Italian Labour Law e-Journal
Issue 1, Vol. 17 (2024)
ISSN 1561-8048
https://doi.org/10.6092/issn.1561-8048/19786

The Maritime Labour Market in Transition.

Camilla Faggioni*

Abstract

The research explores the relationship between the spreading of digital technologies and the maritime labour market. The field of investigation focused on the transport sector in the European and Italian contexts. Firstly, the reasons and main features of the maritime employment crisis are discussed, with particular regard to crew shortage, lack of generational turnover and mismatch. Secondly, the current transition from on-board work to shore-based work is highlighted. The aim of the study is twofold. Primarily, the author intends to illustrate the implications of the spreading of new navigation technologies on the maritime labour market and to investigate the possible developments of the sea-to-land transition. Moreover, the intent is to encourage reflection on how to address the current and future issues that the maritime labour market is facing. The analysis and proposals are divided between the current/short-term situation and the future/long-term issues (that will require completely new actions).

Keywords: Maritime labour market; Seafarers; Digital transition; E-navigation; Active labour policies.

1. Preliminary remarks.

The maritime labour market is currently experiencing a serious crisis. For some reasons, which will be explained below, it is becoming increasingly difficult to recruit skilled and competent seafarers: European shipowners are struggling to meet minimum manning schedules. In addition, some even greater changes are yet to come. New technologies are deeply transforming the shipping industry, giving rise to various forms of electronic navigation, including remotely controlled or fully autonomous vessels. When this type of navigation will take over, the majority of shipping crews as we know them today will no longer be needed, and maritime workers will eventually lose their jobs. Nevertheless, the on-

* Research fellow in labour law at the University of Trento, Italy. This essay has been submitted to a double-blind peer review.

going decrease of on-board jobs will be partially counterbalanced by a growing demand for workers in the e-navigation sector.[1] In fact, remote operators are likely to be selected from those who have navigation experience.[2]

Due to digitalization and the introduction of various forms of e-navigation, crews are already being reduced. In any case, the situation now and in the short-term is very different from what it will be in the long-term; therefore, not only solutions to deal with the current crisis are needed, but also other different solutions should be devised to anticipate the spreading of remotely controlled ships.

After carrying out a brief overview of the impact of digitalization on EU shipping in paragraph 2, I will then divide my remarks into two parts, one devoted to the current and short-term situation, and the other dedicated to the long-term prospects. Within this reflection, I will also analyze the Italian perspective, highlighting what the role of Italy could be in tackling the crisis and the challenges to come. In paragraph 3, I will illustrate the reasons and characteristics of the current maritime employment crisis and propose some approaches to address the current and short-term issues of the market. In paragraph 4, I will discuss the consequences of the transition towards remote control of navigation on employment, underlining the need to support and guide workers throughout this transition. Lastly, in paragraph 5 I will outline some concluding remarks.

2. Digital transition and maritime transport in the EU.

The shipping sector is paramount to the EU economy, since much of the EU merchant transport is based on it.[3] Maritime transport enables trade and contacts among EU member States and between the EU and the rest of the world, and the blue economy represents a crucial source of employment and income for the EU.[4] Moreover, sea transport is environmentally preferred to other types of transport, and it is more energy-efficient for the purpose of moving large quantities of goods.[5] For these reasons, the EU has stated that it

[1] Baldauf M., Kitada M., Mehdi R., Dalaklis D., *E-Navigation, Digitalization and Unmanned Ships: Challenges for Future Maritime Education and Training*, in *Proceedings of the INTED2018 Conference*, Valencia, 2019, 9526; Jo S., D'Agostini E., *Disrupting technologies in the shipping industry: How will MASS development affect the maritime workforce in Korea*, in *Maritime Policy*, 120, 2020, available at https://doi.org/10.1016/j.marpol.2020.104139.

[2] Baldauf M., Kitada M., Mehdi R., Dalaklis D., nt. (1), 9528.

[3] EUROSTAT, *Maritime transport reference metadata in Euro SDMX Metadata Structure (ESMS)*, 2022, available at https://ec.europa.eu/eurostat/cache/metadata/en/mar_esms.htm. *See* also: Heidkamp C.P., Germond Duret C., Morrissey J.E., *Blue Economy. People and Regions in Transitions*, Routledge, London, 2022.

[4] European Maritime Safety Agency, *The EU Maritime Profile. Overview of the EU maritime economy*, 2022, available at:
https://www.emsa.europa.eu/eumaritimeprofile/section-1-overview-on-the-eu-maritime-economy.html#:~:text=Maritime%20transport%20and%20trade&text=Although%20it%20contains%20just%205,out%20of%20the%20EU%2D27.

[5] Corbett J., Winebrake J., *The Impacts of Globalisation on International Maritime Transport Activity. Past trends and future perspectives*, OECD, 2008, 13. To further analyze the matter of the environmental impact of maritime transport, *see* also: European Environment Agency, *European Maritime Transport Environmental Report*, 2021, available at https://www.eea.europa.eu/publications/maritime-transport/.

intends to invest more and more in the blue transition, which is considered essential for a more sustainable EU.[6]

As mentioned, in the last decade shipping has undergone a profound transformation, due to the strong impact of digitalization on the sector. The main change that has taken place in the shipping industry concerns the spreading of new modes of navigation, which make use of digital and electronic tools.[7] The concept of e-navigation was developed by the International Maritime Organization (henceforth, IMO) and the International Association of Marine Aids to Navigation and Lighthouse Authority, and defined as follows: "the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment",[8] Maritime Autonomous Surface Ships (henceforth, MASS) are operated with e-navigation. They could be the "growth engine of the next generation marine industry"[9] and they have been defined by the IMO Maritime Safety Committee as ships "operating at various levels independently of human interference".[10] The Committee identified four different levels of autonomy, depending on the greater or lesser involvement of the crew.

