SKILLSEA

Co-funded by the Erasmus+ Programme of the European Union

METHODOLOGY

DELIVERABLE: 1.1.1
DATE: February 23, 2022
VERSION: 10.0

MAIN EDITOR(S)	A. OKSAVIK, H. P. HILDRE, Y. PAN
CONTRIBUTORS	A. OKSAVIK, H. P. HILDRE, Y. PAN, NTNU NORWAY D. ZEC. I. JENKINSON, B. KELLY, D. PARASKEVADAKIS, R. PYNE
REVIEWER(S)	-
DISSEMINATION LEVEL	PUBLIC

VERSION HISTORY			
VERSION	DATE	EDITOR	SUMMARY OF MODIFICATIONS
V1	Feb 15, 2019	Yushan Pan	First draft
V2	Mar. 26, 2019	R. Pyne	Changes on methodology
V3	Apr. 1, 2019	Yushan Pan	Second draft
V4	May 25, 2020	Arnfinn Oksavik	Third draft
V5	May 27, 2020	Andrew Linington	Language editing
V6	Mar. 1, 2021	Ian Jenkinson	Fourth draft
V7	Mar. 4, 2021	Yushan Pan	Language editing and formatting
V8	Apr. 13, 2021	E.G.T Ouwens Nagell	Formatting
V9	June 15, 2021	Yushan Pan	Revision
V10	November 15, 2021	Ian Jenkinson LJMU	Rewrite

Summary

Deliverable: 1.1.1, version: 1.0, date: 9 April 2021

This report details the research methodology used by the project to deliver the objectives of Task 1.11 (WP1) listed in the application. This work package aims to investigate maritime professionals' current and future skills gaps in seagoing and shore-based roles.

Deliverable	Name
D1.1.1	Methodology
D1.1.2	Current skills need
D1.1.3	Future skills and competence needs
D1.2.1	Skills and competence gap between current and future needs
D1.2.2	Identification of mismatches on a structural basis
D1.2.3	Impact on occupational profiles
D1.3	Recommendations for Education and Training

Table 1 Deliverables for Work Package 1

This work package aims to analyse the current and future skills needs on a structural basis. It investigates maritime professionals' current and future skills mismatches in seagoing and shore-based roles. The methods used to collect data (roles and associated skill profiles) include:

(1) Extracted data from documents

(2) Surveys of employees in stakeholder groups

(3) Semi-structured interviews

(4) Focus groups with stakeholders representing sub-sectors.

The data was used to synthesise profiles of current and future roles. These were compared against relevant published studies for the sector and cross-referenced against similar studies in other sectors. Significant differences were investigated. Jobs (roles and skill profiles) were then aggregated into occupational groups defined by International Skill Classification Codes (ISCO), and differences between skills profiles were identified (i.e. mismatches between current and predicted profiles). Future skills needs were then estimated by extrapolating time-series labour statistics for occupational groups (ISCO coded skills profiles) linked to the sector and the results compared with other sectors.

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seagoing and shore-based roles.[1] Technology and digitalisation are transforming the maritime industry, creating demand for a new generation of competent, highly skilled professionals. Europe is a source of maritime expertise. Ensuring employees have the relevant skills and experience will enable the industry to remain competitive. Maritime careers also need to attract and retain both male and female European nationals.

The four-year SkillSea project aims to ensure that maritime professionals possess the skills for the rapidly changing maritime labour market. SkillSea is co-funded by the Erasmus+ programme of the European Union. It is intended to develop a strategy to:

(1) Make the education and training for maritime professionals future-proof, adaptable and attractive

2) Provide them with the correct skills for the labour market

(3) Ensure the sustainability of the European maritime industry.

This report details the methodology used to deliver the outcomes from Task 1.1. of the SkillSea project plan. The Foresight methodology provides the framework for Task 1.1, which aims to analyse current and future skills needs on a structural basis. The study works within the time horizons in Table 2, which reflect those used in published studies on global trends and technologies. They are used to guide the selection of stakeholders and questioning.

