of the educational system. Education and research are, therefore, central components of the blue growth strategy and it is recognized that training itself, and the delivery of high-quality graduate programmes, is part of the engine which drives innovation and technology development in maritime sectors.

In the Marine board analysis, there is a mismatch between the needs of policy and industry in a changing world, and the typically more traditional approach to educating graduates within the University system. Even existing a strong emphasis on Blue Growth in Europe, the traditional marine-based graduate programmes at Masters and Doctorate level do not equip the future marine professionals with the ability to realize the potential of a sustainable blue economy. The sector needs graduates who:

- Understand the needs and requirements of blue industries, and have had exposure to both academic and non-academic careers;
- have and can apply multi-disciplinary knowledge to complex marine systems;
- have a good range of transferable skills and experience; and
- can ensure innovation and bring new ideas to address new challenges.

World Economic Forum (WEF)

Focusing on a core set of 35 work-relevant skills and abilities that are widely used across all industry sectors and job families, a the Future of Jobs Report (WEF, 2016) finds that those practical skills will be subject to an accelerated change and significant disruption in the immediate future. On average, they anticipated by that time, by 2020, more than a third of the desired core skill sets of most occupations will be comprised of skills that are not yet considered crucial to the job (in 2016), according to the responders to the survey.

Findings from relevant stakeholders

In order to diagnose and assess skills and competence needs perceived and assumed in the "field", at the industry level, several interviews, group discussions and observation of activities have been developed. To do so, 10 major points of discussion guided/supported interviews and group discussions in a as smooth and discrete as possible way, trying to not condition the interviewees

From this work, performed mainly in the last two years and synthesized from 02 January to 15 March of 2020, the relevant findings and conclusions of each of the 10 points are shown as follows:

1. How valuable can be **skills and competences** in the port and maritime sector?

   Reality is becoming clear that, even emerging economies, such as China and India, are no longer competing on the basis of cost alone. The port and maritime value chain have been evolved strongly and to be competitive any player has to show strong differentiating factors with highly skilled workforces. So, to reach and maintain a competitive advantage, **investment in skills and education is the key**.

   In the maritime domain, education and training is an interdisciplinary field that covers technical skills, such as ship management and engineering, and soft skills such as leadership and communication. These specific **maritime skills and competences are critical** to enhance the quality of work and increase management efficiency as well as to maintain the competitiveness of maritime industry.

2. Main **Competence Gaps** perceived in day-to-day reality? How can they be filled?

   Some important competence gaps are easily noticed by a well positioned observer, due to the sector being in permanent change and evolution, with particular relevance for:

   - Management skills – skills related to Strategic management, Project management, Logistics management, Supply Chain management and

Leadership, which have undergone an increasing importance and require open-minded leaders and managers.

- Technical Skills – It is quite consensual that there is a cultural shift towards 'softer' disciplines. In general, countries are graduating more social sciences students than natural sciences students. This is creating a gap between supply and a continued demand for graduates in traditional academic subjects such as mathematics and science, with subsequent impact at the operational level. Increasingly, companies are requiring seafarers and port workers to have additional academic qualifications as well as some experience of working ashore. In the field of the Port and Maritime Operations, the more relevant technical skills, in the general perspective of the main actors, are:

  - Integrated logistics (operations, transport and distribution)
  - Port and shipping operations
  - Value chain management (designing, planning, assessing, analysing and performance evaluation).

  Of particular relevance, companies identified some qualification profiles that are not easily available on the market, which are:

  - Integrated logistics profiles (operation, handling, distribution)
  - Supply Chain Specialist
  - Port operator
  - Shipping/transport technician and manager.

- Soft Skills – Despite the wideness of the soft skills domain and different perspectives from interviewees, one common point is the need to guarantee the successful integration of young workers in the port and maritime sector. This aspect assumes noticeable importance, considering the increasing of the workforce average age (exceeds 45 years) and, in the next years, an almost

simultaneous retirement of the core workers will most probably occur. In this particular aspect, inefficient operations and risk of loss of knowledge and experience of older workers are easily perceived. On the other side, young people are not interested in the maritime sector, most probably due to the lack of knowledge about the sector, working conditions and different occupations, as well as a negative image that often still prevails. Young workers new to the sector have a totally different mental framework and, usually, experience some difficulties to adapt to this specific reality. Nevertheless, the soft skills highlighted by sector interlocutors are as follows:

- Clearcut values and educated character
- Interpersonal Communication
- Leadership and teamwork
- Proactivity and accountability
- Creativity and Innovation

A particular emphasis on **creativity and innovation** has been made by different port and maritime actors, pointing out that workers need to be able to develop new, imaginative solutions to problems rather than relying on traditional thinking and ways of working. Specially, young workers will encounter real problems in the maritime work environment that were not covered during their education. Therefore, it is most relevant to equip them with proper problem-solving and solution-providing tools.

