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History of Changes

Table 1: History of changes

Version	Publication date	Changes
1.0	21.04.2023	Initial version for discussion and submission

Contractual aspects

Project: Maritime Logistics Engineering and Management (MarLEM)

https://grupoqualiseg.com/marlem

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Participant(s) – Project Coordination Team members

Collaboration – All consortium partners

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Legal Disclaimer

The project Maritime Logistics Engineering and Management (MarLEM) has received funding from the European Commission (EC), Executive Agency for Small and Medium-sized Enterprises (EASME), European Maritime Fisheries Fund (EMFF), under grant agreement No. 863713.

1. Executive Summary

The main objective of this report is to synthesize the relevant aspects of the MarLEM project implementation and, above all, is to provide the main conclusions and recommendations that might allow the proper exploitation of the project outputs: the Master Program and the Atlantic Knowledge Triangle (AKT).

This report is structured by parts for a better development and understanding of the hereinafter described matters, as follows:

- Part 1 – describes the relevant results, aspects and/or conclusions resulting from Interviews and interactions with MarLEM partners and the main actors from the port-maritime sector are hereinafter presented, and results obtained from the survey that has been conducted with MML master program candidates, as well

- Part 2 – provides a state of play of the Atlantic Knowledge Triangle development and implementation, namely involved organizations, ongoing projects, initiatives/projects in the design phase and research & Innovation areas and investment

- Part 3 – provides a contribute on the implications and impacts for workforce skills of mega-trends driving change across the Maritime Logistics sector. Two critical mega-trends have been considered and "dissected": Maritime Decarbonisation and Maritime Digitalisation.

As can be withdrawn from the whole report and particularly from the conclusions, the MarLEM project achieved its main objectives, namely to launch the Master Program in Logistics (MML) and the Atlantic knowledge Triangle (AKT).

2. MarLEM's Objectives

MarLEM addresses the EMFF-02-2018 Blue Careers, mainly focused on the "lack of entrepreneurial skills" challenge, but also regarding the two other challenges as follows. Relevant objectives' indicator are:

a) Lack of entrepreneurial skills

Ultimate Objective – To develop a **Master Course in Maritime Logistics Engineering and Management**.

b) Lack of structured, defined and continued collaboration between industry and education/training

Ultimate Objective – To establish a "platform" involving, in a permanent basis, **industry, university and interface entities**.

c) Lack of "skills ecosystems" at sea basin level between education, industry and public authorities

Ultimate Objective – To develop a **Knowledge Triangle Network involving Industry, Universities and port, maritime and education Authorities.**

3. Report development

3.1. Part 1 - Master Course in Maritime Logistics (MML)

The MarLEM master course concept, approach and structure has its basis in the technical pillar of Strategic Logistics and in the soft skills pillar in line with 21st Century Skills. Technical and soft skills ought to be integrated in the master course in a balanced way aiming at providing state of the art skills allowing the development of the expected competencies.

The MarLEM master course approach and methodology is based on the principles of the Quality Management with particular relevance to ISO 10015 and ISO 21001 International standards.

Introduction

To evaluate the master program's performance, in its launching phase, a survey has been designed and conducted through meetings (with MarLEM partners and other relevant port-maritime actors) and by sending a questionnaire to the master program candidates.

This survey has ben led by QUALISEG with NOVA, UoS and WEGEMT cooperation, in the development phase. All partners contributed for the survey discussion phase.

This survey integrates the main topics that have been considered important, by the MarLEM partners, to evaluate the Master Program attributes, such as design, planing, scheduling, etc…, in cooperation with relevant actors of the port-maritime dimension. This survey has ben led by QUALISEG with NOVA, UoS and WEGEMT cooperation, in the development phase. All partners contributed for the survey discussion phase.

For each topic, the relevant results, aspects and/or conclusions resulting from:

- Interviews and interactions with MarLEM partners and with the main actors from the port-maritime sector are hereinafter presented, and
- results obtained from the survey that has been conducted with MML master program candidates (listed in annex 1.1. at the end of the document). Quantitative results along this document can be checked in annex 1.2.

3.1.1 Master program relevant figures

The main figures of the 2022 “test” edition, are the following:

- Applicants number – 24 (see annex 1.1)
- Candidates that has been formally accepted – 6.

3.1.2 Technical program

Curricular units, credits and program

The Master Program received a **positive feedback (90,91%)** for each program’s course which allows the conclusion that the Master Program is well structured and designed.

Load distribution and schedules

Although NOVA SST received a **positive feedback (81,82%)** for each program’s course the following observations have been expressed:

- Working professionals find hard to conciliate the academic tasks with the professional careers also with the familiar commitments (for example, time with small children), meaning that the classes schedule, working days from 9 to 16 h, needs to be adjusted properly
- the requirement of face-to-face classes also creates constrains for professionals, sometimes they need to travel or having mandatory meetings during the class schedule
- candidates do not consider the “working student” benefits enough to support their participation in such a demanding master. According to the working-student regulation, the student can dedicate 6h/week from their working time to attend classes, also they can be exempt from work to do course’s evaluation like exams or tests.

Alignment with individual or collective needs

The Master Program received a **positive feedback (90,91%)** regarding the point above, meaning that a positive alignment with individual or collective needs exists.

Areas to be improved/enlarged (digital, green, automation,…)

The Master Program received a **positive feedback (81,82%)** regarding the point above, which allows the conclusion that the Master Program is well structured and designed.

Soft skills / technical skills proportionality

The Master Program received a **positive feedback (90,91%)** regarding the point above, meaning that an adequate balance between soft and technical skills is perceived by the candidates.

Teachers/Experts and Program credibility

The Master Program received a positive feedback (81,82%) which gives confidence that the Master's board of teachers and experts is well recognised by the candidates.

3.1.3 Program format

Students' requirements / profile

The Master Program received a **positive feedback (90,91%)** regarding the point above, meaning that the established requirements are being properly accepted by the candidates.

Accessibility, physical/virtual/hybrid formats

Even receiving **positive feedback (63,64%),** this slightly positive result expresses the candidates' will to have a higher level of virtual classes.

According to the NOVA SST pedagogical council, the classes need to be face-to-face. In exceptional cases it can be a hybrid format, this is the professor at NOVA SST facilities, and some students can join using the zoom platform.

The process of changing the master from face-to-face to on-line requires a new certification from A3ES (the competent authority regarding the Master Program certification). Also, NOVA needs to acquire/obtain the proper resources and infrastructure, as required by A3ES.

Teaching/learning methodologies

The Master Program received **positive feedback (81,82%)** which gives confidence that the selected methodologies are well recognised by the candidates.

Professionals / students specific programmes

The Master Program received **positive feedback (81,82%)** which gives confidence that the Master Program's courses are properly designed and planned.

Mobility, internationality

The Master Program received **slightly positive feedback (63,64%)** which, again, expresses the candidates' concerns related to the program's mobility capabilities.

3.1.4 Economical aspects

Fees, …

The Master Program received **very negative feedback (9,09%)** which expresses the candidates' perception that this is not a cheap program. A specific work needs to be developed to, at least, communicate the differentiating aspects of the program and its subsequent costs.

Financial support, subsidies,…

The Master Program received **very negative feedback (9,09%)** which, again, expresses the candidates' perception that the program has no specific financial support, for instance, to support costs related to the tuition fees and accommodation.

3.1.5 Added-value

Master degree value/recognition by the market, peers, individual/personal perspective, etc…

The Master Program received **full positive feedback (100%)** which gives full confidence that the program can be recognised as a valuable tool by the market in general.

The master as a tool to positively evolve in the organizations' career program

The Master Program received **full positive feedback (100%)** which gives full confidence that the program is recognised by the candidates as a valuable tool to increase their capabilities to evolve positively in their organizations and, if wanted, to apply to other organizations' jobs.

3.1.6 Other aspects

Professionals/students availability to attend the program

The Master Program received **negative feedback (45,45%)** which, again, expresses the candidates' perceived difficulties to attend the program. This, again, emphasizes the need for evolving the master program for a hybrid format.

Sector attractiveness for new students and professionals

The Master Program received **positive feedback (72,73%)**. This result can reflect the global perception of the candidates, by balancing the program's value (100%, see 1.4.1 and 1.4.2) with other aspects such as economics (9,09%), accessibility and mobility (63,63%, both).

Sector attractiveness for women

The Master Program received **negative feedback (36,36%)**; this result has not been, yet, properly clarified, perhaps reflecting the general perception that, even with a valuable program (as perceived), much more work needs to be done. From the discussion with MarLEM partners, the actions below have been recommended by the UOS Team:

- Creating funding opportunities for women engineers to participate in this programme
- run a targeted promotion campaign in the Association of Women in Science and the Society of Women Engineers
- use female figures in the promotional materials
- run 'Women in Engineering' type of activities to showcase successful women in the maritime industry.

Dissemination issues

The Master Program received **negative feedback (45,45%)** which emphasizes the need for higher investment in the program's dissemination and promotion at European, Africa and Asia regions.

3.1.7 Questions to reflect upon

Does the Master Program need technical or operational modules to be included to increase its attractiveness?

The proposed master's programme aims to upskill and train the learners in the area of maritime logistics through 60-ECTS taught modules. The programme also offers individuals an opportunity to build up their network through their fellow students. However, several recommendations are drawn here to increase the programme's attractiveness as below:

- Increase industry and academic collaborations through guest lectures and seminar series
- Provide more flexible learning options, where possible, for those who are not able to quit their job.

There are necessary adjustments in terms of classes schedule and the possibility to offer a hybrid solution for working students. NOVA SST is available to extend the classes in working days until 10 pm.

Some key parameters in this direction could be the following:

- Ensure recognition/accreditation by the major maritime countries (this is also related to the last question in this list)
- reduce (or completely remove) the compulsory physical presence of the course participants. This would reduce the living cost (for non-resident people) and the time spent away from the security of their jobs professionals could do the course after-work hours).

It is believed/perceived that this programme is a very good opportunity to upskill or reskill employers to take on new roles in ports or maritime companies. This may help employees to close the skill gaps in their companies.

Is it appropriate/necessary to improve and re-submit the master program to A3ES to increase its flexibility, attractiveness, etc…?

The process of changing the master from face-to-face to on-line requires a new certification from A3ES (the competent authority regarding the Master Program certification). Also, NOVA needs to acquire/obtain the proper resources and infrastructure, as required by A3ES.

To making considerable changes to the program, particularly concerning the implementation of a hybrid model, then will be appropriate and required by the certification authority.

Does a part-time Master's degree could be a way to go?