Terms used throughout this task will follow the glossary of terms set out by Cedefop terminology of European education and training policy. (1) The Cedefop Practical Framework(2) will provide consistency, enable comparative analysis, and ensure data compatibility with EC systems. Skills profiles will be mapped using the Cedefop occupational skills profiles methodology. (3)

	Time horizons		
	Short 2020 - 2025	Mid-term 2025 - 2030	Long term 2030 - 2050
Current Skills Need			
Future Skills Need			

Table 2: Time horizon for the current and future skills needs

[1] Summary document of the Blueprint for Sectoral Cooperation on Skills ETF-ECSA, 2017

Methodology

Foresight is the 'systematic, participatory, future intelligence gathering and medium to long term vision-building process aimed at present-day decisions and mobilising joint actions'.(4) The framework combines qualitative and quantitative methods and tests the evidence base through analysis of trends and drivers, combined with road mapping. The steps towards completing Task 1.1 are summarised as follows:

1. Mapping and understanding current skills needs **(Task 1.1.2)**: Review of strategic policy developments of regulators (International Maritime Organisation-IMO, European Maritime Safety Agency-EMSA etc.) and regulatory framework for sea-based maritime skills (international and national). Overview of maritime education and training offered by the public (Higher Education Institutes-HEI and Vocational Education and Training Institutes-VET) and private organisations (delivery, curriculum, learning goals, etc.). Engagement with key stakeholders and understanding their roles in the sector and related policies. Mapping current skills needs based on current projects and research at regional, national, and European levels.

2. Future skills needs (**Task 1.1.3):** Analysis of trends and drivers is undertaken to provide the basis for developing scenarios and vision. This phase is supplemented by surveys and semi-structured interviews with business leaders and industry experts. Focus groups with industry stakeholder groups and road mapping are used to develop a probable course of action.

3. Implementation: The outputs from Task 1.1.2 and 1.1.3 (1 and 2 above) are then used to develop the steps required to implement the course of action and to identify key indicators of progress:

    a) Identify skills mismatches in the current workforce and the size and characteristics under a Business-as-Usual scenario, and a recommendation on how to close the 'skill mismatch'. **(Task 1.2.1)**
    b) Outline the mismatches between compulsory curriculum and the competence programmes delivered by training centres and industry training programmes. **(Task 1.2.2)**
    c) Recommend changes in: (1) Educational curricula delivered by MET academies, training centres, and on-the-job training, (2) Learning and delivery methods, and (3) Occupational profiles. **(Task 1.2.3)**

The Norwegian Centre approved data collection and analysis for Research Data (NSD). Data storage and analysis followed the rules of the NSD. Details of individual identity and company names have been removed and remain anonymous, except for five leaders selected from the shipping industry.

Mapping and understanding current skills needs

Sector employment and skills issues

Employment and skills issues are reviewed regarding the EU Blue Growth strategy[2] and studies conducted by the European Commission, (5) (6) and on behalf of stakeholder groups including the European Transport Workers' Federation, the European Community Shipowners' Associations, (7) (8) (9) and industry actors. (10) Skills required for sea-based roles and defined in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) [3] are considered along with transitional skills[4]and skillsets required in shore-based roles (green, digital, sector-specific, and cross-sectoral). Current and projected global labour market trends are based on the ISF/BIMCO Manpower Report ISF/BIMCO Manpower Report (11). Recruitment and training in the European shipping industry (12). Recruitment and retention of seafarers and the promotion of opportunities for women seafarers. (13)

Industry and education stakeholders

Relevant maritime industry stakeholders were identified based on the following groups:

(1) Shipping companies (companies owning and/or operating both cargo or passenger vessels in national and international trade)

(2) Companies and organisations providing services to the sector: insurance; classification societies; ship management; crew management; labour unions; logistics, equipment and stores; pilotage; shipping agents; cargo surveyors; ship repair; offshore industry; maritime administrations; training centres. An overview of the framework of maritime education and training (MET) across the European Union is provided, and representative MET stakeholders in Higher Education Institutions (HEI), Vocational Education and Training Institutions (VET), and Maritime Training Centres identified. The programmes offered by these stakeholders were reviewed with reference to the regulatory framework of the STCW and associated IMO model courses and the Bologna declaration.