Other skills also mentioned are: **concentration, reflection, contemplation, visualization, emotional intelligence, complex problem solving (CPS) and simple solution approach (SSA).**

- Digital Skills – this is a field to which all involved actors call particular attention, due to the need and trend of the digitalization of the companies of the sector, with particular emphasis on single window technology. Essentially, digital skills are a requirement to increase competitiveness but also they are a tool to attract and

retain young qualified workers in the companies. The specific skills commonly mentioned are as follows:

- Data analysis expertise
- Information and Communication Technology (ICT)
- Cybersecurity
- Systems integration.

- Green Skills - due to the legal requirements and also to the policy and commitment of the organizations of the sector regarding sustainability, green skills are also recognised as an important skills dimension. Factors such as the following need to be addressed:
  - Sustainability awareness
  - Economy of resources
  - Increased efficiency
  - Reduce time and waste.

3. Main **gaps** are in the soft or in the technical dimension?

   Concerning competencies/skills (technical versus soft skills), it becomes clear that, for the generality of the port and maritime actors, technical and soft skills are relevant and **have to be provided in a balanced way**. In the technical field, analytical skills to overcome technical challenges are an important aspect. In the soft-skills dimension, leadership, decision making, proper educational knowledge and professional attitude assume particular visibility.

   It is commonly accepted that this sector needs a simultaneous upskilling and reskilling of the workforce to develop required skills and attain desired competencies.

4. What kind of **training**, reskilling/upskilling of the workforce in the **Maritime Logistics** domain should be developed?

It comes clear, from the companies' perspective, that the port and maritime new workers are not currently being supplied with the right information at any point in their education that allow them to be able to easily adapt to a reality totally different from the regular reality of other sectors. It is commonly argued that students/new workers should have the possibility of developing specific training in the port and maritime field, granting them the proper knowledge of this specific reality, both in the technical and cultural domains.

Regarding active workers, it is important to help them evolve their present competencies, allowing them to acquire the most required skills and to develop the desired competencies. Training methodologies, such as on-job-training, project based learning, case-study based learning and Work-Based Learning (WBL), have to be implemented and/or reinforced in the majority of the port and maritime sector. In-company training and training for the unemployed (which can be funded through the employment insurance system), may significantly improve workforce competencies, in a bottom-up approach.

Any of the above mentioned learning methodologies have their particular advantages, depending on the nature of the knowledge being provided. For instance, problem based learning (PBL) is the proper methodology to develop creative thinking and problem solving, using problems as a starting point for the acquisition and integration of new knowledge. In this methodology, lecturers/trainers use real-life problems to be discussed by students/trainees, in the search for the better solution.

5. How relevant do you consider training, reskilling/ upskilling the workforce in the use of **digital and data-driven technologies** such as big data, Internet of Things, artificial intelligence, etc...?

Considering the continuous increase in the port and ship operations' automation towards autonomy, it is expected to have more and more Artificial Intelligence (AI) systems, namely Decision Support Systems (DSS), which implies an increasing number of sensors, actuators, communication devices, and so on. To properly deal with this new reality, for the majority of the ports, it is of the most importance to invest

in the upskilling and reskilling of the workforce, especially in the following dimensions:

- Robotics and automation
- Data analysis
- Systems integration.

Regarding particularly the reskilling perspective, once again, an important effort has to be put in place in the soft skills dimension to prepare mentalities to evolve in this higher technological dimension. For instance, literacy on Information and Communication Systems and Decision Support Systems is particularly relevant. To illustrate this need, we may observe workers that, having a new electronic tool that allows to develop a particular function by teleworking, do not check or validate the correct execution of the expected action, leading to potentially critical incidents. It is crucial to teach persons that technology may replace people at the execution level but does not substitutes people in the verification and validation levels of work.

6. Is the progressive introduction and the increasing relevance of **21st century skills** within the training offer important?

Even though the majority of the interlocutors are/were not aware of the 21st century skills approach, after being explained the concept they fully agree on the need to include such elements in education and training. The most emphasized aspects are in line with those above mentioned on point 2 (perceived gaps – soft skills) but, becoming aware of the 21st elements, even in a slight way, two aspects assume relevance:

- Flexibility and
- Accountability.