In a low-level state of automation, the system merely collects information, while the crew (who is present, but in smaller numbers as compared to classic crews) analyzes and determines the nature of the collected information. As the level of autonomy increases, the system performs more and more functions, eventually leading to the case where all functions are devolved to the computer system, except for emergency purposes.[11] Many countries are currently developing MASS systems at each of these levels.[12] Therefore, the role of workers in the maritime industry is already significantly changing.[13]

---

[6] European Commission, *Horizon 2020 – Work Programme 2018-2020: Smart, Green and Integrated Transport*, Brussels, 2019.

[7] *Ex multis*, cfr.: Portales J., *El desafio legal de los buques autónomos*, in Petit Lavall V., Puetz A. (eds.), *El transporte como motor del desarrollo socioeconómico*, Marcial Pons, 2019, 303-313; Vartdal B.J., Skjong R., St. Clair A.L., *Remote-controlled and autonomous ships*, in *DNV*, 2019; Zampella P., *Navi autonome e navi pilotate da remoto: spunti per una riflessione*, in *Diritto dei trasporti*, 2, 2019, 583-602; Komianos A., *The autonomous shipping era. Operational, regulatory, and quality challenges*, in *International Journal on Marine Navigation and Safety of Sea Transportation*, 2, 2018, 335-348.

[8] *See* International Maritime Organization – Maritime Safety Committee, *Circ. 1610*: *Initial descriptions of maritime services in the context of e-navigation*, June 14th, 2019, available at:
https://www.imo.org/en/OurWork/Safety/Pages/eNavigation.aspx.

[9] Jo S., D'Agostini E., Kang J., *From Seafarers to E-farers: Maritime Cadets' Perceptions Towards Seafaring Jobs in the Industry 4.0*, in *Sustainability*, 12, 2020, 2, available at https://doi.org/10.3390/su12198077 .

[10] International Maritime Organization, *Takes First Steps to Address Autonomous Ships*, May 28th, 2018, available at http://www.imo.org/en/MediaCentre/PressBriefings/Pages/08-MSC-99-MASS-scoping.aspx .

[11] Jo S., D'agostini E., Kang J., nt. (9), 2.

[12] For example, the autonomous ship Yara Birkeland, operated by the Fincantieri-Vard and Kongsberg groups, sails in Norwegian waters carrying up to a maximum of 120 TEUs from Porsgrunn to Larvik, for a total of 37 miles. The ship is currently manned by a small crew, but may soon begin to be entirely operated remotely from a RCC. *See*: Chaumette P., *Navire du futur: les conditions de travail des navigants au commerce, avant leur mise à terre?*, in *Neptunus*, 25, 1, 2019.

[13] Jo S., D'agostini E., Kang J., nt. (9), 2. *See* also: Carril Vázquez X.M., Fotinopoulou Basurko O., *Breves consideraciones sobre el impacto de los avances tecnológicos aplicable al buque desde una prospectiva iuslaboralista*, in Garcia-Pita Y Lastres J.L, Diaz De La Rosa A., Quintans Eiras M. (eds.), *El derecho maritimo, las nuevas tecnologias y los retos del progreso*, Aranzadi, Cizur Menor, 2021, 225-247; McConnell M., *A brief reflection on deconstruction, "digital disruption" and the employment of seafarers*, in Charbonneau A., Fotinopoulou Basurko O., Mandin F. (eds.), *Le travail et la mer. Liber amicorum en hommage à Patrick Chaumette*, Pedone, Paris, 2021, 287-293.

Most projects of unmanned ships are based on sensors that can communicate with an electronic brain.[14] The electronic brain works through a sophisticated algorithm that enables to decide the actions to be taken, considering the sensory information received. In particular, the unmanned ship is equipped with systems that allow self-steering at the detection of objects, in order to avoid collisions with other objects.[15]

3. Current and short-term prospects for maritime workers.

3.1. The maritime employment crisis.

It is out of question that remote control navigation will play a crucial role in the future of shipping.[16] In fact, the multifaceted capabilities of new technologies, their rapid development, as well as the fact that companies are always looking for more cost-effective solutions, point to unmanned navigation as an upcoming phenomenon.[17] The lower stage of autonomy is already quite common in today's shipping: fleet operation centers or remote-control centers (henceforth, RCCs) sometimes oversee the navigation of ships in coastal areas covered by the Vessels Traffic Service.[18] Such ships are fully manned, but the crew is assisted by an RCC when the ship approaches land. In the future, remotely controlled ships are very likely to be entirely maneuvered from the dock, even while sailing on the high seas.[19]

However, the described decision-making algorithms still need some refinements, and this constitutes the main obstacle to the large-scale spreading of this model. The sector is currently in an intermediate phase, where there is still demand for seafarers, and so will be for the upcoming years. Some foresight simulations and economic projections carried out by the World Maritime University note that in the short run an increase in seafarers demand is expected, because of the relatively slow pace of automation, which is largely offset by the increase in the volume of transports.[20] Conversely, in the long run a sharp change of course is predicted, with a considerable decline in demand for seafarers by 2040.