Document review

A qualitative review was undertaken of relevant documents relating to the present or future skills required in the maritime industry and those considering technological developments that may impact the future skillsets. These include: (1) Project reports: Harmonisation of European Maritime Education and Training Schemes (METHAR) (14), The Thematic Network on Maritime Education, Training and Mobility of Seafarers (METNET) (15), KNOW-ME project, The Mapping of Career Paths in the Maritime Industries (16). European Port Workers Training Scheme - EU-PORTRAItS. (2) Published study reports: Mappings of career pathways in maritime industries. (17) (16) Analysis of retention issues Diversification of Seafarers' Employability Paths. (18) Current and future needs for skills needs in the marine and maritime sectors. (19) (20) (21) (22) (23) (24) (25) Lexical analyse[5] was used to provide quantitative data to support a qualitative review of documents associated with: (1) Issues affecting core areas of the maritime industry(9) (maritime economy, maritime regulation (law), and technology). (2) Maritime education and training associated with the STCW Convention and IMO model courses. (3) Programmes offered by representative MET stakeholders. The data identifies important subjects and associated actions based on the terms and expressions most frequently mentioned in the selected body of documents.

[2] https://transport.ec.europa.eu/transport-modes/maritime_en
[3] https://www.imo.org/en/OurWork/HumanElement/Pages/STCW-Convention.aspx
[4] Referenced to the Key Competences Framework of the European Commission.
[5] Wordsmith 7.0 (Lexical Analysis Software and Oxford University Press)

Measures include the frequencies of the words used, keywords and collocations of the most significant terms.

Stakeholder survey

A survey was used to identify the most critical areas of knowledge and expertise required by sea-based and shore-based personnel employed with modern shipping companies and companies operating in related industries. The target subjects for the survey were members of shore-based management or those responsible for the development and use of new technologies. In contrast, for shipboard personnel, the survey mainly targeted officer positions with operational and management functions onboard larger ships and those who might consider new jobs ashore within the maritime industry. Positions below the operational level (EQF Level 4) are not considered in detail because the skills needed for these roles are only rarely transferable to occupations ashore.

The survey was based on standardised questions following a fixed scheme and distributed to respondents in representative stakeholder organisations via the European Transport Workers' Federation (ETF), directly from partners, through selected publications. Respondents are identified through desk-based research and contacted in person before filling out the questionnaire. The selection criteria included: (1) Use or participation in the development of new onboard technologies (2) Use or participation in new business models in shipping; (3) Participation in the development of new legislation or similar requirements; (4) Regularly employs senior masters, chief engineers, and other maritime experts (4) Involvement in the management of significant on-the-job training (5) Involved in education and training in advanced subjects. The numbers of respondents per stakeholder organisation are:

- Shipowners (40)
- Ship managers and operators (30)
- Classification societies (5)
- Unions (8)
- Crew managers (20)
- Training centres (20)
- Agents (20)
- Pilots (10)
- Insurance, P&I (10)
- Logistic companies (5
- Equipment and store providers (5)
- Cargo survey (10)
- Maritime administration (3)
- Shipyards (4)
- Offshore industry (5)

Two surveys were developed, one for seafarers and one for shore-based personnel. Both questionnaires shared the same core set of questions. At the same time, the one for shore-based staff also included an additional set of questions, mostly related to expected developments in the maritime industry. Both questionnaires were developed and distributed using the SurveyMonkey platform. Participation was voluntary, and participants were allowed not to answer a question or questions or terminate their participation at any time.