It may be attractive for some professionals who have a job or live in another country or have parental or caring responsibilities so that they have more time to finish the course. The University of Cambridge opened a part-time Master of Studies course, taking place over two academic years and the course is flexible enough to fit around the learners' jobs and other commitments. The part-time master's degree could be combined with a hybrid teaching mode so the provision of online learning may attract more students as mentioned above.

Is that possible to promote a hybrid teaching mode?

Hybrid teaching mode reflects more flexibility for the students and academics, not only during the pandemic but post-pandemic, as well. Nowadays, the University of Glasgow supports special education automation software for its students, allowing them to access the benefits of virtual reality teaching from their own places. Students enjoy materials created by the lecturers, download the lecture notes, watch recorded videos and take online tests, or access relevant audio and video material on their own time at their own pace. The software will also shift the responsibilities of lectures to spend less time on routine tasks. This new mode of learning can be utilised to attract more students.

This will create a very positive impact on the expansion of student enrolment and the course reputation worldwide.

Why not evolve to a master program's new version for students and/or a mixed program for students and professionals?

This may require more discussion to design a new version of the programme for students and/or a mixed program for students and professionals.

Incorporating recent university graduates together with existing professionals who wish to be upskilled or reskilled would probably improve the number of people joining the course.

According to the Portuguese legislation, this is only possible if we offer a master with 90 or 120 ECTS; NOVA/DEMI (the department responsible for delivering this master) does not have enough professors to do it by itself, which constitutes an opportunity to increase cooperation with MarLEM academic partners.

Why not seek for the support of the sector governmental structure to financially support the public and private organizations to invite their professionals to attend the master program?

This could be an excellent opportunity to increase the Master Program's attractiveness. There is European funding that goes via national channels for this kind of purposes. It would be a time consuming process though, depending on the level of bureaucracy of each country.

Regarding shipping companies sending their employees to join this Master's course, some discounts can be offered to these companies if they send above a certain number of students to join the programme. Right now, NOVA is offering a discount for companies that enrol more than 2 students.

Is it Africa a viable region to attract students / professionals or should we promote the program in Europe and/or Asia?

Expanding the scope of student enrolment and improving the dissemination of the project will play a positive role to attract more students and professionals. On the UoS perspective, potential markets for international student recruitment are India, China, Turkey and Indonesia.

According to NOVA's experience, african student have some (major) gaps in their academic degrees. In this case the best is to have for the first weeks just one shift with these students (not a segregation but an inclusion strategy) where the professor can work with them the main concepts and skill. Or we can use a tutorial strategy, with one professor being a tutor for one or more students.

With regard to the region, the focus should be given to Europe unless there is a particular requirement in the call of this proposal to consider non-European countries too.

3.2. Part 2 – The Atlantic Knowledge Triangle (AKT)

Regarding to provide a state of play of the Atlantic Knowledge Triangle development and implementation, this part of the follow-up report describes, on present time, how the AKT is evolving, structured by the following topics:

- Aim and rationale: Strategic Positioning, Mission, Vision and Scope
- The AKT space and involved organizations
- Ongoing projects
- Initiatives/projects in the design phase
- Research & Innovation areas and investment.

3.2.1 The AKT aim and rationale

Strategic Positioning

Knowledge creation and projection in the **port-maritime domain**, including sea-shore interaction.

Mission

To create conditions to promote, design and implement **research, development, innovation, training, standardization and related initiatives** to provide adequate skills, in line with required competences, contributing to strengthen the EU Atlantic Maritime Capabilities.

Vision

AKT aims at becoming a recognized Collaborative Platform, focused in the Atlantic Area, that promotes effective initiatives and opportunities for Knowledge creation and dissemination. By aggregating entities from Academia, Authority and Industry, AKT will become the adequate space for **creating ideas, raising consortia, launching projects and boosting, as a final purpose, the competitiveness of Atlantic Blue Economy**.

Scope

Potential fields of intervention in the AKT scope that have been defined, are:

- Maritime Engineering and Management
- Blue Digital
- Logistics, Ports and Transports
- Naval Industry
- Environment and Ocean Energy
- Defence and Security
- Safety at Sea
- Sea-shore interaction
- Resilience and Sustainability of the Port-Maritime Communities.

3.2.2. The AKT space and involved organizations

The **Atlantic Knowledge Triangle (AKT)** involves entities from Industry/Clusters, Universities/Research entities, and port-maritime and education Authorities, constituting a "platform" that promotes effective initiatives and opportunities for Knowledge creation and dissemination.

AKT has a clear focus on skills and competences development involving, presently, **62 organizations** (mainly centred in the Atlantic Area) from **13 countries.** Special relevance for **2 associations/clusters (ENMC and WEGEMT)** that work at **European level**; see table 2.

Table 2: AKT partners and respective countries of origin

Partner Name	Country
ACADEMIA/RESEARCH (25)	
C2TN - Centro de Ciências e Tecnologias Nucleares	PT
Centro de Formação Profissional das Pescas e do Mar	PT
Centro de Formação Profissional e Superior	ST
Consorcio para el diseno, C. E. y E. de CANarias (PLOCAN)	ES
École Nationale Supérieure Maritime	FR
Escola do Mar dos Açores	PT
Foundation for Research and Technology - Hellas	GR
Hellenic Centre for Marine Research	GR
INOV, Instituto de Engenharia de Sistemas e Computadores, Inovacao (INOV)	PT
Instituto Profissional dos Transportes e Logística da Madeira (IPTL)	PT

Konrad Wolf Film University of Babelsberg	DE
Mar Ambiente e Pesca Artesanal	ST
Marine Institute	IR
Munster Technological University	IR
Nantes Université	FR
National Maritime College of Ireland	IR
Technische universiteit Delft	NL
Universidad de La Laguna (ULL)	ES
Universidad de Murcia	ES
Universidade de Coimbra (UC)	PT
Universidade dos Açores (UAc)	PT
Universidade Nova de Lisboa (UNL)	PT
Université de San-Pedro	CI
University of Malta	MT
University of Strathclyde (UoS)	UK
INDUSTRY/CLUSTERS (24)	
Aclunaga - Cluster del Naval Galego	ES
Asociacion Centro Tecnologico Naval y del Mar	ES
Asociación Cluster Canario del Transporte y la logística (CCTL)	ES

Associação Comercial e Industrial do Funchal (ACIF)	PT
CMC – Cluster Maritimo de Canárias	ES
Decel – auditoria, consultoria e serviços, lda	ST
Ecosistemas Virtuales y Modulares S.L. (EVM)	ES
Estaleiros Navais de Peniche, SA (ENP)	PT
European Network of Maritime Clusters – ENMC	EU
Fórum Oceano – Associação da Economia do Mar (FO)	PT
GCE Ocean Technology	NW
Managing Company of Science and Technology Park of Crete SA	GR
Maritime Cluster Northern Germany	DE
MSE International	UK
Naval Architectural Services	MT
P&O Maritime	MZ
Pole Mer Bretagne Atlantique	FR
Port Maputo	MZ
Qualiseg, Engineering and Management (QS)	PT
Represe, Lda	ST
Stichting STC-Group (STC)	NL
Strategis – Maritime ICT Cluster	GR

Vipa Connect, Lda (VGPC)	PT
WEGEMT – Marine University Association	NL
AUTHORITIES (13)	
Administração dos Portos de Sines e do Algarve	PT
Agência de Promoção do Comércio e Investimento	ST
Agencia Regional Desenvolvimento da Investigacao, Tecnologia e Inovacao (ARDITI)	PT
Autoridad Portuaria de Santa Cruz de Tenerife (APSCT)	ES
Direção Geral da Autoridade Marítima	PT
Direção Geral de Recursos Naturais, Segurança e Serviços Marítimos	PT
Direção Regional do Mar	PT
Dirección General de la Marina Mercante	SP
EUROCRIME (EC)	IT
Gabinete para os Acidentes Marítimos e Aeronáuticos (GAMA)	PT
OBECEF (OB)	PT
Portos dos Açores (PA)	PT
Irish Maritime Development Office (IMDO)	IR

Table 3: Organizations' roles

Organization	Role and Contribution
University/ Research entity	Universities and Research entities bring cutting-edge knowledge that will be applied on the design, development and implementation of defined actions such as training programs, applied research and mobility actions.
Industry / companies / SMEs	Industries play an important role in AKT by bringing continuously the 'market's voice', meaning they feed the interface from the industrial/economic side. They give inputs in the design and development phases and collaborate on the validation of developed actions to be implemented. Industrial partners also cooperate in the projects' follow-up, dissemination, and results' exploitation.
Clusters / maritime sector representatives	Associations, clusters and other societal representatives will be actively involved in the development of the situation analysis, usually the first phase of any project. They are always involved in the design, development and implementation of defined actions. They also cooperate in the dissemination of the projects and the results' exploitation.

3.2.3. AKT initiatives and projects

Since the AKT launching, some important initiatives and projects have been initiated, as listed hereinafter. It is important to stress the main focus on research & innovation applied to skills/competence and capability development.

Ongoing projects

Mobility for Maritime Logistics (M4ML)

M4ML has a close connection with MarLEM, building synergies and developing cooperation between higher education institutions located in Portugal and Norway.

M4ML project aims at promoting and support the bilateral exchange between Portugal and Norway of students/trainees, teachers and lecturers within the domain of Master programmes in Maritime Logistics, whilst contributing to the improvement of the curricula and to develop innovative learning materials in the scope of the referred programmes, and in particular in the context of a new master degree that is exclusively dedicated to graduate professionals and lifelong learners. In order to achieve the referred project aim, the following objectives were defined:

- Provide mobility and exchange opportunities to Portuguese and Norwegian students/trainees as well as Teachers, Lecturers and Researchers within the domain of Master programmes in Maritime Logistics;

- Contribute to the improvement of the Maritime Logistics Engineering and Management curricula of the involved academic institutions, namely with the integration of the Sustainable Development Goals (SDG) in maritime logistics themes;

- Contribute to the development of innovative learning materials in the domain of the maritime logistics engineering and management curricula;

- Encourage mutual learning between European industries and academics in the Blue Economy field.

The MarLEM Master Program, can benefit from the M4ML process of knowledge and experiences transfer, expanding their knowledge regarding maritime logistics, identifying and incorporating good practices from the entities and countries involved and thus strengthen their teaching and researching skills, and increasing the number of students engaged with these topics.

Marine Pollution Control Simulator (MPCS)

The MPCS project aims at developing a cloud-based tool easily reachable through different platforms (mobile, tablet, or laptop), that allows the providing of training, exercising, assessment, and performance evaluation of the marine pollution control, at different levels, namely:

• Collective and Individual competence

• regional, National and Supranational levels

• small and large-scale scenarios.