[14] Komianos, nt. (7), 336.
[15] Baldauf M., Benedict K., Krüger C., *Potentials of e-navigation – enhanced support for collision avoidance*, in *International Journal on Marine Navigation and Safety of Sea Transportation*, 4, 2014, 613-617; Komianos, nt. (7), 336.
[16] Soyer B., Tettenborn A., Leloudas G., *Remote controlled and autonomous shipping: UK based case study*, Institute of International Shipping and Trade Law, Swansea, 2021, 6. For an overview, cfr. also: Chaumette P. (ed.), *Economic challenge and new maritime risks management: what blue growth?*, Gomylex, 2017, available at https://ideas.repec.org/p/hal/journl/hal-01793050.html .
[17] For further analyses of the subject, *see:* Valle C., *La problématique juridique des navires autonomes*, University of Nantes, 2018; Van Hooydonk E., *The law of unmanned merchant shipping - an exploration*, in *The Journal of International Maritime Law*, 20, 2014; Lopez Varela S., Salgado Don A., Perez Canosa J.M., *Analysis critico de la navigacion-e a bordo: situacion actual y perspectivas de futuro*, in Garcia-Pita y Lastres J.L., Diaz De La Rosa A., Quintans Eiras M.R. (eds.), *El derecho maritimo, las nuevas tecnologias y los retos del progreso*, Aranzadi, Cizur Menor, 2021.
[18] Janßen T., Baldauf M., Müller-Plath G., Kitada M., *The Future of Shipping: A Shore-Based Experience?*, in Bauk S., Ilčev S.D. (eds.), *The 1st International Conference on Maritime Education and Development*, Springer, Berlin, 2021, 52 ff.
[19] Van Hooydonk E., nt. (17).
[20] World Maritime University, *Report "Transport 2040 – Automation, Technology and Employment. The Future of Work"*, 2019, 22, available at https://commons.wmu.se/lib_reports/58/.

Traditionally, in order to perform the seafaring profession, the requirements are to possess and maintain stringent, physical and professional suitability. Moreover, most shipboard activities can only be performed by those who hold the professional title that qualifies them for that activity. With digitalization, seafarers have also been required to own very sophisticated digital skills related to the use of software and hardware tools, and to cyber security, big data, computer programming, etc.[21] The more autonomous and sophisticated the ship is, the fewer workers are needed to operate it, but they have to be very well-trained and experienced.[22] The ratio of the Japanese container ship fleet is a good example: 5 officers out of 7 crew members.[23]

Although the number of crew members has been greatly reduced over the years, currently there is a crew shortage. The first reason lies on the increasing volume of sea transport. In addition, it is not easy to find figures with the necessary requirements, titles, and advanced digital skills. Moreover, younger individuals are increasingly disinclined to pursue a career as a navigation officer. This leads to another aspect of the maritime employment crisis: the lack of a generational turnover.

The current crew shortage in Europe particularly regards high-skilled seafarers – such as officers, especially machine officers.[24] Indeed, the maritime labour market can be divided into two different sub-markets: one comprising low skilled ordinary seafarers, and the other composed of officers. EU-resident, ordinary seafarers have been gradually replaced by non-EU seafarers due to the new opportunities introduced by open registers.[25] Conversely, when it comes to officers, EU shipowners are struggling to find qualified personnel.[26]

Seafarers training regime and the qualifications and requirements needed to work on board are outlined in the Convention on Standards of Training, Certification and Watchkeeping for Seafarers (henceforth, STCW),[27] which establishes internationally uniform minimum standards. The convention is updated periodically and provides for certain digital competencies to perform many of the shipboard roles. However, the overall structure of seafarers training should be radically revised. In fact, in the short-term it will be crucial to implement well-structured vocational training policies for those who are going to continue working onboard. Human resource management will have to change and start upskilling

[21] Cicek K., Akyuz E., Celik M., *Future skills requirements analysis in maritime industry*, in *Procedia Computer Science*, 158, 2019, 271; Jo S., D'Agostini E., Kang J., nt. (9).
[22] To further analyze this subject, *see* Lutzhoft M., Hynnekleiv A., Earthy J.V., Petersen E.S., *Human-centred maritime autonomy - An ethnography of the future*, in *Journal of Physics: Conference Series*, 1357, 2019, available at https://iopscience.iop.org/article/10.1088/1742-6596/1357/1/012032.
[23] Dujardin B., *Le facteur humain dans la conduite du navire*, in *La Revue Maritime*, 2008, 105.
[24] For data on crew shortage at European level, *see* https://transport.ec.europa.eu.
[25] About open registers, cf., *ex multis*: Chaumette P. (ed.), *Gens de mer: un marché international du travail*, Gomylex, 2016, 259-284; Shaughnessy T., Tobi E., *Flags of Convenience: freedom and insecurity on the high sea*, in *Journal of international law and policy*, 5, 2006, 1-8; Alderton T., Winchester N., *Globalisation and De-Regulation in the Maritime Industry*, in *Marine Policy* 26, 2002, 35-43; Boczek B., *Flags of convenience. An International legal study*, Harvard University Press, Cambridge, 1962.
[26] Faggioni C., *The International Ship-Registers in Europe: An Analysis from the Labour Law Perspective*, in *Ljubljiana Law Review*, 83, 2023, 63.
[27] International Maritime Organization, *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, 1978. *See*: Chaumette P., *Recrutements, formations et carrières dans la marine marchande en Europe*, in *Annuaire de Droit Maritime et Océanique*. *Tome XXX*, 2012, 287-318.

strategies, and educational and training institutions will have to adapt to the new market demand in terms of skills.[28] Seafarers will need to have appropriate knowledge of cyber security, big data, maintenance of digital devices and computer systems programming. Moreover, their training should be based on the principle of knowing not only how to do something, but also why it is done.[29] Finally, training programs should consider that skills are quickly lost if they are not continuously practiced, thus a frequent verification, evaluation and updating is necessary. In this transition phase, it could be truly helpful to obtain and receive feedback from crew members about their experiences with e-navigation and cooperation with remote operators.

3.2. Addressing the crisis. The Italian point of view.

The renewal of the international training system would represent a first step, following which each States could determine domestic policies. However, reaching an agreement at the international level might take a considerable time.[30] Meanwhile, single States can work to update their regulations and improve their employment policies. As far as the Italian legal system is concerned, there is an urgent need to define many procedures that are still entrusted to completely outdated rules. Also, education and training systems and programs are not adequate, and demand-supply matching strategies are not entirely up to date.