Current skills needs

Based on the document review and survey, it was possible to identify: (1) Sector issues/challenges related to skills (e.g., around recruitment, retention and mobility, or deficiencies in core skill sets, etc.), (2) Mismatches in current provision, and (3) Plausible measures to address these deficiencies. Skill mismatches/gaps were identified in general or in specific sub-sectors of the maritime sector. In addition to the skills identified as skills needed onboard are the highly recommended skills for a seafarer, after serving at management-level positions onboard, looks for a job ashore in the maritime cluster. A lack of these skills might be understood as the leading cause preventing higher mobility between onboard and shore-based jobs within the maritime industry.

Future skill needs

Trends and drivers

A review of a sample of relevant published documents (26) (27) (10) is used to analyse global trends and drivers affecting the maritime sector and industry clusters, together with the impact of new technology. This is complemented by reviewing recent trade articles, news reports, and websites to provide ideas/insights on possible futures resulting from these trends. Five senior industry leaders were also asked to give their ideas on how the sector is changing and the necessary future skills. The leaders selected represent a cross section of the maritime sector and are from: a shipping company; a classification society; a maritime technology company; a shipping services company; and a marine insurance company. In this way the work gathered insights on general tends and drivers, as well as an understanding of how leaders in stakeholder organisations might respond.

Semi-structured interviews

The document review and statements from the industry leaders were also used to inform a series of semi-structured interviews with stakeholders in shipping, classification societies, finance, technology, manufacturing, labour unions, and education. A 'folk explanation' approach allowed researchers to study and discuss the interviewees everyday working lives, their experience with new technologies in the workplace, and the role of university and industry. They enabled the researcher to probe an answer with questions like 'tell me more' or 'what exactly do you mean?' The strength of this approach is the ability to access directly what happens in the industry – i.e., to examine what people do in real life rather than asking them to comment upon it.

There was no restriction on the number of interviews or focus groups. Work with participants continued until saturation was reached and responses became repetitive. The opening question with interviewees is: What are the skills of seafarers in the future, i.e., in the years 2030 or 2050? Then the interviewer follows up with: How do you predicate them? Besides these questions, the guide below provides a framework for the interview. However, the interviewer could follow up with other questions outside this guide, which are relevant to the answers from the interviewees within the research scope of work package one. Notably, the mixed questions (no significant difference between current and future) were designed to help researchers understand and distinguish the current and future skills from the experts' perspective. By doing so, we avoid being emotional and/or advice-giving on the answers.

Focus groups

Focus groups are used to gain an understanding of future skills. They allow researchers to obtain data from a purposely selected group of individuals. Focus groups enable participants to discover that particular views about the future are shared, confirm that this is a common interest, and are more likely to be correct, or conversely discover disagreements. This method is especially useful for those industry sectors where factors drive shipping markets in addition to technological development, such as crew recruitment (cruise and passenger), ship finance, insurance and more. The project selected three focus groups from: 1) the cruise and passenger sector, which is labour intensive, and 2) the container shipping sector, as it comprises oceangoing and coastal/regional vessels.

Secondary qualitative data were used to outline and categorise the knowledge, skills, and attitudes perceived as necessary for the relevant occupational roles to compare 'what people believe now' in the interview. Most of these data sources were published reports from the World Economic Forum, Cedefop, etc., and published academic papers.

Implementation

Summary

The outputs from D 1.1.2 and D 1.1.3 were used to develop the steps required to implement the course of action and identify key progress indicators. Profiles of current and future roles were developed. These were compared against relevant published studies for the sector, cross-referenced against similar studies in other sectors, and significant differences investigated. Jobs (roles and skill profiles) were then aggregated into occupation groups defined by International Skill Classification Codes[6] (ISCO). Differences between skills profiles were identified: i.e., mismatches between current and predicted profiles. Future skills needs were estimated by extrapolating time-series labour statistics for occupational groups (ISCO coded skills profiles) linked to the sector and the results compared with other sectors. Occupational Skills Profiles[7] which considers the level of education and training required for a particular occupation, were used to assess the impact on occupational profiles.