Observing the state of the art, MPCS is an innovative tool considering the following aspects:

• No similar tools in the marine pollution control or related area were found, so far

• MPCS is adjustable to individual or collective training and exercising, allowing the development of Collective Competence in a virtual environment; state of the art virtual simulation tools are focused in the individual competence development

• MPCS will allow the Response Capacity Assessment of the involved actors facing an incident-based in the potential pollution scenarios.

Supported in Mathematical Models, Discrete-Events Simulation (DES) and Game-based Learning (GBL), MPCS adopts the game approach as a learning experience to allow the player to understand the subject matter within a real-world context. This approach improves the interface, increases actors involvement, therefore constitutes a better tool for competences acquisition. Particularly, the Massive Multiplayer Gaming (MMG) technique allows the simultaneous involvement of several players located in different places, making possible to assess the performance of the team that is facing a specific scenario (i.e. oil spill) without employing physical means, needed on a real environment exercise.

Capacity Building in the field of Maritime Vocational Education and Training (CBM-VET)

CBM VET aims to support the relevance, accessibility, and responsiveness of VET institutions and systems in São Tomé e Principe, as a driver of sustainable socio-economic development. Bearing this in mind, CBM-VET, with a specific focus on the port/maritime and fisheries domain, aims to develop a transnational cooperation platform that builds (or improves) local capacity in vocational education and training in order to tackle societal, technological, and economic challenges in São Tomé e Principe.

IPTL, Qualiseg and EVM, organizations established in the EU Member States that are applying to this call, are, among other fields, experts in VET projects, granting quality assurance mechanisms, in the maritime and fisheries domain, creating educational programmes based on digital tools (commercial and in-house developed) for both trainees and trainers, as well as establishing a proper interaction between the providers of education, target audiences and market needs. Proof of this, is all the previous projects these companies have worked on, at National and International levels.

In addition, IPTL, a VET institution, duly recognized by the Portuguese educational and maritime authorities, in September 2021, during a visit of a delegation of São Tomé e Principe government to its facilities in Madeira Island, was also challenged to help STP in the process of providing skills and competences to their seafarers and also to “paliês” (women that sell fish in the local markets).

Initiatives/projects in the design phase

Initiatives or projects in the design phase mean, in practical terms, that they are in the phase of seeking for adequate funding. All projects hereinafter described are in the proposal stage and, some of them, as already been submitted for funding to EU funding schemes such as Erasmus+, EMFAF or UCPM.

The Atlantic Centre of Vocational Excellence (ACoVE)

This project is seeking for funding in the scope of the Erasmus+ Programme and involves, directly, 21 different organizations (SMEs, port-maritime clusters, universities, apprenticeship schools and authorities) from 9 countries.

Atlantic Centre of Vocational Excellence (ACoVE) aims to design, develop and implement a Centre of Vocational Excellence to raise a transnational cooperation platform in education and training. ACoVE strategic positioning is based on applying innovative approaches to tackle societal, technological, and economic challenges of the European Atlantic countries, and countries in the scope of the WestMed Initiative.

ACoVE's vision is the vanishing of the barriers/frontiers between EQF3 to5 and EQF6 to 8 levels of learning, extending what we are doing in other projects (e.g., MarLEM, …) and in the scope of the Atlantic knowledge Triangle (AKT).

ACoVE will launch a cooperation network in a basis of a Knowledge Triangle concept: Industry will articulate with Apprenticeship schools and with Universities to establish the better framework for skills development, continuous improvement and needs fulfilment, to attain Excellence.

ACoVE project established the following specific objectives:

- **End-users' involvement and needs' satisfaction** - ACOVE aims to increasingly involve end-users from the port-maritime sector regarding to acquiring the "Customer Voice" and, in this way, the Customer Satisfaction or the satisfaction of end-user needs

- **Introducing innovative teaching and training methodologies** - ACoVE will develop a thoroughly situation analysis of the port-maritime actual and future reality in terms of skills and competences, particularly related to digital, green, resilience and sustainability

- **Designing, Developing and Implementing teaching and training actions** - based on the output of the situation analysis, the Gap Analysis report, ACoVE will guide its intervention related to the education and training providing in line with EU priorities

- **Creating education-industry-public authorities' networks at sea basin level,** by:

    - Establishing the basis for an Atlantic regional Knowledge Triangle Network involving, from Industry and societal vertex, port and maritime clusters, associations and companies, from the Academia vertex Apprenticeship Schools and Universities related to port and maritime and, from Authorities vertex, port and maritime authorities, and education authorities as well

    - Having a strong cooperation between Apprenticeship Schools and Universities, it will foster cooperation within the education and training sector which is of the most relevance to meet present and future demands, since it requires significant expertise and resources. Nevertheless, this cooperation at international level will strength mobility of students, teachers, and maritime professional trainers in line with Erasmus+

    - Enforcing the industry perspective, with the lead of an entity of the interface Industry/University, an SME specialized on the Port and Maritime sector and the cooperation of maritime clusters and port and maritime management companies

    - Enhancing the attractiveness for students and professionals by granting the recognition and certification of the provided training by the International Maritime Organization, at global level, increasing career value and workforce mobility.

- **Establishing appropriate governance and fund raising**, by:

    - Establishing a quality culture supported on the implementation of a quality management system in accordance with ISO 21001 - Management Systems for Educational Organizations – standard and the best practices of the EQAVET Framework

- Implementing a Quality and Innovation Management System to assure the compliance with EQAVET Framework, supported in the ISO 21001 and ISO 56003 international standards, which will end on the ACoVE certification

- Establishing appropriate coordination mechanisms employing the best practices of the ISO 44001 standard to assure the attaining the desired collaboration of ACoVE members and the achieving of the best possible resultsDesigning and implement and adequate structure and associated mechanisms to grant that ACoVE is permanently aware of the funding opportunities to fund new ideas/projects, new education and training programs, and arising opportunities.

The Atlantic Maritime Research Centre (AMRC)

The Atlantic Maritime Research Centre (AMRC) is a project proposal that aims at developing an Excellence HUB for Port-Maritime Research and Innovation (PMR&I), with its "epicentre" at the EU Atlantic ultra-peripheral regions of Azores, Cabo Verde, Canary and Madeira Islands. AMRC involves, directly, 19 different organizations (SMEs, port-maritime clusters, universities, apprenticeship schools, authorities) from 6 countries.

The strategic positioning of AMRC is fully aligned with European Union strategies and priorities, such as the Green Deal, Digital Transition and, once AMRC is focused on PMR&I, it will have a particular alignment with the Atlantic Action Plan 2.0. AMRC also contributes to the 2020 EC's framework of 'European Education Area', to The Digital Education Action Plan (2021-2027), the European Skills Agenda for sustainable competitiveness, social fairness and resilience, matches the key principles of the Pact for Skills Charter, and relates with the working paper issued by Cedefop & ETF (2020): "The importance of being vocational, challenges and opportunities for VET in the next decade" in which age neutral upskilling pathways are being promoted.

The PMR&I to be provided by the AMRC will allow the proper framework and leverage to develop technologies and innovative solutions for better and sustainable exploitation of sea and ocean resources such as the design, building and operation of vessels, harbours and more widely any kind of human-related activity centred around ocean and coastal resources.

The AMRC's scope is: "Maritime Research and Innovation that brings technologies and innovative solutions for better and sustainable exploitation of sea and ocean resources such as the design, building and operation of vessels, harbours and more widely any kind of human-related activity centred around sea and ocean resources". AMRC will develop PMR&I, focused on the following domains, which will constitute the AMRC's pillars:

- **Sustainable and Resilient Oceans and Coasts** – developing new (or reforming the) ways of doing and, by this way, lowering the activities' impact on marine and coastal environment aiming at reducing emissions under the "Fit for 55" package 1, aiming to reach a 55% reduction in GHG emissions by 2030 relative to 1990 and be carbon neutral by 2050

- **Education and Training** – skills and competencies innovation, supported on new digital and virtual ways/methods, as particular relevance to the involvement of simulation and augmented reality, to reduce the skills' gap or misalignment, to attract professionals to port-maritime activities and to improve gender equality

- **Safety and Security** – planning for developing and applying disruptive technologies such as Blockchain 4.0 to port-maritime security and to food-supply chain and, Behaviour Based Systems and digitalization to improve port-maritime safety.

Maritime sAfety and opeRationaL EfficiencY (Marley)

This project aims to bring internationally leading scientific institutions, namely the Univ. of Southampton and Delft Univ. of Technology, with NOVA and Qualiseg Ltd from the widening country, to enhance networking between the participating institutions, to enhance scientific and technological capacity in the area of maritime safety and operational efficiency through knowledge exchange and transfer, to raise the research profiles of the coordinating institution and their staff, to improve the capability to apply for competitive research funding, and to strengthen the research management and administrative skills of the coordinating institution.

The Marley project encompasses the following specific objectives:

- To deliver improved excellence capacity and resources to the linked institutions with a principal focus on NOVA, by means of organising short specialist courses, providing opportunities of high quality learning through summer/winter schools, developing an e-platform to facilitate distance learning, and organising short-term visits between the partners

- to enhance strategic networking activities of the partners by linking NOVA with two internationally leading institutions in the area of maritime safety and operational efficiency and with national, regional and with international authorities and stakeholders networking and knowledge exchange activities, communication, dissemination & exploitation

- to raise the reputation, research profile, and attractiveness of NOVA and its staff by means of collaborating on existing research activities, generating strategic joint proposals for future funding opportunities, generating joint publications, and organising postgraduate conferences

- to strengthen the research management capacities and administrative skills of the staff of NOVA by delivering seminars and workshops on grant proposals writing, grant and project management, innovation and knowledge exchange policy, best practices in facilitating open access publishing, and by setting up a peer network for grant proposal review

- to improve creativity and the development of new approaches in R&I of the participating institutions by means of providing mentoring and joint supervision for young researchers and doctoral candidates, and industry secondment.

Women on Waves (WoW)

Blue economy sectors, particularly fishing and aquaculture, are predominantly male-dominated activities in Europe. Men provide the main labour on board fishing vessels, and men own most fishing boats and aquaculture farms. Only 3.7% of those employed in the EU fishing fleet are women.

We strongly believe that most women do not pursue a maritime career because there is a stigma that it is a male profession. However, with technological advances (lowering the physical relevance of the activities) and women's mental evolution towards emancipation, we also believe that is the time to move ahead and start attracting women to port-maritime activities, in line with the EU Gender Equality Strategy.