The placement of seafarers has been subject to special regulations since 1925.[31] The *Regio Decreto* (Royal Decree) 1031/1925 defined the establishment of maritime placement offices, in charge of labour intermediation specifically for the maritime sector.[32] The establishment of a specific system of maritime labour supply and demand matching reflects the awareness of the peculiarities of a sector that combines navigation safety with seafarers protection.[33] Furthermore, maritime employment contracts are characterized by a high level of discontinuity that requires special attention, and the international dimension of the navigation system makes the maritime sector even more peculiar. By virtue of subsequent reforms, to date the placement of seafarers is not restricted to maritime placement offices: bilateral bodies, common employment agencies and *Capitanerie di Porto* (harbor offices) can also carry out maritime labour intermediation activities.[34]

---

[28] Baldauf M., Kitada M., Mehdi R., Dalaklis D., nt. (1), 9525. *See* also: Kim J.K., Ahn Y.J., Lee C.H., *A study on the improvement of the system of seafarer education suitable for the 4th industrial revolution*, in *Journal of Fisheries and Marine Sciences Education*, 29, 2017, 1072-1082.

[29] Lopez Varela P., Salgado Don A., Perez Canosa J.M., nt. (17), 521.

[30] World Maritime University, nt. (20), 16.

[31] Royal Law-Decree 24th May 1925, No. 1031, converted into Law 18th March 1926, No. 562. *See:* Corbino E., *Il mercato del lavoro della gente di mare e l'azione dei sindacati operai*, in *Giornale degli Economisti e Rivista di Statistica*, 9, 1925, 473-491.

[32] Cardillo C., *Nuovo collocamento della gente di mare*, in *Il Diritto Marittimo*, 3, 2007, 951-961.

[33] *See:* Riccardi A., *La riforma dei servizi per il lavoro e il collocamento della gente di mare*, in *Rivista Italiana di Diritto del Lavoro*, 36, 2017, 648-656; Riccardi A., *Il collocamento della gente di mare*, in Ghera E., Garofalo D. (eds.), *Organizzazione e disciplina del mercato del lavoro nel Jobs Act 2, Commento al decreto legislativo 14 settembre 2015, n. 150*, Cacucci, Bari, 2016, 237-239.

[34] Signorini E., *La gente di mare. Il collocamento*, in Basenghi F., Levi A. (eds.), *Le semplificazioni procedurali, le sanzioni e le pari opportunità nel jobs act*, Giappicheln,li, Turi 2018, 74; Riccardi A., nt. (33), 2017, 659-660 and Riccardi A.,

The system was amended by the *Decreto del Presidente della Repubblica* (Presidential Decree) (henceforth, DPR) 231/2006.[35] The DPR 231/2006 – overcoming the previous regime dictated by the *Regio Decreto* 1031/2925 and Articles 125 and 126 of the *Codice della Navigazione* (Italian Navigation Code)[36] – was aimed at the simplification and rationalization of procedures and at redefining the professional qualifications of seafarers and their minimum requirements. In addition, it intended to provide the necessary information technology to improve labour supply and demand matching in the maritime sector. The system pursued transparency by mapping and tracking workers and building a database of individuals available for boarding.[37]

However, the DPR of 2006 has not yet been fully implemented: in order to take effect, it needed a series of implementing decrees that were never issued.[38] Indeed, in 2015 the enactment of two decrees changed again the placement of seafarers,[39] but it did not repeal DPR 231/2006, nor did it fully implement it. Doubtlessly, this contributed to a certain confusion with respect to the general regulatory framework. The two 2015 decrees determined a rewriting of the attribution of competencies, with a view to reevaluating the top-down role of the State over that of Regions, under the direction of the *Agenzia Nazionale per le Politiche Attive del Lavoro* (Governmental Agency for Active Labour Policies – henceforth, ANPAL).[40]

The various implementing decrees envisaged by the aforementioned DPR 231/2006 should be urgently adopted. In fact, the absence of structured workforce monitoring practices is one of the main causes for the difficulty in matching job-seeking resources with the various job opportunities in the sector, and the completion of the 2006 reform could represent a step forward in this sense. Of course, the implementing decrees should be adopted considering the additional changes made by the two 2015 decrees. In fact, it is necessary to coordinate and standardize employment and training policies on a national level as much as possible, and the two 2015 decrees represented a first step in this direction. Coordination activities with the *Comitato Interministeriale per le Politiche del Mare* (Interministerial Committee for Maritime Policies – henceforth, CIPOM) should be strengthened, and a single and constantly updated and integrated portal should be implemented, with the databases of

Semplificazione in materia di collocamento della gente di mare, in Ghera E., Garofalo D. (eds.) *Semplificazioni, sanzioni, ispezioni nel Jobs Act 2, Commento ai d.lgs. 14 settembre 2015, 149 e 151*, Cacucci, Bari, 2016, 89-92.

[35] Presidential Decree 18th April 2006, No. 231: *Regolamento recante disciplina del collocamento della gente di mare, a norma dell'articolo 2, comma 4, del Decreto legislativo 19 dicembre 2002, n. 297*. *See*: Ricci G., *Gente di mare: la riforma del collocamento*, in *Guida al lavoro. Il Sole 24 Ore*, 32, 33, 2006, 24-30.

[36] Royal Decree 30th March 1942, No. 327: *Approvazione del testo definitivo del Codice della Navigazione*. *See* also: Decree of the *Ministero della Marina Mercantile*, 1992, No. 584: *Regolamento recante le norme degli uffici di collocamento della gente di mare.*

[37] Signorini E., nt. (34), 67.

[38] Giasanti L., *Codice della Navigazione. Il lavoro marittimo*, in Del Punta, R, Scarpelli F. (eds.), *Codice Commentato del Lavoro*, IPSOA, Milan, 2020, 755.