Flexibility as a tool to prepare people to the multidisciplinary work which is a need in the port and maritime reality and Accountability to fight the noticed increasing every day irresponsibility.

7. If you had to establish **priorities**, which of the following would be the first for you: Higher Education, Apprenticeship training, Work-Based training, any other way?

Currently, the busy lifestyle of adults already in the workplace gives no time to attend formal training classes, either in universities or in training centres. Thus, virtual training and e-learning are increasingly important as a means of promoting re-skilling in a way that is more tailored to individual requirements. On the other hand, every time it is possible to train people in the work context, this has to be the preferred model. On job training and work-based learning are, in this way, methodologies to be implemented in line with each reality.

Regarding young workers and others about to integrate the port and maritime workforce, specific education and training programs should be (re)designed in order to better implement training programs fully aligned with the sector reality. Once again, the work-based learning approach assumes particular relevance.

From the student point of view, work-based learning in a modular scheme allows students to choose modules they feel a vocation to, leading to a better alignment between the new worker's objectives and employer's objectives.

8. How to increase the **attractiveness of maritime careers** for graduates and early-career skilled workers by promoting ocean literacy?

Promoting ocean literacy is naturally important but, in order to attract young people for a maritime career, campaigns promoting general information and awareness about ocean potentialities and what can go wrong due to human interactions are not enough.

To attract people to a maritime career some concrete actions need to be implemented, such as:

- Modernize training programs, including the above-mentioned skills and, particularly, education and training organizations need to focus on achieving excellence rather than increase coverage

- Improve communication with universities and training centres, bringing a clear message to the students on how port and maritime sector is leading technology development and implementation and the amazing dimension of Strategic Logistics and Supply-Chain management, for instance
- Assure new potential workers that coming to this sector gives them differentiated skills and competences that will be valuable tools whenever they wish to move to another sector
- Port and maritime sector needs to develop a world-renowned capabilities and reputation which will undoubtedly be decisive to attract people to join the workforce.

9. How to enhance visibility and promote the **role of women** in the maritime sector, regarding the enforcement of women presence?

Looking at the available figures related to gender distribution, two different realities may be perceived in the sector: in the port and shore activities the relative number of women compared to men is much lessunbalance them when compared to maritime activities, meaning that the number of women on board of ships is in fact is indeed very low.

In the interlocutors' view, the above-referred actions to attract people expectedly will have success in attracting women to the sector. However, a particular action should be implemented to highlight the positive challenge for a woman when embracing a maritime career, similarly to what has been done by navies with encouraging success. This and the assurence of providing equal job opportunities, pay and recognition, may significantly improve the attractiveness of the sector to women.

At the education and training institutions level, gender-specific fellowships and dedicated funding encouraging women students, along with requirements to increase study positions reserved for women, have to be considered, adjusted and implemented.

10. How valuable do you find the development and implementation of **meeting points** for the most relevant stakeholders from industry, academia and research, to periodically discuss important aspects – what could be the better way?

From the interlocutors' perspective, a structured and permanent collaboration between the port and maritime industries and the education and training sector assumes an important role to tackle the need of aligning the required competencies with the skills provided. In particular, the following points may have a positive contribute to reach the desired objective:

- Establishing a permanent industry led collaboration platform which will better help on clarifying the type and degree of the required skills
- Easing the involvement of specialized professionals from the port and maritime industries to provide teaching and training that are effectively focused on the sector reality
- Involving the sector in redefining education and training programs will definitely have a positive impact on the alignment between required competencies and skills provided
- Involving port and maritime authorities in this space of knowledge, along with industry and academia, will strengthen the basis for a successful approach regarding the reduction of the existing misalignment.

The so-called "meeting point" or the "knowledge triangle" (authorities, industry, academia) are important platforms with a particular role in the reskilling/upskilling actions, by allowing a wide involvement of all stakeholders when a new high-education programme is to be launched, positively contributing to the sector's training needs satisfaction and, at the same time, to raise the attractiveness to young workers and improve the employability of students.

Existing High-Education Programs

Having a global picture of the end-user needs in terms of the desired competencies, a review of the existing high-education offerings in the field of Logistics potentially applied to maritime domain, has been made in order to clarify how and to what degree this offer is aligned with and covers end-user needs.