The WOW project will develop relevant activities regarding to attract women to port-maritime economy, such as:

- To develop an encompassing benchmarking study involving traditional “men sectors”, such as truck driving and aviation, to properly understand what moved women to embrace those sectors and, subsequently, consider those aspects in the WOW’s strategy and, subsequently, establish operational actions to attract women to the port-maritime sector

- to develop a Technological specialisation programme EQF level 5 comprising general, scientific and technological training components and WBL, with the particular relevance of 6 months of working-based training onboard a ship

- to bring together female representatives of different sectors to increase their networking opportunities, knowledge sharing, visibility, etc…

- to implement good gender equality practices supported by an intergenerational approach.

The WOW’s ultimate goal, is to demystify the false idea that port-maritime professions are “men professions”.

Ship Sustainability Index (SSI)

The main goal of SSI is to create an indicator that can accurately expresses the Sustainability (Safety/Social Responsibility, Economic Performance, and Environmental Safety) of a ship, as a result of the performance of its systems and subsystems (crews, installations, systems, equipment) on the three dimensions of the Sustainability.

The SSI indicator is the ultimate result of a breakdown structure of indicators (comprising 5 levels) which includes all systems and subsystems that contribute to the overall performance of the fishing vessel, in terms of safety, as well as in the environmental and economic dimensions. In technological terms, SSI is supported in three main pillars:

- A Network for data acquisition, processing and communication
- a Decision Support System to help ship owners and related authorities to define proportional actions
- a document structure encompassing procedures, technical specifications, programs and inspection reports.

It summarizes all available information resulting from data collection from deployed sensors and specific assessment of the vessel's condition. For this reason, it is a dynamic indicator, which means, it is updated whenever there is new information available.

Regarding to assure the reliability and the trustability/credibility (by crews, shipowners and maritime authorities) of the indicator, SSI is validated through statistical analysis techniques of the collected data.

Chemical, Biological, Radiological and Nuclear - Simulator (CBRN-S)

The CBRN-S project aims at developing a simulator to enhance Collective Competence in the field of the Chemical, Biological, Radiological and Nuclear events management. CBRN-S project will be a cloud-based tool easily reachable through different platforms (mobile, tablet, or laptop), that allows the provision of training, exercising, assessment, and performance evaluation of the Chemical, Biological, Radiological and Nuclear events management, at different levels, namely:

- Collective and Individual competence
- regional, National and Supranational levels
- small and large-scale scenarios.

Observing the state of the art, CBRN-S is an innovative tool considering the following aspects:

- CBRN-S is adjustable to individual or collective training and exercising, allowing the development of Collective Competence in a virtual environment; state-of-the-art virtual simulation tools are focused on individual competence development
- CBRN-S will allow the Response Capacity Assessment of the involved actors facing an incident-based on the potential CBRN scenarios.

Supported by Mathematical Models, Discrete-Events Simulation (DES) and Game-based Learning (GBL), CBRN-S adopts the game approach as a learning experience to allow the player to understand the subject matter within a real-world context.

This approach improves the interface and increases actors' involvement, therefore constituting a better tool for the acquisition of competences. Particularly, the Massive Multiplayer Gaming (MMG) technique allows the simultaneous involvement of several players located in different places, making it possible to assess the performance of the team that is facing a specific scenario without employing physical means, needed on a real environment exercise.

Blockchain applied to Maritime Security (BaMS)

BaMS project, aims to implement Blockchain technology encompassing all the port-maritime information systems, particularly the Logistics Single Window, that will undoubtedly have a significant impact on port-maritime security and efficiency, improving transparency and communication between the shareholders and users of the information.

Blockchain technology's potential as a peer-to-peer distributed database could bring value in terms of trust, network expansion, visibility, and more. Data is freely accessible while maintaining its security. The relevant aspects associated to BaMS are:

- **Trust between parties** - the information on the blockchain is trustworthy because it is based on shared consensus among various participants. Partners establish a reputation on the blockchain over time, demonstrating their trustworthiness to one another. Companies in the port chain must be able to trust one another in order to share information and improve efficiency in shared procedures

- **higher container throughput** - network security - transaction automatization - container tracking/tracing

- **expanding the Network** - Another way that blockchain offers value to port logistics and digitalization is by encouraging network growth and interconnectivity. Companies in the Blockchain port make the port smarter. The network would become decentralized in the case of a public and open blockchain system, and the parties would be able to join individually rather than through a centralized entity

- **supply chain flow integration** - Supply chain flows can be better integrated with blockchain technology (physical, financial and information flows). It is important for the many parties involved to share certain information in order to move the actual flow of products through the port, such as when unloading a container of its cargo.

The use of a blockchain platform could make it easier for those participating in the process to share information. This can be accomplished by keeping track of the shipment on the ledger. Rather than exchanging documents, the parties participating in the process are given the authorization to access the information storage block. As a result, a unique, shared piece of data can be created that can be

accessed in real-time and with fewer transaction costs. The process can be hastened even more by bringing in parties who are currently not involved (banks, insurance companies).

The adoption and implementation of blockchain technology can significantly improve the security and, simultaneously, the processes' efficiency, once a huge number of actors interact by exchanging goods, providing supporting documents, involving vehicles/machines and moving persons across the boundaries. The implementation of Blockchain technology encompassing all the port-maritime information systems, particularly the Logistics Single Window, will undoubtedly have a significant impact on port-maritime security and efficiency, improving transparency and communication between the shareholders and users of the information.

Safety Scoring Permit (SSP)

Despite the decrease in the accident rate over the years, the statistics show a large number of fatal and serious work accidents: 2.4 million workers/year die as a result of occupational injuries and illnesses. The global costs of work-related accidents and illnesses represent in Europe around 3.3% of the GDP (EUR 476 MM in 2017).

In the last years, there have been lots of investments related to equipment protection, management systems, but the turning point has to be given with a focus on behaviour, investing in improving behaviours - moving from unsafe to safe acts is undoubtedly the strategy to achieve effective accident reduction and work proactively.

SSP is based on the BBS philosophy, the scorecards system, and the "point system" for road safety. Behaviours are assessed by direct observation, bonuses (for safe behaviours) and penalty points (for unsafe behaviours) are allocated, allowing to monitor the individual and collective performance. This approach has been validated and demonstrated and its success led the companies, where the SSP has been demonstrated so far, to express their interest in investing and implementing in the SSP.

From the collected data, it is estimated that once SSP has been implemented, it can contribute to reduce between 20 and 40% of work-related accidents and subsequent lost days due to injuries, meaning a potential high reduction of the unsafe costs and therefore a very relevant economical and social value.

Considering the SSP's potential and its readiness to be fully implemented at the market level, we aim to develop a strategic alliance involving clusters, companies, universities and authorities which will work as an important lever to promote SSP at the end-users level. Simultaneously, partnerships with OHS companies/specialists will be developed regarding to build a network of SSP providers that will grant broad dissemination in the defined clusters/sectors.

Benford's Law applied to fraud control (BLaw)

Having in mind that the ultimate objective of the EU regarding the fight against fraud, is: to adopt the necessary measures in the fields of the prevention of and fight against fraud, by making available the BLaw platform for the detection and alert of potential suspicious data, BLaw project will contribute to the EU's objective, by addressing the following priorities:

- Corruption as an enabler of organised crime and as a means to infiltrate the licit economy and the society
- sector-specific corruption, including, but not limited to, corruption in customs, in environment, corruption linked to drug trafficking, illicit financial flows and money laundering
- challenges to corruption prevention in the public and private sector, including, but not limited to, on conflicts of interest, revolving doors, codes of conduct, ethics
- obstacles to transparency in public decision-making, including in areas such as lobbying, asset disclosure and political party financing.

The BLaw project will make available an important tool to support the prevention of and the fight against fraud in particular, allowing the implementation of the following activities:

- Monitoring of fraud and corruption linked to the disbursement of EU and National funds, public procurement, healthcare, citizen investments and other societal economical and financial processes
- Analysis of fraud and corruption to expand fraud and corruption-specific research, knowledge and understanding in law enforcement, prosecution services and the wider public, including, but

not limited to, the use of robust statistics on fraud and corruption for evidence-based policy-making

- Development and dissemination of good practices in the prevention of or fight against fraud and corruption across the EU

- Support for anti-corruption action by for example, reinforcing civil society and citizens in exposing corruption and other serious crime through the share of relevant data that can be analysed by BLaw.

Research & innovation areas and investment

R&I areas and projects

The table 3 (at the end of this section 3.3.), presents 19 pilots and demonstrators that are in the discussion and design phase, involving partners from AKT space. As may be observed, each pillar has research areas (7 in total), which integrate the projects. Noticeable relevance for the early interest of many partners to actively collaborate on the projects discussion, design and pre-planning phases.

The proposed projects are fully aligned with the following EU strategies: “A new ERA for Research and Innovation”, “The European Green Deal”, “Atlantic action plan 2.0”, Portuguese National Strategy for the Ocean 2030, and Azores, Canary, and Madeira RIS3.

R&I infrastructure and equipments investment

For the proper implementation of AKT in general and the AMRC, specifically, investment on R&I infrastructures and equipment is naturally required. We are actively working on this possibility of building a **Port-Maritime Research & Innovation and Learning & Training Centre Research & Innovation** facility in Porto Novo, Madeira Island, which, at least by now, we are calling the Maritime Simulation Centre (MCS). This facility will be duly equipped with research rooms, simulators, computers, etc…, aiming at being a state-of-the-art R&I facility.

Along with the Maritime Simulation Centre, AMRC is envisaging raising a Ship Operations Monitoring Centre, a facility that will support the operationalization of Safety, Security and Sustainability projects, such as Ship Sustainability Index, Autonomous Vessels, Safety Scoring Permit or the Blockchain projects.

The investment in these facilities is fully compatible with the regional specialization strategy (RIS3 and EREI RAM 2021-2027) and there are available funding options such as private equity and regional incentives. Funding schemes like Valorizar 2020, which elects the port-maritime sector as a priority and finances infrastructures and technology, or Prociência for R&D purposes, are examples of funding opportunities already available. Initial contacts have been made with regional authorities (such as:

DRMAR, DRP, SRE), which fully support the AMRC project including potential investment in the MCS facility.