[39] Legislative Decree 14th September 2015, No. 150: *Disposizioni per il riordino della normativa in materia di servizi per il lavoro e di politiche attive, ai sensi dell'articolo 1, comma 3, della legge 10 dicembre 2014, n. 183*; Legislative Decree 14th September 2015, No. 151: *Disposizioni di razionalizzazione e semplificazione delle procedure e degli adempimenti a carico di cittadini e imprese e altre disposizioni in materia di rapporto di lavoro e pari opportunità, in attuazione della Legge 10 dicembre 2014, n. 183.*

[40] About the relationship between central and peripheral bodies in labour policies, *see:* Salomone R., *Rischi e opportunità nelle riforme del mercato del lavoro al tempo del PNRR*, in *Lavoro e Diritto*, 2, 2023, 196-200.

the *Istituto Nazionale per la Previdenza Sociale* (National Institute for Social Security) and ANPAL.[41]

It should be noted that in 1993 the *Ministero della Marina Mercantile* (Merchant Fleet Ministry) was abolished: since then, maritime policy responsibilities have been divided among at least eight ministries. This situation has often compromised the possibility of developing a homogeneous national policy for the entire sector. The current government includes a *Ministro per la Protezione Civile e le Politiche del Mare* (Civil Protection and Maritime Policies Ministry), without portfolio and with extremely limited functions. However, in November 2022 the CIPOM was established: a cross-ministerial committee with the task of ensuring the coordination and definition of strategic directions for sea policies at the national level, through the elaboration of the *Piano del Mare* (Maritime Plan) every three years. The first *Piano del Mare* has already been adopted and represents a first step toward the revision of seafarers placement procedures.

One of the most urgent aspects that needs to be updated concerns training requirements for seafarers, since the Annex to DPR 231/2006 still applies. Its list of board qualifications and related duties and requirements seems to be no longer in line with the real needs of the shipping industry. Moreover, the educational programs for professional titles should be reviewed. Due to the specificities of the shipping sector, it is necessary to activate proper training methodologies based on technological innovation – such as the use of simulators and virtual reality exercises. In addition, new models of skills certification and administrative validation of training could be identified. To address the issue of generational turnover, it would be appropriate to improve the coordination of training programs and maritime sector, and to facilitate the transition of students to the maritime labour market. Some experiences of dual vocational training in the maritime sector have already been carried out in other countries, such as Spain, with very high rates of professional placement. For example, in the case of the dual programs provided by the *Xunta de Galicia,* placement rate was around 97%.[42] Indeed, structured campaigns aimed at career guidance toward the maritime sector could be promoted.

Employment agencies could play a central role, especially if systemic actions are taken to integrate their know-how in innovative employment measures with the know-how of maritime placement offices.[43] In this sense, a major role can certainly be played by ANPAL, as coordinator in charge of conducting and systemically implementing active labour policies aimed at supporting and revitalizing employment.

[41] Comitato Interministeriale per le Politiche del Mare (CIPOM), *Piano del Mare 2023-2025*, July 31st, 2023, 132, available at https://www.gazzettaufficiale.it/eli/gu/2023/10/23/248/so/36/sg/pdf.

[42] Consejo Economico y Social, *Report: Fisheries, Aquaculture and the Processing Industry in Spain*, 3, 2023, 13, available at https://www.ces.es/documents/10180/5232164/Inf0323_conclusiones-EN.pdf/dba048cb-5002-827c-40ea-4a5bcc794e25?version=1.1.

[43] About the most innovative and digitization-driven active policies, *see:* Scarano G., Colfer B., *Linking Active Labour Market Policies to Digitalisation. A Review between Remote and Automated Possibilities*, in *International Journal of Sociology and Social Policy*, 13-14, 2022, 98-112; Sacchi S., Scarano G., *Digitalizzare le politiche del lavoro. Da dove si comincia*?, in *Percorsi di Secondo Welfare*, February 6th, 2024, available at https://www.secondowelfare.it/primo-welfare/digitalizzare-le-politiche-del-lavoro-da-dove-si-comincia/ .

Both in terms of training activities and supply-demand matching practices, local institutions should work in synergy with social partners. It is necessary to involve businesses and employers in policies aiming to hinder mismatching,[44] for example through individual profiling of workers.[45] From this point of view, the reference to bilateral bodies among the possible key figures in seafarers placement by the DPR 231/2006 must be welcomed.

As regards the role of unions, their inclusion should not be difficult, given that the International Transport Workers' Federation (henceforth, ITF) has always been concerned about the consequences of digitalization on seafarers, reflecting and proposing dialogues with employers associations.[46] The current system outlined in the Annex to DPR 231/2006 establishes a strict list of on-board qualifications. However, due to the increasing need for professional qualifications over those considered in the minimum manning schedules, the possibility should be guaranteed to defer to national collective bargaining the identification of additional qualifications.

4. Long-term prospects for maritime workers.
4.1. The sea-to-land transition.

In the medium to the long-term, it is reasonable to assume that unmanned ships will begin to sail even on the high seas. These ships will probably be developed as part of a local transport system, creating new nautical routes as an alternative to other transport systems.[47] Therefore, many maritime workers may lose their jobs (starting from low- and medium-skilled workers), and the seafaring profession may eventually disappear.[48] Forecast simulations conducted so far show that the introduction of highly automated ships will lead to a sharp decrease in global demand for seafarers by 2040, where the effects will no longer be offset by the projected increase in the volume of maritime trade.[49]

However, the growth of automation will also give rise to new job opportunities. Workers will not necessarily have to navigate for long periods to work in the maritime industry. The crew will be able to simply observe monitors and panels from which to check the various parts of the ship without the need of their physical presence, except when strictly necessary. This will avoid them exposure to the considerable risks that are typical of maritime work, thus this transformation could facilitate the inclusion of young people and women in the maritime sector. This is not surprising since, as in other sectors, automation and