Outcomes

Skills mismatches in the current workforce and the size and characteristics under a Business-as-Usual scenario, and a recommendation on how to close the 'skill mismatch'. **(Task 1.2.1)**. A search was undertaken to identify any current initiatives to address the skills mismatches identified. The findings were compared with the education and training currently delivered by MET providers across Europe using programme documents provided by SkillSea partners. Mismatches between compulsory curriculum and the programmes delivered by training centres and industry training programmes were then identified **(Task 1.2.2),** and changes are recommended to: (1) Educational curricula delivered by MET academies, training centres, and on-the-job training, and (2) Learning and delivery methods, and the impact on occupational profiles is given in (3) **(Task 1.2.3)**

[6] https://ilostat.ilo.org/resources/concepts-and-definitions/classification-occupation/
[7] https://www.ilo.org/global/topics/apprenticeships/publications/toolkit/programme-and-project-level/developing-programmes/developing-occupational-profiles/tools/lang--en/index.htm

Ethical considerations

Ethics issues on primary data

Firstly, the work package will deal with personal data. This type of data is defined and scoped as research into future skills' social, cultural, political, economic, ethical, technical, and aesthetic aspects. It involves interactions with and/or collections of personal data from and about individual persons from online and offline sources or other sources for data processing purposes.

EU legal framework

Except for Norway, all EU partners will have a 'white statement' regarding data protection and informed consent.

Norwegian legal framework

Norway has special requirements for data privacy. The questionnaires for the current skills will be reported to the Norwegian Centre for Research Data (NSD), although no sensitive data will be collected. In addition, the contact information of the internal ethics committee from NTNU will be written on the first page of the questionnaires and other information to protect the rights of the participants. Participants can withdraw their participation at any time during the project duration without any reason.

Besides the above legal framework, there are three actors[8] to be considered in the Norwegian legal framework for semi-structured interviews:

- Controller: the person who determines the purpose of the processing of personal data and which means are to be used (POL §2.4)
- Processor: the person who processes personal data on behalf of the controller (POL §2.5)
- Data subject: the person to whom personal data may be linked (POL §2.6)

Personal data that may be directly and indirectly connected to a physical person includes name, PIN, IP address, job title, company name, and location. Thus, if data is recorded includes sensitive personal data (POL §33), for example, data that reveals information relating to racial or ethnic origin, political opinions, philosophical, or religious beliefs, the fact that a person has been suspected of, charged with, indicted for, or convicted of and so on, we will follow the guidance of Norwegian privacy law. In addition, the official reporting form (Personvernombud meldeskjema 2019 [English version]) will be used for the whole work package 1. Approval of data collection and analysis for the WP1 will be obtained in April 2019.

Ethics issues on secondary data

Besides the semi-structured interviews, secondary data will also be extensively used for the study on both current and future skills needs (D1.1.2, D1.1.3). Below we use a table to illustrate how ethics issues are considered (see Table 3).

8 See Vocabulary https://nsd.no/personvernombud/en/help/vocabulary.html

Issue	How this will be addressed
Have confidentiality, anonymity, non-identifiability, and non-traceability been handled?	All sensitive information from internal and external documents from an entity will be kept confidential, anonymous, non-identifiable, and non-traceable.
How does data protection law affect the collection and analysis of secondary data?	The EU General Data Protection Regulation (GDPR) principles and Norwegian data privacy regulations will be adhered to at all times when gathering personal data and related sensitive data, including affiliations.
How will the secondary data recording and analysis be conducted, verified, and by whom?	UNIRI[9], LJMU and NTNU, with facilitation responsibilities, will conduct data collection and analysis. WP leaders with facilitation responsibilities will ensure the data recording and verification process is timely accurately and includes all WP participants.
Who will see the results? Will some parts be withheld? Who owns the data?	The results will be made publicly available as a requirement of the Erasmus+ programme (outlined in the Erasmus Plus Programme Guide). Certain parts of the research to be withheld will be outlined. Steps will be taken to guard that outputs will not be identifiable/traceable to individuals/organisations.