Table 4: R&I projects structured by areas and aligned with EU pillars

Pillars	Research Areas	Pilots Demonstrators pre-planning
Sustainable Use of Maritime Space (Sea and Coasts)	Space (land and sea) use	Improvement of logistics and space use
		Ship Sustainability Index
		Invasive species management/monitoring
		Engineered Reefs
		Decarbonization of the port's and fleet economy
	Automation	Autonomous Vessels
		Autonomous fishing vessel dash-board
	Water Management	Salt Water to Fresh Water
		Hydraulic Inverter
Education and Training	Profile and Curricula Innovation	Maritime Engineer and Manager
		VET in the Maritime sector
		Careers Management Integrated Platform
	Augmented Reality-Based Training (ARBT) and Simulation-Based Learning (SBL)	Marine Pollution Control Simulator (MPCS)
		Augmented Command & Control (ACC)
		CBRN-E Simulator
Safety and Security	Security	Blockchain 4.0 applied to port-maritime security
	Safety	Blockchain 4.0 applied to food-supply chain
		Safety Scoring Permit
		Safety in ports through digitalization

3.3. Part 3 - Port-maritime megatrends: Maritime decarbonisation and digitalization

3.3.1 Introduction

Once the MarLEM project addresses the existence of gaps and needs for higher education and the future skills gaps in the Blue Economy, it is, therefore, relevant to develop a prospective study to answer the question: what will be the implications for workforce skills of mega-trends driving change across the Maritime Logistics sector? Two critical mega-trends have been considered: maritime decarbonization and digitalization.

The objective of WP8 is to identify actions to build on the work of the MarLEM project into the future. It aims to answer the question: what will be the implications for workforce skills of mega-trends driving change across the Maritime Logistics sector? Two critical mega-trends have been considered:

- 'Maritime Decarbonisation' is of major significance to the sector to reduce and move emissions to zero. This disruptive technology will affect all aspects of vessel and port operations and the workforce will need to gain new skills to meet the different ways of working

- 'Maritime Digitalisation' is less obvious as there is no policy timetable. However, companies will increasingly deploy digital systems to remain competitive in a decarbonising world.

The Blue Economy has the potential to deliver growth and jobs in the coming years but an adequate supply of blue skills is mandatory. The European Commission's Annual Growth Survey identifies the growing skills gap affecting particular knowledge intensive sectors with particular relevance for:

- 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.

3.3.2. Maritime Decarbonisation

The maritime sector generally has been quite slow to remediate its contributions to global warming through reduction of its emissions of greenhouse gases (GHG). However, the regulatory landscape is now changing rapidly to drive down GHG emissions. The initial impetus came from a 2011 annex to the IMO MARPOL Convention which set a target of 50% reduction in carbon emissions from the world fleet by 2050. Under pressure from national governments and the EC, this target is now being significantly tightened: first to full decarbonisation by 2050 but now also more ambitious interim targets of 40% reduction by 2030.

Innovative methods to achieve 'net-zero' are constantly evolving. Due to the planned lifetime of vessels, transition to ships equipped with new technology will be a long-term process. During this time ports will have to adapt and evolve to meet the new requirements of their clients.

Although the target date of 2050 to achieve 'net-zero' appears to give adequate time to prepare the workforce, the reality is that decisions need to be taken now. The range of potential solutions to achieve a sustainable maritime sector are numerous but are at different stages of development and trialling. For many there are significant hurdles and complexities to overcome including statutory requirements, supply and infrastructure, safety issues and reliability. Because of this decision makers face a "Fog of Uncertainty".

More recent analysis (notably the 4th GHG study) commissioned by IMO has assessed the potential pathways to meet the various 2050 targets. Some broad implications can be drawn to bring some clarity to the 'fog':

- Improvements in vessel efficiency and deployment of propulsion measures such as wind-assist could potentially remediate approximately half of the 2008 GHG emissions without any changes to the fuel mix;

- For further reduction, novel low-carbon or zero-carbon fuels will be needed. LNG is a low-carbon fuel which appears to be widely seen as an interim solution to achieve 2030 targets. In the longer term e-fuels (methanol, ammonia, hydrogen) will be required, but all these options involve innovative on-board systems and novel in-port bunkering and supply;

- All-electric propulsion is an option for shorter transit distances and is being deployed on ferries and short-haul RoRo vessels. Substantial investment in capital assets and workforce skills will be needed, both for on-board electrical systems and shoreside charging infrastructure;

- Emissions at berth also contribute to a vessel's carbon footprint (CII rating) and shore-power provision by ports will be needed. Cruise ships and refrigerated container ships are likely to require high power supplies from the port, up to 10MW, imposing significant novel infrastructure on-board and in port.

What is certain is that skilled workforces will need to be trained and be adaptive, however, many of the skills required will be relevant to more than one of the new areas of the disruptive technology.

Assessing the Impact

The Maritime Just Transition Task Force Secretariat is an unprecedented initiative comprising the International Chamber of Shipping (ITS), the International Transport Workers' Federation, the United Nations Global Compact (UNGC), the International Labour Organisation (ILO) and the International Maritime Organisation (IMO). Its purpose, to explore how best to support the maritime workforce make the shift to a decarbonised shipping industry.

One of its first actions was to commission a study offering an initial assessment of the impacts decarbonisation will have on the workforce in the sector. Conducted by DNV, the study[1] did not seek to provide an exhaustive overview but to give an initial indication and insight into the impact on seafarers and the training they will need to meet the changes.

Three different decarbonisation scenarios were used to assess the number of seafarers requiring additional training. These were:

- Option 1 - At least 50% GHG (Greenhouse Gas) reduction by 2050 (IMO 2018)

- Option 2 - Decarbonization by 2050 (DNV Maritime Forecast, 2021)

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[1] (Insights Into Seafarer Training And Skills Needed To Support A Decarbonised Shipping Industry - Report No. 2022-0814, 2022)

- Option 3 - Zero Carbon by 2050 (Lloyd's Register (LR) and University and Maritime Advisory Services (UMAS), 2019)

The use of alternative fuel technologies will play a major role in the decarbonisation of the sector and require new/additional training. To estimate the number of seafarers needing this training with the introduction of the new fuels the study included: Dual Fuel Methanol ICE, Dual Fuel Ammonia ICE, Dual Fuel Liquid Hydrogen ICE, Hydrogen Fuel Cell, Ammonia Fuel Cell and Battery.

A key finding of the study reported that all 3 scenarios point towards an immediate need to train seafarers. However, the timing and type of training will be dependent on the ambition of decarbonization trajectories and the future fuel mix.

The figures estimated from the 3 options give the following profiles for the new training requirement:

Table 5: Additional Training and Skills Required for Seafarers

Option 1 IMO 2018 – At least a 50% reduction in emissions by 2050	Number of seafarers working on ships with alternative fuels and technologies anticipated to peak at **310,000** in **2050** *Scenario anticipates a significant rise for training on alternative fuels in the **2040s** (between **310,000 and 750,000** seafarers)		
Option 2 Decarbonisation by 2050 (DNV)	**750,000** seafarers would require additional training to handle alternative fuels and technologies by **2050.** *Scenario anticipates a significant rise for training on alternative fuels in the **2040s** (between **310,000 and 750,000** seafarers)		
Option 3	**2030**	**2035**	**2020s/2050** *Scenario anticipates training

'Zero Carbon by 2050' (LR/UMAS)	**450,000** requiring training by **2030**	**800,000** requiring training by **2035**	requirement following a steep curve from the mid-2020s until 2050
** The number of seafarers expected to work on ships fuelled by LNG/LPG is predicted to increase by approximately 100,000 new seafarers every second year until 2038, in both the DNV modelled 'IMO 2018 scenario' and the 'Decarbonization by 2050 scenario*			

The study highlighted that planning for seafarer training to meet the decarbonisation goals is already subject to several constraints. The lack of clarity surrounding viability, uptake and slow regulatory development for alternative fuels makes planning suitable training a challenge. Investment will be needed to develop training centres with up-to-date equipment and action required to overcome the lack of competent trainers and predicted shortage of experienced seafarers.

The importance of this is emphasised in a report covering hydrogen and alternative fuels which noted "the general lack of maritime and fuel-specific competence among suppliers and end users is recognised as a main safety hurdle for alternative fuels and their modes of operation".

However, it is also true that some of these e-fuels, notably ammonia and methanol, have been handled by some ports as cargo for many years. The knowledge in how to handle these materials in port and on-board ships does exist but it is not widespread and it is not orientated towards handling them as fuels (with a need to transfer fuels from bunkering facilities into ships' tanks). Specialist new training curricula and rapid roll-out to personnel are both needed to address this challenge.

Vessel and Shore Operations

Work on moving the Maritime sector to 'net zero' has commenced but much of it is still in the early stages. The following give an overview of the evolving situation and the future skills requirements for maritime logistics to meet the targets:

- **Increasing use of shore power (onboard and in port)**

  The British Ports Association[2] reported that very few Shore Charging Berths existed in global ports and those which had been installed had relied on Government or other 3rd party funding. Some ports had shore power facilities or were considering it but this was mainly for smaller craft (fishing, leisure, service and patrol vessels). They also ascertained that many vessels were not equipped for shore power and their operators were not putting it as a priority for the future. However, it was noted that RoRo vessel owners were looking at the potential of ship-to-shore connections and also enquiries had come from smaller cruise vessel operators.

  Port operators are now looking to provide the facilities needed to meet this requirement and demand will increase significantly as new legislation is introduced. It is anticipated that the EU will be improving its shore power regulations through the 'Fuel EU Maritime Initiative' and the 'Alternative Fuels Infrastructure' which will require vessels to connect to shore power when berthed.

  SMART Ports are evolving and there will be an increased reliance on digitalisation to operate them. Currently port equipment (e.g. RTG and Container Cranes and dockside tractor units) operable in hybrid mode or fully-electric is commercially available. Additionally, freight handling equipment can be controlled remotely and provide operational data to a Central Control Room.

  These changes in technology will require the seafaring and shore operatives to have additional skills covering safe day to day operation, fault-finding and repair including MV/HV Electrical systems. A similar requirement will also apply for staff responsible for operating the digital

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2 (Reducing Emissions From Shipping in Ports: Examining The Barriers To Shore Power, 2020)

based systems. Ports and vessel operators will need to identify the competences and skills for each.

As demand for shore power increases, ports will be required to optimise the throughput of power in order to satisfy vessel demand at a competitive cost. Deployment of PV solar on roofs and over vehicle parking/waiting areas will become commonplace, to reduce the amount of power that has to be procured from the grid. In-port batteries will also become standard infrastructure so that ports can peak-lop their grid demand, absorb maximum solar generation, and time-shift when they buy power from the grid (in countries with time-varying pricing). Safe operation and maintenance of high power batteries, as well as the smart controllers needed to optimise their performance, is a specialist field. These skills do not exist currently in ports and will need to be accessed either by training in house personnel or by out-sourcing these works to contractors who will also then required trained personnel.