In Europe there are more than 200 universities working in logistics related areas, approximately 30 graduate or postgraduate curricula, degree or program related to Logistics, Supply Chain Management, Maritime Engineering or Maritime Management. There is, in fact, some interesting high-education programs and, from those and according to EduMaritime[1], the best graduate and postgraduate programs in Europe are shown on table 2.

Table 2 - Best graduate and postgraduate programs in Europe according to EduMaritime (2018)

Country	University	Area	Graduate and Postgraduate Programs
Greece	Piraeus University of Applied Sciences (Technological Education Institute of Piraeus)	Manage Business Operations and Supply Chain & Naval Automation; Shipping and Transport Technology	PSP in New Technologies in Shipping and Transport (1 year)
	University of The Aegean (UAegean)	Shipping, Transport and International Trade	PSP - Shipping, Trade and Transport; MSc in New Technologies in Shipping and Transport (1 year); MSc in New Technologies in Shipping and Transport (2 years)
	American College of Greece (ACG) & ALBA Graduate Business	Shipping Management, Finance,	MBA in Shipping (1 year full-time, 2 year part-time); MSc in Shipping Management (1 year full-time, 2 year part-time); MSc in International Shipping and

[1] *Edumaritime network has been founded in 2012 and is a global maritime and logistics education & training media company catering to audience across United States, UK, Europe, Australia & New Zealand, Far East and Asia.*

	School	Logistics, and Supply Chain Management	Finance (1 year)
	Business College of Athens (BCA)	Shipping and Maritime Business Studies Education	MSc Shipping Business (1 year Full-time, 2 years Part-time); MSc Shipping (e-Learning)
Italy	MIP Politecnico di Milano	Supply Chain Management Education	MSCPM - International Master in Supply Chain and Procurement Management (Full-time, English, 1 year); GEMOS - Global Executive Master in Operations and Supply Chain (Part-time, English, 1 year)
Spain	Technical University of Catalonia (UPC)	Maritime Technology & Transport; Marine, Naval & Nautical Engineering; Shipping & Marina; and, Supply Chain	Masters Degree in Nautical Engineering and Maritime Transport (1.5 years); Master's degree in Naval Architecture and Ocean Engineering with Major in Yacht and Pleasure Craft Design Or Ocean Energies (2 years); Master's degree in the Management and Operation of Marine Energy Facilities (1.5 years); Masters Degree in Supply Chain, Transport and Mobility (2 years); Executive Masters Course in Lean Supply Chain Management - Directing Operations and Logistics (Spanish - 1 year); Masters Program in Shipping Business (Spanish - 1 year); Masters Degree in Coastal and Marine Engineering and Management (CoMEM) (2 years - for Erasmus students); Postgraduate Program in Harbor Management (Spanish - Approx 6 months)
	Escola Europea de Short Sea Shipping	Intermodal Logistics Training	
	Zaragoza Logistics Center (ZLC)	Logistics & Supply Chain Management Education	MIT-Zaragoza Master of Engineering in Logistics and Supply Chain Management (ZLOG); Blended MIT-Zaragoza Masters; MIT-Zaragoza-Ningbo Master of Engineering in Logistics and Supply Chain

			Management (3C Program); Master in Supply Chain Management (MDSC)
Turkey	Yaşar University	International Trade & Logistics Management and Maritime & Port Education and Training	MA in International Trade and Finance; MA in International Logistics Management
Denmark	Copenhagen Business School (CBS)	Shipping, Logistics and Supply Chain Management Education	MSc in Economics & Business Administration (Supply Chain Management) - 2 years - Full-time Taught in English; Executive MBA in Shipping & Logistics (The Blue MBA) - 22 months - Part-time Taught in English
	Aarhus University (Aarhus Universitet - AU)	Logistics and Supply Chain Management Education	MSc in Logistics and Supply Chain Management (2 years)
	Technical University of Denmark, (DTU)	Transport & Logistics, Maritime Engineering, and Offshore Wind Energy Education and Research Programs	MSc Engineering Program in Transport and Logistics; Nordic Master in Maritime Engineering; MSC in Offshore Wind Energy (2 years)
	University of Southern Denmark (SDU)	Global Logistics & Supply Chain Management, and Maritime Archaeology Education	MSc in Economics and Business Administration - Global Logistics and Supply Chain Management (Odense, 2 years); MA in Maritime Archaeology (Esbjerg, 2 years)