[44] *See*: McGuinness S., Pouliakas K., Redmond P., *Skills mismatch: concepts, measurement and policy approaches*, in *Journal of Economic Surveys*, 4, 2018, 985 ff; Ciucciovino S., *L'intermediazine alla prova dello skill mismatch*, in *Lavoro e Diritto*, 2, 2023, 309-332; Faioli M., *Matchmaking. Tecnologia avanzata, regole e mercato del lavoro*, in *Lavoro e Diritto*, 2, 2023, 333-352.
[45] *See*, in this same issue: Bebber A., *Digitalization and labour market: the role of profiling in occupational transitions.*
[46] About global collective bargaining and social dialogue in the maritime sector, cf., among many: Lillie N., *Global Collective Bargaining on Flag of Convenience Shipping*, in *British Journal Of Industrial Relations*, 1, 2004, 47-67; Smith J., *Le Passage du blue ticket au Green ticket: le dialogue collectif entre ITF et les armateurs peut-il améliorer le respect des droits des marins?*, in *Annuaire de Droit Maritime et Océanique. Tome XXII*, 2004, 265-283.
[47] World Maritime University, nt. (20), 83.
[48] McConnel M., nt. (13), 290.
[49] World Maritime University, nt. (20), 22.

technological advances in shipping undoubtedly present challenges and opportunities which can be exploited to improve working conditions and make the market more inclusive.

4.2 Supporting the transition. The Italian point of view.

Doubtlessly, the described reality inevitably challenges the current state of the maritime labour market. In order to appropriately address and respond, the maritime leadership and social partners need to recognize the importance of being proactive in managing the effects of emerging technologies.[50]

First, it could be useful to start planning active policy measures for ashore redeployment of those who will lose their jobs due to crew reductions. In this sense, the transition should be accompanied and facilitated. The ITF has highlighted the need for workers affected by crew reductions to receive free reskilling training. In addition, the ITF has proposed a form of compensation that could be applied to workers who lose their jobs due to automation.[51] Actually, a compensation system would be unnecessary if a functioning system of active policies could be implemented. As the "classic" maritime labour market shrinks, a new maritime labour market creates new possibilities related to the remote control of vessels.[52] Therefore, it seems appropriate and reasonable to direct maritime workers to this new market. Indeed, it would be more desirable for policies to anticipate the moment of dismissal and to facilitate seamless transit from one market to the other.[53] These policies should be based on individualized counselling, targeting those who feel that the remote-control labour market is appropriate to their aptitudes and aspirations.

Ex-seafarers could use much of the skills acquired with their jobs onboard in the remote-control sector. This would not only make training activities shorter and easier, but it could also be relevant from the point of view of workers satisfaction and self-realization. In this regard, a study carried out within the World Maritime University has shown that those who have previous navigation experience are particularly suited to carry out remote route control activities, as they are already familiar with vessel traffic.[54] The study was based on a series of

[50] About the need for labour reforms to be future-oriented, *see:* Calafà L., *Le politiche del mercato del lavoro nel PNRR: una lettura giuslavoristica*, in *Lavoro e Diritto*, 2, 2023, 165; Salomone R., nt. (40), 94.
[51] International Transport workers Federation, *Seafarers, inland waterways, fishers. Response to the challenges of the future of work*, 2019, available at https://www.itfglobal.org/en/focus/future-work/positions-and-responses.
[52] About the probable transition of seafarers to shore-based roles, *see:* Saxe S., Jahn C., *Digitalization of Seaports – First Ideas*, Fraunhofer, Hamburg, 2017; Thomas F., *Réflexions sur la descente a terre des gens de mer (escale et transit) dans l'Union européenne*, in *Neptunus*, 1, 2013; Kitada M., Baum-Talmor P., *Maritime Digitization and Its Impact on Seafarers' Employment from a Career Perspective*, in *Proceedings of the International Association of Maritime Universities (IAMU) Conference*, Tokyo, 2019; King J., *Technology and the seafarer*, in *Journal for Maritime Research*, 2, 2000, 48-63; Chaumette P., *Navire du futur: les conditions de travail des navigants au commerce, avant leur mise à terre*?, in *Neptunus*, 1, 2019; *De l'évolution du droit social des gens de mer. Les marins sont-ils des salariés comme les autres? Spécificités, banalisation et imbrication des sources*, in *Annuaire de Droit Maritime et Océanique. Tome XXVII*, 2009, 471-499.
[53] Colasanto M., Lodigiani R. (eds.), *Il ruolo della formazione in un sistema di welfare attivo*, Fondazione Pastore, Rome, 2007, 10 ff.
[54] Baldauf M., Kitada M., Mehdi R., Dalaklis D., nt. (1). Cf. also: Porathe T., Prison J., Man Y., *Situation Awareness in Remote Control Centres for Unmanned Ships*, in *Proceedings of the Conference "Human Factors in Ship Design & Operation"*, 2014.

remote-control navigation simulations designed to observe and compare the performance of personnel with navigation experience with that of personnel with no navigation experience. It was found that participants with a navigation background acted strategically and more proactively, better coordinating their actions in maneuvering with the other ships in the scenario. In addition, their choices were more compliant with the dictates of the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS). This clearly highlights that familiarity with sea-maneuvering could be a key requirement for remote operators to ensure safe and efficient navigation.[55]