Table 3: Ethical considerations of secondary data collection

9 University of Rijeka

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Appendix 1 Data collection and analysis

Secondary data to inform this study can be obtained from the needs identification studies completed to date and the analysis of various reliable sources of industry discourse. The purpose of the secondary data analysis proposed will be to outline and categorise the detailed Knowledge, Skills and Attitudes perceived as necessary for the relevant occupational profiles, comparing 'critical now' with “Future needs”. While most of these data sources are in the form of published written materials, this activity differs from a literature review. The sources are coded to identify and capture significant information from the data, resulting in putting them into 'containers'. Data analysis for the secondary data is the same with semi-interview studies. A necessary stage in developing the primary data collection instruments will be the rigorous analysis of secondary data sources.

Analysing the second data involved eight steps[10]

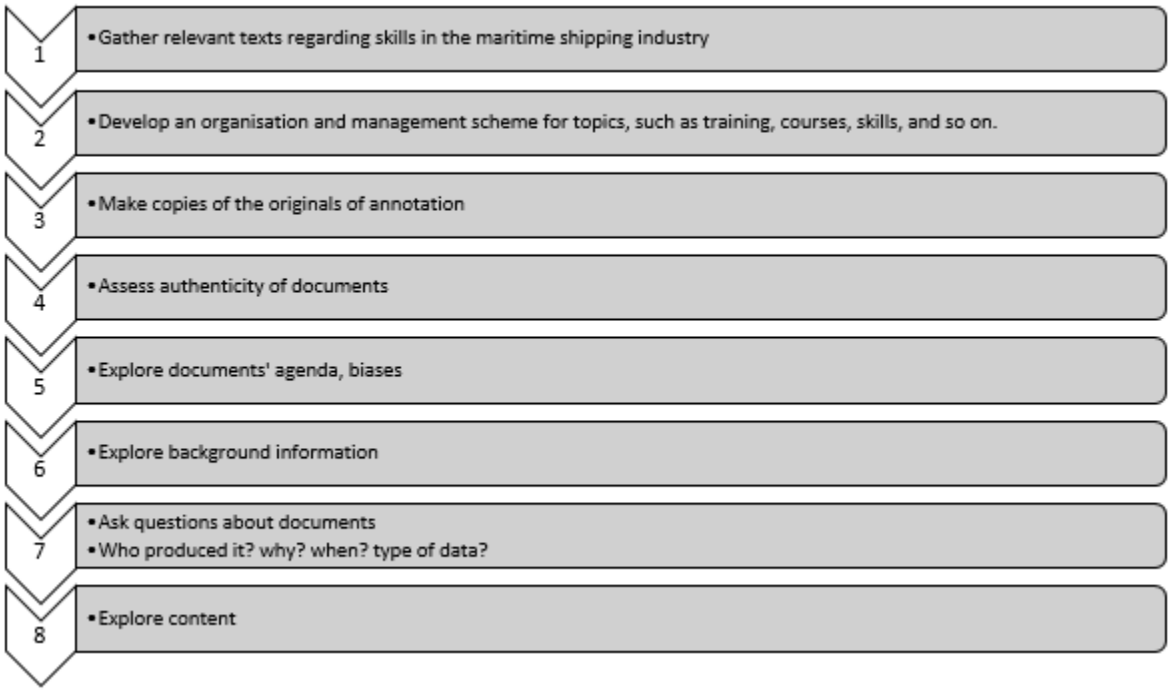

Figure 9: Steps for analysing secondary data

10 O’Leary, Z. 2014. The essential guide to doing your research project (2nd ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Appendix 2 Interview and focus groups

A. Interview template

Introduce myself:

Name, researcher/professor/officer at institution/organisation in Norway. I have worked for many years in the maritime sector. I became interested in how digitalisation will influence skills in the maritime sector.