Finland	Aalto University	Logistics & Service Management	Masters Program in Information and Service Management with Specialization in Logistics and Service Management (English, 2 years); Nordic Master in Maritime Engineering (NMME) (English, 2 years)
	Satakunta University of Applied Sciences (SAMK)	Logistics Engineering, Marine Technology and Maritime Management	Postgraduate program: Master's Program in Maritime Management (Master of Marine Technology or Master of Engineering Online & Blended Learning - 1.5 to 2 years)
	Helsinki Metropolia University of Applied Sciences	International Business & Logistics Education	-
Norway	BI Norwegian Business School	Shipping Management, Logistics & Supply Chain Management and Ocean Industries Education	MSc in Business - Logistics, Operations, and Supply Chain Management Major (2 years, full-time); Executive MBA (EMBA) Ocean Industries (1.5 years, Part-time)
	Molde University College (HiMolde)	Logistics, Supply Chain Management and Petroleum Logistics	MSc in Logistics (2 years) and in in Petroleum Logistics (2 years)
Sweden	World Maritime University (WMU)	Maritime, Logistics, Port & Energy Education, Research & Training	MSc or Postgraduate Diploma in Maritime Affairs; MSc in International Transport and Logistics ITL (Shanghai, China); MSc in Maritime Safety and Environmental Management MSEM (Dalian, China); PG Diploma in Executive Maritime Management offered in pertnership with DNV GL (11 months); PG

			Diploma in Marine Insurance (1 Year - Distance Learning); PG Diploma in Maritime Law (1 Year - Distance Learning); Postgraduate Diploma in Maritime Energy (1 Year - Distance Learning)
	Jönköping University (JU)	Logistics and Supply Chain Management	MSc with major in Business Administration (International Logistics and Supply Chain Management) - 1 year
	Lund University	Logistics & Supply Chain Management Education	MSc in Logistics and Supply Chain Management (2 years, Full-time)
	Linnaeus University (LNU)	Maritime Training at Kalmar Maritime Academy and Logistics & Supply Chain Management Education at LNU	Master of Social Science or Master of Science in Business and Economics with specialization in Business Process Control and Supply Chain Management
Latvia	Transport and Telecommunication Institute (TSI)	Transport & Logistics Education and Research	Master of Social Sciences in Transport and Logistics: (2 years Full-time, 2.5 years Part-time)

The analysis of the available information allowed us to conclude that the programs closer to Maritime Logistics Engineering and Management have an approach essentially at the operational level or at the Applied Logistics level, with less emphasis on Strategic Logistics or Logistics Engineering. As mentioned above, although there are approximately 30 graduate or postgraduate courses related to Logistics, Supply Chain Management, Maritime Engineering or Maritime Management, none of these develops the concept of Integrated Logistics or Maritime Engineering and Management.

Conclusions and Recommendations

Conclusions

After identifying/reviewing:

- Key port and maritime stakeholders' needs, values, and objectives
- Logistics Engineering and Management state of the art
- Previous projects, studies and relevant entities perspectives,

the following conclusions may be drawn:

1. From studies, projects and relevant entities perspectives

    - A clear consensus on the existence of a growing skills gap affecting in particular knowledge intensive sectors, with particular emphasis on two factors:

        - A skills mismatch between labour market needs and the output of educational institutions

        - A lack of communication and cooperation between education and industry to efficiently align supply and demand.

    - It is also consensual among stakeholders and interested parties that the ageing of the industry's workers is a reality, suggesting that one of the most important challenges is generational change and the transfer of information and experience to young workers. To this end, improving the image of the sector in order to attract workers and increase the participation of women, are key factors to maintain competitiveness, as well as labour mobility between regions. Moreover, it is very important to achieve a high level of training and acquisition of skills to improve the productive capacity of enterprises. Thus, it is crucial to adapt and evolve existing education and training programs providing more and more skilled workers to the sector.

2. From key stakeholders in the port and maritime sector

- The investment in education and training in the port and maritime sector is crucial to help the sector acquiring proper competences and to increase performance and competitiveness. Although more than an increase in the amount of investment in education and training, the focus needs to be in the alignment between required competences and provided skills

- The main skills gap exists, essentially, in the following skills typologies: Technical, Management, Digital, Green and, last but not least, Soft skills. In the field of Technical skills, Integrated Logistics and Value Chain Management assume particular relevance

- Technical skills have to be developed and improved in a balanced way with soft skills and, in this dimension, Values, Communication, Leadership, Accountability and Creativity have been highlighted

- Students/new workers should have the possibility of developing specific training in the port and maritime field granting them the proper knowledge of this specific reality, both in the technical and cultural domains. Methodologies of training, such as on-job-training and Work-Based Learning, are considered to be adequate solutions