Multiple actors need to be involved to guide the sea-to-land transition, and each of them can have a crucial role in facilitating it. As regards the role of legislative and regulatory bodies, an international legal framework for remotely controlled vessels and RCC operators would be of great help. Unfortunately, current maritime Conventions are silent on the minimum training standards required to become an RCC operator, and the STCW does not even mention the new shore-based roles.[56] Of course, the training requirements for RCCs operators must necessarily be different from those for seafarers, given the diversity of tasks. An internationally uniform qualification and certification system would be ideal, such as the one established for seafarers in STCW. This system could be added to the STCW itself, with a part dedicated to the new figure of the remote operator, or it could be regulated within the new MASS Code, currently drafted within the IMO.[57]

However, despite the willingness and determination of international organizations, indications are that international guidelines and regulations regarding autonomous transport are unlikely to be achieved within the next decade.[58] In the meantime, highly automated transport solutions could be implemented at the local level and governed by the national legislation or by bilateral agreements between countries. For this reason, States should begin to develop their own strategies and devise upskilling and reskilling training, starting to fill the regulatory void with a focus on active policies that support workers through the transition. Lessons could be learned from some States that have already taken some steps forward. For example, in the UK some preliminary guidelines on these matters have been provided in a voluntary code put together by the UK Maritime Autonomous Systems Regulatory Working Group (MASRWG).[59]

It is extremely difficult to say if and at what level Italy could play a pioneering role in devising regulatory strategies and implementing employment policies for the automated

[55] Baldauf M., Kitada M., Mehdi, Dalaklis D., nt. (1), 9528.
[56] Soyer B., Tettenborn A., Leloudas G., nt. (16), 7. Cf. also: La Torre U., *Navi senza equipaggio e shore control operator*, in *Diritto dei trasporti*, 2, 2019, 498-502; Choi J., Lee S., *Legal status of the Remote Operator in Maritime Autonomous Surface Ships (MASS) under maritime law*, in *Ocean Development and International Law*, 52, 2021, 445-462.
[57] The MASS Code is a non-mandatory, goal-based instrument regulating the operation of maritime autonomous surface ships. The aim of the International Maritime Organization is to adopt it as soon as possible to take effect in 2025. This instrument could form the basis for a mandatory instrument expected to enter into force in 2028. *See:* https://www.imo.org/en/MediaCentre/HotTopics/Pages/Autonomous-shipping.aspx.
[58] World Maritime University, nt. (20), 16.
[59] In this code, RCCs are defined as "the set or system of equipment and control units that are needed at the site or sites where safe and effective remote command, control and/or monitoring of the MASS, or several MASS, is conducted".
.

maritime sector. It is especially difficult to predict the long-term ability to cultivate the right skills and talent for the future maritime workforce. Knowing Italy's lack of interest in maritime policies in the past decades,[60] the predictions are not positive. However, Europe is one of the areas of the world where autonomous ships could spread first, and Italy has recently shown a new awareness and willingness to build a better strategic vision for the introduction of emerging technologies in the maritime sector, with the issuance of the *Piano del Mare*. On the one hand, upskilling, reskilling and redeployment goals could be pursued with the already issued legal instruments, especially if the 2006 reform – lastly modified by the two decrees of 2015 – is applied. On the other hand, given that the digital transition has assumed some specific features in the maritime industry, new guidelines are necessary. In this sense, the *Piano del Mare* represents, once again, a first step forward. The CIPOM, in collaboration with the Ministry of Labour and the Ministry of Transport, should focus more on vocational retraining, promoting medium- and long-term training courses aimed at the acquisition of the skills required in the new professional sector: the seafarer of the future will have to combine navigational skills with data fluency, ability to interpret and analyze large amounts of data, digital operation of equipment such as ships, cranes and winches, as well as software engineering of fundamental programs and systems.[61] Also, as mentioned, the policies should not be directed at the re-employment of those who will lose their jobs due to the spreading of e-navigation, they should rather aim at facilitating direct market-to-market transitions, anticipating and preventing company insolvencies.

Besides the vocational training efforts, the measures could consist in profiling and personalized counselling, internships, hiring bonuses. Some lessons could be learned from existing measures, such as the *accordo di transizione occupazionale* (employment transition agreement), even if it is an instrument that intervenes *a posteriori* when the corporate crisis is already occurring, and other measures have been exhausted. The aim of the *accordo di transizione occupazionale* is to provide incentivizing benefits for employers, facilitating hiring both through a permanent contract and through professionalizing apprenticeships (*apprendistato*).[62] An interesting aspect is that a union consultation process is compulsory, and it must result in an agreement.[63] This agreement must explicitly define actions aimed at both re-employment and self-employment of the workers involved, with the possibility to rely on *fondi interprofessionali* (multisector funds)[64] as far as upskilling and reskilling activities are concerned. Obviously, the major role in the support of maritime workers throughout the sea-to-land transition can be played by ANPAL, but the role of bilateral bodies and unions will also be essential. As pointed out, bilateral bodies already play a key role in the placement of seafarers, being able to perform labour intermediation. In addition, the ITF has a long history of representing the interests of maritime workers at the international level and is

[60] Fabbri D., *Italia, penisola senza mare*, in Caracciolo L. (ed.), *L'Italia è il mare*, in *Limes*, 10, 2020, 47 ff.
[61] World Maritime University, nt. (20), 83.
[62] Legislative Decree 14th September 2015, No. 148: *Disposizioni per il riordino della normativa in materia di ammortizzatori sociali in costanza di rapporto di lavoro, in attuazione della legge 10 dicembre 2014, n. 183*, art. 22-ter; Law 30th December 2021, No. 234: *Bilancio di previsione dello Stato per l'anno 2022*, art. 1, para. 243-248.
[63] Legislative Decree 14th September 2015, No. 148, art. 24.
[64] The *fondi interprofessionali* are organizations set up to finance training measures for employees of the joining companies (Law 23rd December 2000, No. 388, art. 118.)

committed to working at the national and regional levels to build sustainable strategies for the future of maritime work. Collective bargaining could be a good tool to build accompanying systems for workers who show an interest in shifting into the RCCs labour market. Collective agreements should consider the changes that are taking place in the maritime labour market. First, ship-owning industry collective agreements should devote more space to life-long education and training, as it has already been done for other categories.[65] If we consider the current Italian national collective agreement (CCNL) of the shipping industry, it only mentions digital training in Section 11, Annex 12, where it states that one of the purposes of vocational training should be "developing professionalism in connection with the development of ship automation".[66] The CCNL also established the *Comitato Nazionale Paritetico per il Lavoro Marittimo* (National Joint Committee for Maritime Labour) that has the task of promoting initiatives to analyze the training needs of the sector indicated by ship-owning companies.[67] Still, the efforts of social partners could and should go further.