The new requirements will need to be supported by competent seafarers and port staff and courses meeting the Maritime workforce's requirements which will need to be planned and provided.

- ## Fuel Transition and Bunkering

Several options are being considered for alternative fuels including Methanol, Ammonia, LNG and Hydrogen and there are benefits and barriers to each. Safety and toxicity are key factors for all the fuels but particularly relevant to hydrogen and ammonia. Significant financial outlay is required to install, operate and maintain the facilities to store and handle the fuels.

LNG is beginning to establish itself as a 'green' fuel with a recent example of two new RoRo ferries being introduced on cross-channel routes between France and the UK. Running hybrid on LNG/Battery, the system provides all power for propulsion and onboard services. The vessels are also equipped to connect to shore power allowing ship systems to operate whilst berthed and also to recharge the batteries for use on the next voyage. Methanol is also evolving as an alternative fuel and Wartsila, a leading manufacturer of marine engines has announced that its first methanol powered engine will be rolled-out on a new ship during 2023.

Liquid Hydrogen (LH_2) is considered as having the potential to become a popular solution for several shipping segments although it has significant safety issues to be addressed. LH_2's

extremely low-boiling point makes it more challenging to store and in gaseous form has a considerably higher explosion risk than the other alternative fuels.

DNV have organised the development of a 'Handbook for Hydrogen-fuelled Vessels'[3] to help provide guidance on current safety and regulatory barriers and as a knowledge base to assist with the future approval for bunkering and fuel handling aboard the vessel according to DNV and IMO Standards. Although LH_2 is used in land-based industries and transport, the power demand for a ship will require a hydrogen installation of a much larger scale.

Hydrogen is also being introduced to port usage with testing of dual fuel straddle carriers commencing in the Port of Antwerp in April 2023. This will evaluate the design of the equipment and other factors necessary to scale it up, including the supply and storage of hydrogen for the entire fleet. This is being supported by PIONEERS, an EU Horizon 2020 project.

Ammonia is now being seen as having a role to play as an alternative marine fuel[4]. During combustion it produces no CO2 or SOx emissions. It has a low-flammability range, high auto ignition temperature and slow flame propagation making it a safer fuel than LNG, LPG and hydrogen in terms of fire risk. However, a potential barrier to its use is the toxicity of its fumes which depending on their level (ppm) can cause mild discomfort, irritation to eyes/throat and in high concentrations cause rapid death. Furthermore, it remains toxic when in water and is also corrosive requiring materials used to store or transfer it having to be carefully selected. As a marine fuel ammonia is new and research and projects and are currently being undertaken globally to harness its full potential. The systems and regulations for handling and using it as a fuel will be developed as work evolves however, there will need to be considerable investment to establish facilities for handling it.

Alternatives such as Biofuels, and synthetic fuels are also being considered. These are 'drop-in' substitute fuels so bunkering and storage will be similar to the current methods for the fuels they replace. However, such fuels are expected to remain costly.

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[3] (Handbook for Hydrogen-fuelled Vessels, 2021)

[4] (Safety evaluation of using ammonia as marine fuel by analysing gas dispersion in a ship engine room using CFD, 2022)

DNV have produced the 'Skills and competencies for the operation of ships using alternative fuel technologies' which are shown at Annexes 1 and 2.

- **Electrification and marine engineering maintenance (on board)**

Electric and hybrid-powered vessels using large lithium-ion or alternative chemistry batteries will be a route to the 'net-zero' target for the maritime sector. The ability to store electrical energy and use it with optimal efficiency will contribute to reducing fuel consumption and emissions when required. Such hybrid operation is expected to be especially valuable when vessels are in harbour waters and manoeuvring to/from berth, as combustion engines are typically operating inefficiently in these operations. The IMO 4th GHG study found that such in-port operations are responsible for a major share of carbon emissions and other pollutants causing poor air quality in port cities.

Maritime lithium-ion batteries can be up to several hundred times larger than traditional electric vehicle batteries. They will also be used in a more hostile environment than ashore with extreme charging, demanding operational patterns and increased shock and vibration. Operating in these conditions will present new challenges particularly with regard to safety[5].

A major risk of lithium-ion batteries in comparison to lead-acid is an increased risk of fire. A lithium-ion battery fire is regarded as one of the most dangerous and difficult to control and extinguish, with traditional ship-fit fire suppressor systems not capable of the task and can worsen the situation.

Furthermore, lithium-ion batteries (and most other battery types) can produce off-gassing when being charged. This necessitates dedicated ventilation systems in the battery space, sensors in the ventilation system to detect presence of noxious gases as well as PPE for personnel who might be required to enter battery spaces for maintenance or inspection purposes.

The evolving use of electricity as a power source will require seafarers to be trained in the maintenance and safe operation of the shipboard systems using the new technology.

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5 (DNV-GL Handbook for Maritime and Offshore Battery Systems, 2016)

- **Deployment/operation of wind assist systems aboard vessels**

Wind power is also being developed as a method to assist with propelling vessels and reduce emissions. Amongst the work taking place for commercial vessels is the Oceanbird concept developed in a three-year Swedish R&D project. The team consisted of Wallenius Marine, KTH Royal Institute of Technology and SSPA/RISE and supported by Swedish Transport Administration.

Following this, work has commenced to build a vessel incorporating the wing sail and associated technology. The Orcelle Horizon will be the first primarily wind powered RoRo vessel. 220 metres in length it will be used as deep-sea car/truck carrier and capable of carrying over 7,000 cars or other vehicles. It is intended to utilise the wind as the main method for propulsion but an engine is fitted for when there is unfavourable weather or the vessel is manoeuvring,

The vessel is being constructed and trialled as the Orcelle Horizon Project and has received €9M from the Horizon 2020 EU funding program. The project commenced in January 2023 and completes in December 2027 with the ship due to commence sailing in late 2026. It is predicted that emissions will be reduced by up to 90% compared to a conventionally powered vessel of a similar size.

Mitsui O.S.K Lines (MOL) has commenced construction of the zero-emission 'Wind Hunter' vessel. Due for launch in 2024 it will be the test-bed for new applications for hydrogen fuel and wind power. The vessel is 60/70 meters long, uses multiple rigid collapsible sails and underwater turbines will generate electricity to electrolyse pure water made from seawater and then produce hydrogen to be stored in liquid form. When winds are light the hydrogen will power a fuel cell to provide propulsion.

It can be seen that wind assistance is a practical solution being explored to help decarbonise maritime operations for large vessels. It is also recognised by IMO as a significant element of achieving net-zero.

- **Improved energy efficiency: Vessel Energy Management (VEM)**

The introduction of fuel-efficient vessels and the low carbon fuel options will help in the sector's movement towards 'net zero' but it is recognised that effective energy management of individual vessels and at fleet levels is vital.

With the greater use of digitalisation and an increased number of sensors monitoring and analysing the ship's systems, modern vessels are becoming sophisticated sensor hubs. This provides an effective method to meet the Vessel Energy Management (VEM) requirement by collecting data for assessing the energy consumption of onboard systems operating in their different modes. Equipped with this information systems can be optimised and the vessel operated at maximum efficiency. Real-time data can also be sent to the vessel operator ashore to be monitored and acted upon as required.

3.3.3 Digitalisation (affecting on board and shoreside activities equally)

As shown above, digitalisation has an important role to play in achieving net-zero. However, it is also a mega-trend in its own right as shown by the expanding deployment of digital-twin approaches to vessel management. Such systems are integral to the growing requirement for reliability-based maintenance and automation that can offer a reduced overall cost of ownership.

With the introduction of autonomous vessels, Smart Ports and other systems linked to Remote Control Centres there will a significant increase in the use of digitalisation. These will require people working with them to have the relevant knowledge to operate, fault-find and take appropriate action to overcome problems. The competence for this will be required by seafarers and staff working ashore and be a need across a wide range of job roles.

Several innovation trends are driving increased digitalisation as illustrated below.

- **Enhanced route optimisation**

  Electronic navigation is already extensively used aboard ships and overlaid route optimisation can enable improved fuel efficiency. Future autonomous vessel operations will need navigation operators in shore-based Remote Control Rooms to be familiar with the use of Electronic Chart Display and Information Systems (ECDIS). Passage planning will be essential for the remote vessels and operators will need to be conversant with the principles of electronic navigation[6]

  ECDIS training is available for Maritime Users from many Colleges, HE and commercial course providers and is recognised by the Maritime and Coastguard Agency (MCA) and other national certifying organisations.

  Presently, courses are focused on onboard systems used on current vessels but these will be the basis for those installed on unmanned ships. It is predicted that autonomous vessels will have integrated systems covering navigation, collision avoidance and automatic communication.

[6] (Bachari-Lafteh & Harati-Mokhtari, 2021)

One other area where enhanced route optimisation will be required is for wind assisted vessels which will rely on the technology to find the best wind conditions for optimising the ship's course. This will be essential to operate the vessels effectively and achieve the maximum reduction in emissions.

• De-crewing to reduce seafarer costs

The International Maritime Organisation (IMO) has defined four categories of Maritime Autonomous Surface Ships (MASS) with differing degrees of autonomy:

- Degree one - Seafarers onboard to operate and control shipboard systems and functions
- Degree two – Remotely controlled ship with seafarers onboard
- Degree three – Remotely controlled ship without seafarers onboard
- Degree four -Fully autonomous ship with an operating system able to make decisions and determine actions by itself

De-crewing is seen as a method of decreasing costs but reduced or no crew presents many challenges such as the legal requirement to maintain a proper lookout by sight and hearing, overcoming onboard system failures, maintaining security and legal liability. The savings from crew reductions also have to be weighed against any additional cost for the technology taking over their role. A reduction in crew afloat is countered by the need for suitably qualified personnel ashore to monitor and control the fleets. There will also be a need for suitably skilled staff to maintain and repair the new technology aboard the vessels.

- **Increasing onshore personnel with remote/ autonomous operations**

As ships are de-crewed there is a need for the operation of MASS to be monitored from Remote Control Centres (RCC) ashore. These are starting to be established and an example is Ocean Infinity who are already using an RCC to operate their autonomous vessels from their base in Southampton. The company is planning to build a further one or two RCCs to provide 24/7 coverage and backup in the event of a Centre having a major failure. This is anticipated to be the norm for supporting autonomous fleets.

Under de-crewing, ship's officers will be made redundant from their seagoing role but there will be a need for their knowledge and expertise in the RCCs. It is predicted that there will be a shortage of applicants for these posts and it is possible that to supplement the seafarers a non-seagoing qualification will be developed covering parts of the Ship's Officer duties which will be vital to running the RCC and meeting the regulatory requirements associated with it.