- Regarding workers already in the workplace, the busy lifestyle of adults leaves no time to attend formal training classes, either in universities or in training centres, which raises the need for virtual training and e-learning and, whenever possible, to develop the training in the field, on-job-training and Work-Based Learning

- The increase of the sector attractiveness is a must and, in order to attain this target, important actions must be undertaken, such as training programs modernization, communication improvement among academia, authorities and the sector, the development of world-renowned capabilities and reputation

- To attract women to a maritime career, a particular action should be implemented to highlight the positive challenge for a woman when embracing a maritime career

- The design and implementation of a “meeting point” or of the “knowledge triangle” (authorities, industry, academia) may assume a decisive role in the reskilling/upskilling actions, contributing to the sector’s training needs satisfaction and, at the same time, to raise the attractiveness to young workers.

3. From existing education offerings in Europe on Maritime Logistics Engineering and Management

    - Despite that there are approximately 30 graduate or postgraduate courses related to Logistics, Supply Chain Management, Maritime Engineering or Maritime Management, none of these develops an Integrated concept in the field of Strategic Logistics, such as Maritime Logistics Engineering and Management.

Recommendations

Considering the relevant data in this report and particularly the conclusions, in the framework of the MarLEM proposal and Grant Agreement, the following recommendations to the MarLEM project and to the involved entities should be considered:

- Assuming the existence of gaps and needs in higher education related to the port and maritime sector, the development of a Master degree program in Maritime Logistics Engineering and Management has to be designed regarding the filling of those gaps and needs, aligned with the "XXI Century Skills / Learning" approach and with the OECD Conceptual Framework for Education for 2030

- Having in mind that Industrial Engineering and Management is considered more and more an excellent area of education, providing professionals with proper skills to the industrial environment, this master degree program in Maritime Logistics Engineering and Management, in an innovative approach, has to be build on the concepts of Integrated Logistics and Industrial Engineering and Management, adapted to the Maritime reality

- To establish a view “from the sea to shore”, the program needs to be structured based on the “market voice”, integrating port and maritime industries needs and perspectives, in order to assure that the “process voice” from academia will develop the desired skills regarding the enhancement, of also, entrepreneurial competences

- To design and plan an adequate balance between technical skills and soft skills and engineering and management dimensions, to help students to better cope with port and maritime culture, which is an important step to their success and companies’ competitiveness

- To plan and implement a training approach “from practical to conceptual”, supported on Project Based Learning and Work Based Learning, meaning that every student will develop and implement a concrete project applied to the maritime reality, establishing the basis for a more favourable framework regarding the development of student’s entrepreneurship capabilities, allowing them to more easily put in place their own ideas, projects, products or start-ups

- To assure the availability of relevant experts to teach and train students, including the involvement of specialized professionals from port and maritime domain

- To validate the education and training effectiveness, i.e., the alignment between the Master Course results and its objectives and expected results, with a confidence level of 90%, by the continuous monitoring of remaining skills gaps and mismatches

- To foster cooperation within the education sector, affirming the master program as a Joint Master Program at European level (as in MarLEM's Proposal and Grant Agreement), which will strengthen mobility of students, teachers and maritime professional trainers in line with Erasmus+ program

- To ensure the certification of the Master Degree Program is in accordance with EU regulations in the European Higher Education Area (EHEA), by Portuguese, British and Greek authorities (respectively A3ES, QAA and HQA), enhancing the attractiveness to students and professionals, through the Master Program's recognition and certification at EU level, increasing career value

- To provide the relevant technical and operational recognition of the Master Program by Port and Maritime Authorities, such as International Maritime Authority (IMO), DG MARE, EMSA and EU members Port and Maritime Authorities

- To disseminate the Master Program embracing Academia and Industry environments, assuring the broad reaching of students and industry professionals, targeting around 50 000 students and maritime workers

- To establish the proper framework and the development of an an Atlantic regional Knowledge Triangle Network involving, from Industry vertex, port and maritime clusters and companies, from the Academia vertex, Universities related to port and maritime or industrial engineering and management and, from Authorities vertex, port and maritime authorities, as well as education authorities in the framework of European Association for Quality Network

- To set the basis for an easy transfer of the collaboration platform to North Sea and Mediterranean Sea realities, encouraging and supporting the adoption and

implementation of the Knowledge Triangle Network in North Sea and Mediterranean Sea realities.

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