Introduce my research

Explain the purpose of my research. Request consent to participate in an interview and ask permission to use the information gained in the interview in my research

Always ask:

1. Name

2. Function

3. Contact information

4. Can you describe your work and daily responsibilities in your own words.

5. Particular interests

6. Anonymity (if yes; ask name or organisation; purpose alias)

7. On the record/off the record (partly anonymous)

B. Guiding questions (ship operators, worker unions): Ask if they can give a demonstration of their work

Ask, if applicable, about options, categories, knowledge organisation, languages, and if they know, since the maritime jobs have their own terminologies.

1. What is your work, in your own words.

2. How can ICT support your work.

3. How they got involved with your work.

4. What is specific to the technology-supported work in your current position.

5. Is the technology solution a good solution for supporting your work.

6. How has your work changed since the introduction of ICT.

7. Do you see the differences between ICT support work and traditional work? What are the differences?

8. In your understanding of ICT supported work, what is maritime knowledge/skills and how is it different from the current job position.

9. How has your work changed since economic changes.

10. How has your work changed since environmental changes.

11. How do you forecast the future skills for seafarers?

The questions with Focus Group participants are structured as follows:

Round 1:

1. How will the overall Maritime Technologies sector [amend to appropriate SkillSea sector – e.g. UK finance, shipbroking and insurance] be affected (in terms of emerging, declining and disappearing jobs)?
2. How existing jobs will be affected (need for reskilling, upgrading, …)?
3. What new jobs/responsibilities/tasks will emerge?
4. What jobs might disappear (and hence the need to educate/train people for them), and whether the affected people have transferable skills for other types of jobs?
5. Which market types (genders, age, abilities, education level, competencies and skills) will be needed and which will be available in the workforce?
6. How can training and retraining of employees help in preventing job losses?

Round 2 (if needed):

1. What new jobs/responsibilities/tasks will emerge?
2. What jobs might disappear (and hence the need to educate/train people for them), and whether the affected people have transferable skills for other types of jobs?
3. How can training and retraining of employees help in preventing job losses?

Appendix 3 Summaries of secondary data

1. A starting point for a holistic consideration of current and projected worldwide trends is the ISF/BIMCO Manpower Report, which is updated every five years. The edition available at the start of the SkillSea project identified an existing shortfall of about 16,500 officers (2.1%) and estimated a need for an additional 147,500 officers by 2025. The most recent report issued in July 2021 updated these figures to be a shortfall of 26,240 STCW certified officers, indicating that demand for seafarers in 2021 has outpaced supply, and further predicts that there will be a need for an additional 89,510 officers by 2026 to operate the world merchant fleet. https://www.bimco.org/news/priority-news/20210728---bimco-ics-seafarer-workforce-report
2. The EU-funded 'Enhancing Recruitment and Training in the European Shipping Industry' project, which concluded in 2010, produced proposals to attract young people to a seafaring career and develop a more stimulating career path and mobility within the maritime cluster. The final report is available at: http://www.etf-europe.org/TrainingAndRecruitment.cfm
3. The joint ETF/ECSA project 'The Mapping of Career Path in the Maritime Industries' provided evidence on the potential and actual career paths of seafarers across a range of member states, with additional work to examine the demand for seafarers at sea and in relevant shore-based maritime sectors, and barriers to the mobility of qualified seafarers between the sectors. The final report can be downloaded on: http://www.ecsa.eu/sites/default/files/publications/054.pdf
4. The "Career Mapping Update 2013" was a follow-up to the first project and aimed at addressing challenges in training sufficient numbers of young people to adequately supply the current and future needs of the European maritime transport industry. The final report can be downloaded here: https://nautilusint.org/media/169249/ETF-ECA-Maritime-Career-mapping-2013.pdf
5. The UK-based Project Ulysses was conducted in response to one of the 2015 Maritime Growth Study recommendations and sought to identify current and future needs for skilled and experienced seafarers throughout the maritime sector. The final report is available at: https://www.maritimelondon.com/wp-content/uploads/2016/09/Project_Ulysses_Covering_Summary_2016.pdf
6. The Institute of Marine Engineering, Science and Technology (IMarEST) report on 'Mitigating the skills gap in the maritime and offshore oil + gas market' (2013) mainly focuses on engineering and recruitment. Still, it contains relevant recommendations on skills, experience and CPD. Notably, it found,
7. '71% of employers state that graduates are not leaving university with all required skills'. The full report is at: https://www.imarest.org/reports/683-mitigating-the-skills-gap-in-the-maritime-and-offshore-oil-a-gas-market-1/file
8. The International Labour Organisation recently produced an analysis on some of the challenges and opportunities linked to the recruitment and retention of seafarers and the promotion of opportunities for women seafarers[11]