The job profile for the new role in the RCC will require the officers to have a good level of expertise for digital skills and automation. To ensure staff are trained to the required level DNV have produced 'DNV-ST-03424 - Competence Standard for Remote Control Centre Operators'. This provides a framework for training, assessing, and certifying personnel working in remote-control centres that support or manage operations at sea.

- **New condition monitoring systems, engineering & maintenance**

In January 2020, the new low sulphur and nitrous oxide limits set in the IMO MARPOL convention became effective worldwide. As the move towards 'net-zero' continues, further legislation will be introduced and operators will become more reliant on Condition Monitoring (CM) systems to ensure their vessels are operating at maximum efficiency. CM is the process of monitoring a particular condition in machinery to identify changes that could indicate a developing fault. Traditionally, this has been based on vibration analysis but now the increased use of sensors allows a wider range of parameters to be monitored from ship's systems in real-time. Coupled with advanced data processing CM provides a predictive tool allowing maintenance to be scheduled or preventive actions taken to prevent further failure and

subsequent unplanned downtime. The system can provide real-time alerts to onboard personnel or to remote control centres.

The CM systems are becoming more complex in their ability to monitor and there is a need for staff trained to implement it or hiring engineers with the required knowledge and experience.

- **Data analytics and digital twins to optimise vessel operation**

A digital twin is virtual model designed to accurately reflect a physical object. The object being replicated is fitted with sensors providing data on vital areas of functionality and the information is relayed to the digital twin. The virtual model can then run simulations to study performance and any issues being encountered. From this knowledge, solutions and improvements can be applied to the original object to operate it more efficiently and take preventative action if required. Digital twins are still in the early stages of development for use with vessels and smart ports. In the maritime industry it is seen as being a valuable tool.

In a port environment data can be collected from a wide range of sources such as cargo-hold information from carriers; performance statistics and maintenance status of port systems including tractors and carriers. From this the twin can provide real-time information to port operatives, freight operators and other users to deliver efficient operations.

4. Conclusions and Recommendations

4.1. Related to the Master Program

From the information contained in Part 1 the following conclusions and recommendations can be drawn:

- The master program attributes: requirements and methodologies, received a positive feedback meaning that the technical dimension is being well perceived by the candidates

- the delivery of the course should be the most flexible possible in order to enable the compatibility with the time schedule of the professional students. Remote classes and recorded materials should be considered, as well as availability of teachers to complement any gaps in the attendance to the classes due to professional impediments

- even though the major part of the candidates clearly expressed the desire of having an hybrid format, this needs to be balanced once online learning is not nearly as effective as a learning experience, hence offering a full programme online is not the goal of MarLEM

- the economical/financial dimension of the master program received a very negative valuation, meaning that specific work needs to be developed to, at least, communicate the differentiating aspects of the program and its subsequent costs and apply for appropriate funding regarding to lower students' costs namely with tuition fees and accommodation

- regarding the program's added value, this dimension scored an impressive 100% the program is recognised by the candidates as a valuable tool to increase their capabilities and to evolve in their organizations and in the market

- regarding the master's attractiveness for women, a specific work needs to be done as described in Part 1 -1.5.3

- dissemination requires a proper review of the selected channels and adequate investment, particularly to promote the program to Africa and Asia regions

- The relatively low interest to the MML programme in 2022 test edition (only 6 candidates concluded successfully the application process) should not raise discourage because the programme is new, so it is normal to receive low number of applications in the first year of the programme. Over a period of time the programme will be known widely and the interest will increase.

4.2. Related to the Atlantic Knowledge Triangle

From the information contained in Part 2, the following conclusions and recommendations can be drawn:

- AKT aggregates entities from Academia, Authority and Industry, providing a "space" for creating ideas, raising consortia, launching projects having as the final purpose, to contribute to the competitiveness increasing of the Atlantic Blue Economy

- AKT has its main focus on skills and competences development applied to 12 fields of intervention on the broad area of the port-maritime sector

- On present time, AKT is involving 53 organizations (mainly centred in the Atlantic Area) from 12 countries. Besides the Atlantic Area, particular relevance for the involvement of some organizations from Asia and Africa

- The AKT dynamics allowed to start the development of 12 initiatives, 3 of these are already ongoing projects

- AKT space is presently working on 7 Research and Innovation areas, supported on 3 pillars fully aligned with correlated EU directives.

4.3. Related to port-maritime megatrends

From the information contained in Part 3, the following conclusions and recommendations can be drawn:

- The route to 'net-zero' for the maritime sector has many challenges to overcome to achieve the objective. Many of the proposed innovations range between the concept stage through to early trials. They cover a wide range of possible solutions and are using new or adapted methods which have to meet regulatory, safety, security and other requirements. These add to the complexity of developing the solutions and will impact on the timescale to deliver them

- the introduction of this disruptive technology will have a major impact on the operation of vessels and ports and the people who work in them. Seafarers will increasingly find their jobs becoming shore-based and new skills and competences will be required by them, port workers and supply chain staff. The use of alternative fuels, digitalisation and other innovative changes will need the workforce trained and re-skilled to deal with them. Planning for this should be done in good time to ensure the training resources are in place to teach staff to be ready for the new technology

- further challenges to this are the limited number of trainers with knowledge and experience from vessels using modern automation systems and/or running on new fuels. This is viewed as a future constraint when large numbers of seafarers require upskilling. Additionally, the inability to attract and retain seafarers poses a significant challenge to the industry's transition and is another area where the sector needs to be proactive to address it

- the DNV 'Insights into Seafarer Training Skills Needed to Support a Decarbonised Shipping Industry' study is an initial assessment but provides a good account of the challenges faced and conclusions with suggestions for future training

- the study also provides a Figure and Table 8.1 showing the personal, organisational and management skills and competences for decarbonisation of the shipping industry. It also provides a similar table for the operation of ships using alternative fuels. Both of these are included as Annexes 1 and 2.

- the other aspect which needs to be addressed is the lack of certainty in the scale and direction of technological change the sector faces, creating the 'Fog of Uncertainty'. Vessel and port operators are seriously concerned about investing in assets and infrastructure which are at risk of becoming 'stranded assets' as new policies and standards are introduced. This in turn prevents investment in upskilling the workforce to operate these assets

- a recent marine skills survey in the UK highlighted the lack of clarity which dissuades academia and businesses to produce firm plans for training. The decision-makers are in the position of making training plans which come to nothing and are costly in time and resources. Waiting until a clear solution is known can have the effect of delaying the plan and consequently the workforce are not recruited and skilled in time. There is also a situation where companies do not put effort into planning for their future workforce needs because they are either swamped with information or have no reliable source to inform and explain what changes may occur in the sector

- good communication between Industry, Academia, Government and other interested parties should be encouraged and established. Through activities such as the Atlantic Knowledge Triangle (AKT) consensus can be achieved and all parties can be kept abreast of progress and the 'way ahead' to help them plan for the future.

5. Annexes

From the above referred facts and evidence, it can be concluded that the project is accomplishing, so far, the established objectives.

Annex 1.1 – Candidates list

Annex 1.2 - Survey results

Annex 1.3. Survey form

Annex 3.1 - Figure and Table 8.1 - DNV - Skills and competencies required for the decarbonisation of the shipping industry

Annex 3.2 -Table 8.2 – DNV - Skills and competencies for the operation of ships using alternative fuel technologies

Annex 3.3 - Maritime Decarbonisation and Maritime Digitalisation references.

Annex 1.1. Candidates list

The table below lists the total candidate that applied to the 1st and 2nd phases of the Master Program prototype edition. 6 candidates have been potentially accepted to start the Master Program edition to be launched in the beginning of 2024.

Count	Application Phase	Name	Outcome	Enrollment fee
1	1ª phase	Candidate #1	Conditional	**Paied**
2	1ª phase	Candidate #2	Not submitted	Pending Payment
3	1ª phase	Candidate #3	Not submitted	Pending Payment
4	1ª phase	Candidate #4	Not submitted	Pending Payment
5	1ª phase	Candidate #5	Not submitted	Pending Payment
6	1ª phase	Candidate #6	Not submitted	Pending Payment
7	1ª phase	Candidate #7	Not submitted	Pending Payment
8	1ª phase	Candidate #8	Not submitted	Pending Payment
9	1ª phase	Candidate #9	Not submitted	Pending Payment
10	2ª phase	Candidate #10	Excluded (missing payment)	**Pending Payment**
11	2ª phase	Candidate #11	Not submitted	Pending Payment
12	2ª phase	Candidate #12	Not submitted	Pending Payment
13	2ª phase	Candidate #13	Not submitted	Pending Payment
14	2ª phase	Candidate #14	Conditional	**Paied**
15	2ª phase	Candidate #15	Not submitted	Pending Payment
16	2ª phase	Candidate #16	Not submitted	Pending Payment
17	2ª phase	Candidate #17	Not submitted	Pending Payment
18	3ª phase	Candidate #18	Not submitted	Pending Payment
19	3ª phase	Candidate #19	Submitted	**Paied**
20	3ª phase	Candidate #20	Submitted	**Pending Payment**
x	3ª phase	Candidate #21	Excluded	Pending Payment
21	3ª phase	Candidate #22	Not submitted	Pending Payment
22	3ª phase	Candidate #23	Submitted	**Paied**
23	3ª phase	Candidate #24	Excluded	Pending Payment

Notes:

Candidate names have been substituted by “Candidate #” to preserve confidentiality of personal data.