[11]https://www.ilo.org/wcmsp5/groups/public/ed_dialogue/sector/documents/meetingdocument/wcms_664163.pdf

Industry's recruitment challenges

1. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/dttl-er-challengeindustry-08072013.pdf
2. https://www.researchgate.net/profile/Jiangang_Fei/publication/292424132_Human_resource_practices_____in_seafaring_Opportunities_for_improving_retention/links/59471e920f7e9b6910f72ddf/Human-resource-practices-in-seafaring-Opportunities-for-improving-retention.pdf
3. A good paper on the recruitment and retention of seafarers: what keeps individuals in a career at sea? http://iamu-edu.org/wp-content/uploads/2014/07/Recruitment-and-retention-of-seafarers-what-calls-to-and-keeps-individuals-in-a-career-at-sea.pdf
4. Exploring the range of retention issues for seafarers in global shipping: opportunities for further research - WMU Journal of Maritime Affairs April 2015, Volume 14, Issue 1, pp 141–157
5. Seafarers' Employability Paths at: https://www.futureacademy.org.uk/files/images/upload/WLC2016FA003F.pdf
6. Interesting analysis on the potential impact of automation and technology on work at sea, the role of seafarers and the shipping industry: http://www.ics-shipping.org/docs/default-source/resources/ics-study-on-seafarers-and-digital-disruption.pdf?sfvrsn=3

Potential skills needs for seafarers

1. International Transport Workers' Federation/World Maritime University report 'Transport 2040: Automation Technology Employment - the Future of Work' has a strong focus on shipping and seafarers: https://commons.wmu.se/lib_reports/58
2. Nautilus Federation: Future proofed? Research into seafarers' views on the impact of autonomous shipping, 2018 - https://www.nautilusint.org/en/news-insight/resources/nautilus-reports/autonomous-shipping-research
3. http://www.sirc.cf.ac.uk/Uploads/Publications/New%20Shipboard%20Technology%20&%20Training%20Provision%20for%20Seafarers.pdf
4. https://www.osm.no/PageFiles/4497/The%20Future%20of%20Crewing%20-%20Shipping's%20Challenges%20and%20Opportunities.pdf
5. MSA – Maritime Skills Need Assessment – 2009 – Attached. Has recommendations on management skills, career progression, strengthening qualifications and training etc.
6. 'Creating a European Skills Council for the Maritime Technology Sector' – attached. Some results on skills gaps in maritime sector p23.
7. 'Training the 21st Century Marine Professional' – attached. Not much of use but some on transferable/generic skills p38
8. Officers' shortage: viewpoints from stakeholders. Int J Mar Navig Saf Sea Transp 3(4):471–474
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Co-funded by the
Erasmus+
Programme of the
European Union