Annex 1.2. Survey results

QUESTION	Answer 1	Answer 2	Answer 3	Answer 4	Answer 5	Answer 6	Answer 7	Answer 8	Answer 9	Answer 10	Answer 11	Positive Value*
1.1 Technical program [Curricular units, credits and program]	Very Good	Good	Good	Good	Good	Very Good	Very Good	Good	Very Good	Good	Acceptable	90,91%
1.1 Technical program [Load distribution, schedules,...]	Very Good	Good	Poor	Good	Good	Very Good	Very Good	Acceptable	Very Good	Good	Good	81,82%
1.1 Technical program [Alignment with individual or collective needs]	Very Good	Good	Poor	Good	Good	Very Good	Very Good	Good	Very Good	Good	Good	90,91%
1.1 Technical program [Areas to be improved/enlarged (digital, green, automation,…)]	Good	Good	Acceptable	Good	Good	Very Good	Very Good	Good	Very Good	Good	Poor	81,82%
1.1 Technical program [Soft skills/technical skills proportionality]	Good	Good	Acceptable	Good	Good	Very Good	Very Good	Good	Very Good	Good	Good	90,91%
1.1 Technical program [Teachers/Experts and Program credibility]	Good	Acceptable	Good	Acceptable	Good	Very Good	Very Good	Good	Very Good	Good	Good	81,82%
1.2 Program format [Students' requirements/profile]	Good	Good	Good	Good	Acceptable	Very Good	Very Good	Good	Good	Good	Good	90,91%
1.2 Program format [Accessibility, physical/virtual,…]	Acceptable	Acceptable	Good	Very Good	Poor	Very Good	Very Good	Acceptable	Good	Good	Poor	63,64%
1.2 Program format [Teaching/learning methodologies]	Good	Good	Good	Good	Poor	Very Good	Very Good	Good	Very Good	Good	Poor	81,82%
1.2 Program format [Professionals/students specific programmes]	Good	Acceptable	Good	Good	Poor	Very Good	Very Good	Good	Very Good	Good	Good	81,82%
1.2 Program format [Mobility, internationality]	Acceptable	Good	Acceptable	Acceptable	Acceptable	Good	Very Good	Good	Very Good	Acceptable	Very Good	63,64%
1.3 Economical aspects [Fees,…]	Good	Acceptable	Poor	Acceptable	Poor	Poor	Acceptable	Acceptable	Acceptable	Acceptable	Poor	9,09%
1.3 Economical aspects [Financial support, subsidies,…]	Acceptable	Acceptable	Poor	Acceptable	Poor	Poor	Good	Acceptable	Acceptable	Acceptable	Poor	9,09%
1.4 Added-value [Master degree value/recognition by the market, peers, individual/personal, perspective,…]	Good	Very Good	Good	Very Good	Good	Good	Very Good	Good	Very Good	Good	Good	100,00%
1.4 Added-value [The master as a tool to positively evolve in the organizations' career program]	Very Good	Good	Very Good	Very Good	Good	Good	Very Good	Good	Very Good	Good	Good	100,00%
1.5 Other aspects [Professionals/students availability to attend the program]	Good	Poor	Poor	Acceptable	Poor	Good	Very Good	Good	Good	Acceptable	Acceptable	45,45%
1.5 Other aspects [Sector attractiveness for new students and professionals]	Very Good	Good	Acceptable	Acceptable	Poor	Good	Very Good	Good	Good	Good	Good	72,73%
1.5 Other aspects [Sector attractiveness for women]	Acceptable	Acceptable	Acceptable	Acceptable	Poor	Good	Very Good	Good	Acceptable	Acceptable	Good	36,36%
1.5 Other aspects [Dissemination issues]	Acceptable	Acceptable	Acceptable	Acceptable	Poor	Good	Very Good	Good	Acceptable	Good	Good	45,45%

Notes:

Positive value – is assumed as the ratio of the sum of the "Very Good" and "Good" answers, divided by the total number of answers.

Answer # - is the answers provided by a specific candidate.

Annex 1.3. Survey form

MASTER IN MARITIME LOGISTICS (MML)

MML Follow-up questionnaire

*Obrigatório

1. Aspects to be discussed and assessed

Aspects to be considered on the development of a survey (in the framework of the project's follow-up) to understand the low interest on the MML 2022 and, subsequently, define the appropriate measures to improve the MML Success on 2023.

1.1 Technical program *

	Very Good	Good	Acceptable	Poor
Curricular units, credits and program	○	○	○	○
Load distribution, schedules,...	○	○	○	○
Alignment with individual or collective needs	○	○	○	○
Areas to be improved/enlarged (digital, green, automation,...)	○	○	○	○
Soft skills/technical skills proportionality	○	○	○	○
Teachers/Experts and Program credibility	○	○	○	○

1.4 Added-value *

	Very Good	Good	Acceptable	Poor
Master degree value/recognition by the market, peers, individual/personal, perspective,...	○	○	○	○
The master as a tool to positively evolve in the organizations' career program	○	○	○	○

1.5 Other aspects *

	Very Good	Good	Acceptable	Poor
Professionals/students availability to attend the program	○	○	○	○
Sector attractiveness for new students and professionals	○	○	○	○
Sector attractiveness for women	○	○	○	○
Dissemination issues	○	○	○	○

2. Questions to reflect upon

Does the Master Program needs technical or operational adjustments to increase its attractiveness? *

A sua resposta

Is it appropriate/necessary to improve and re-submit the master program to A3ES to increase its flexibility, attractiveness, etc...? *

A sua resposta

Why not evolve to a master program's new version for students and/or a mixed program for students and professionals? *

A sua resposta

Why not seek for the support of the sector governmental structure to financially support the public and private organizations to invite their professionals to attend the master program? *

A sua resposta

Is the Portuguese port-maritime sector large enough to feed the master? Is it Africa a viable region to attract students / professionals or should we promote the program in Europe or Asia? *

A sua resposta

Enviar

Limpar formulário

Nunca envie palavras-passe através dos Google Forms.

Annex 3.1. Figure and Table 8.1 DNV - Skills and competencies required for the decarbonisation of the shipping industry

Insights Into Seafarer Training and Skills Needed to Support a Decarbonised Shipping Industry (Report - November 2022)

FIGURE 8.1

Skills and competencies required for decarbonization of the shipping industry

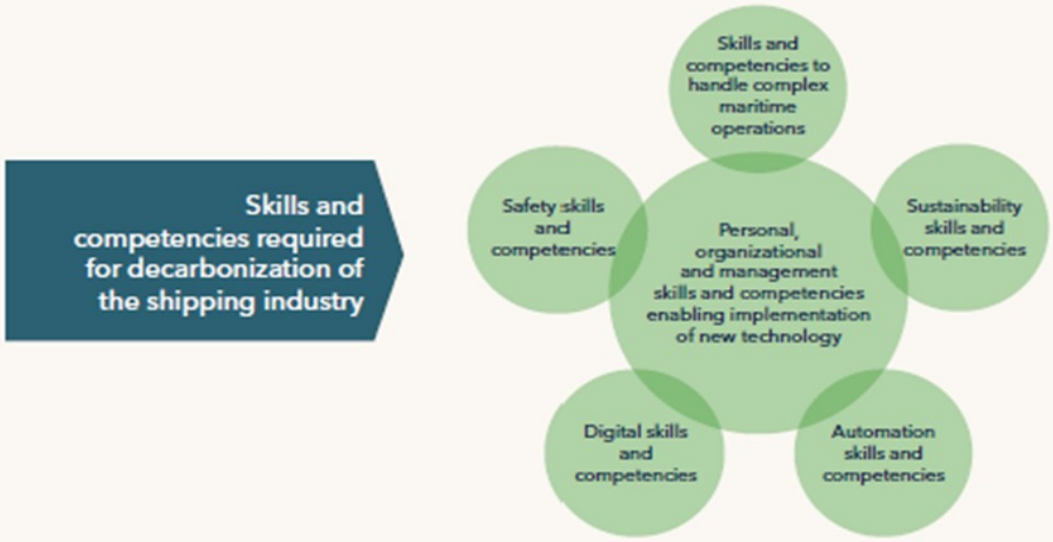

TABLE 8.1

Personal, organizational and management skills and competencies that enable the implementation of new technology in shipping

Personal skills and competencies	
Skills	• Ability to make use of new working methods • Ability to learn new skills as technology changes • Ability to be creative and interact socially with others • Multi-lingual skills for communication in a global operation
Competencies	• Innovation mindset to understand business development and take advantage of digital technology • Analytical thinking (including risk and systems analysis) to interpret and understand the need for change and the measures required
Organizational and management skills and competencies	
Skills	• Ability to communicate and negotiate, to promote required change to colleagues and customers • Ability to market and promote greener products and services • Ability to consult and advise end-users about green solutions and to spread the use of green technologies
Competencies	• Ability to implement change management • Ability to develop and implement management systems • HR and knowledge management • Advanced knowledge in project management to implement new technology • Ability to work strategically, to enable policymakers and business executives to set the right incentives and create conditions to achieve goals • Ability to manage teams and people working remotely and/or in dispersed teams • Ability to coordinate and manage holistic and interdisciplinary approaches incorporating economic, social and ecological objectives

Annex 3.2. Survey form DNV - Skills and competencies for the operation of ships using alternative fuel technologies

Insights Into Seafarer Training and Skills Needed to Support a Decarbonised Shipping Industry (Report - November 2022)

TABLE 8.2

Skills and competencies for the operation of ships using alternative fuel technologies

Safety skills and competencies	
Skills	• Seafarers on vessels operating with conventional fuels will have to adopt the safety mindset of the tanker/gas fleet when working with new fuel types • Ability to implement updated emergency preparedness procedures such as first aid, fire detection and fire fighting
Competencies	• Knowledge of potential hazards of the fuel on board and how these apply to equipment operation and maintenance • Knowledge of gas testing and atmosphere monitoring procedures • Knowledge of fuel-specific chemistry and physics to understand potential safety hazards • Understanding the basic concepts and properties of the different fuel types
Skills and competencies to master complex maritime operations	
Skills	• Ability to perform safe vessel and equipment maintenance with more hazardous fuels on board • Ability to handle the digital and manual systems for bridge, deck, engine, manoeuvring and propulsion that are introduced with the new fuel technology • Ability to master new bunkering methods • Ability to operate complex hybrid and zero-emission machinery • Ability to operate hydraulic components and pneumatic equipment
Competencies	• Knowledge of engine functions and manoeuvring characteristics • Knowledge of how to operate the vessel in an energy efficient manner
Sustainability skills and competencies	
Competencies	• Knowledge of emission monitoring and documentation • Knowledge of environmental economics and the use of performance management systems • Knowledge of logistics and optimization methods to achieve high vessel utilization and advanced routeing • Knowledge of environmental awareness and sustainable development of businesses
Digital skills and competencies	
Skills	• IT and digital skills • Data fluency and ability to interpret and analyse large amounts of data • Ability to operate equipment using digital controls • Ability to solve tasks digitally through operations monitoring and system management • Ability to update, service and repair digital systems
Competencies	• Remote control of operations, logging and analysing data from several sources • Basic digital technology knowledge (IoT, sensors, networks, cyber security, connectivity). Advanced analytics and use of data to optimize the fleet • In-depth technical knowledge to understand complex systems (seafarer as systems manager) • Knowledge of cybersecurity
Automation skills and competencies	
Skills	• Manage automation failure, with onshore support • Detailed knowledge of and proficiency in the use of automated systems. Ability to monitor and correct their function (S/C)
Competencies	• Ability to diagnose defects and rectify via automated systems • Advanced knowledge of electrical systems • Knowledge of programmable logic controllers (PLCs)

Annex 3.3 References

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