Another interesting aspect of the *accordo di transizione occupazionale* is the reference to self-employment. Incentives for entrepreneurship could be interesting for those seafarers who do not aspire to work in the remote-control sector and have entrepreneurial aptitudes. The measures could consist in entrepreneurial training, guidance for business creation and the possibility of accessing extraordinary financial contributions.

A virtuous – and yet belated – measure was also applied in the maritime sector during the Saremar crisis. Saremar was a Sardinian company that handled passengers transport to the minor islands of Sardinia, under a regional assignment.[68] The company went bankrupt in early 2016 and most workers who were employed on a permanent basis remained unemployed for a long period. Initially, the Sardinia Region moved forward with an active policies plan, varying according to the seafarers' age, skills, and employment status. The goal of the policies was to put in place pathways for their re-employment into the maritime sector, requesting the new service-provider to take on-board former Saremar workers.

In 2018, the expenditure of 2.5 million Euro was authorized for the implementation of another program of interventions, which recognized to former Saremar workers the possibility of benefiting from a one-time economic contribution or to be re-employed in municipal shipyards. Beyond the concrete outcomes of the Saremar measures and the difficulties in enforcing some of them,[69] they represent a positive example from the point of

[65] Machì G., *Competenze digitali: contrattazione collettiva e formazione dei lavoratori-cittadini*, in *Bollettino Speciale ADAPT*, 1, 2021, available at https://www.bollettinoadapt.it/competenze-digitali-contrattazione-collettiva-e-formazione-dei-lavoratori-cittadini/.

[66] Italian national collective agreement (CCNL) of the private shipping sector, 2015, Towing Section, Annex 12, available at https://www.filtcgil.it/images/Contratti/Mare/ccnl-marittimi.pdf.

[67] CCNL of the private shipping sector, 2015, Section for the embarkation of EU seafarers on cargo ships and passenger/cargo ferries over 151 GRT and for shipmasters and chief engineers embarked on ships over 151 GRT and under 3000 GRT, Annex 12.

[68] Law of the Sardinia Region 12th June 2018, No. 19: *Misure in favore dei lavoratori ex Saremar*; Resolutions of the Sardinian Regional Council No. 57/14 of 2016, No. 69/22 of 2016, No. 38/10 of 2018, No. 48/38 of 2018.

[69] The difficulties were basically linked to the inertia of the Delcomar company which, as stipulated in the call for the award of the regional transport service, was obliged to redeploy ex-Saremar employees. *See*: Repetto S., *Ex Saremar, marittimi nel caos*, in *La Nuova Sardegna*, April 23rd, 2017, available at https://www.lanuovasardegna.it/regione/2017/04/23/news/ex-saremar-marittimi-nel-caos-1.15239598.

view of the type of policies. These included internships with training vouchers, hiring bonuses, outplacement contracts, as well as a support pathway for workers with entrepreneurial aptitudes. As the most widespread welfare measures in Italy, they aimed to the re-employment of those already unemployed, while the goal for the upcoming maritime labour transition should be to act in time and implement these measures *a priori*, considering that, in an efficient welfare system, workers can transit from a shrinking labour market to an expanding one without passing through unemployment.

5. Conclusive remarks.

In this study, I have explored the impact of digitalization on the maritime labour market, focusing on the ongoing transformation of the seafaring profession and the transition from on-board work to shore-based work. The spreading of remote-assistance systems has reduced crews and changed the characteristics needed to work on-board, contributing to the employment crisis. To address the current crew shortage, Italy should complete the reform of maritime placement and update training requirements and qualifications to align with the real needs of the changed maritime industry. Also, training programs should be revised to include innovative methodologies, such as simulators and virtual reality, and the coordination among schools and the maritime industry should be strengthened, for example through the promotion of dual training experiences. To this end, the know-how of common employment agencies specialized in innovative training systems could be transmitted to maritime placement offices.[70]

In the future, navigation will be more and more remotely controlled: onboard crews will continue to diminish and eventually disappear. For this reason, while we are now witnessing a crew shortage, especially with regard to high-skilled seafarers, in the long term the demand for seafarers is expected to decline significantly. Although these effects may occur several years from now, the transition to remote shipping and shore-based work is already underway. That is why I believe it is not too early to start thinking about how to deal with these changes with as little harm as possible to workers. Given the pivotal role that the sea transport sector has and will continue to have in the EU economy, Italy should develop a long-term plan with a comprehensive strategy for automation in maritime transport that combines innovation, competences and skills, infrastructure and future business models.

Among the various measures that such a strategy should include, a key role should be played by active policies to accompany workers in the transition to shore-based work. In fact, remotely controlled ships need a shore-based crew, and seafarers could successfully be part of it, being it the most natural transit for them. Of course, the shore-based crew will need different skills from a traditional crew: in order to avoid skill-alignment issues and long periods of unemployment for seafarers, active policies should not follow the mass dismissals

[70] On the need for collaboration among the different actors in labour intermediation, cf. Salomone R., nt. (40), 201-202.

of shipping companies, but rather anticipate them by supporting workers even now, and facilitate a smooth sea-to-land transition.

Bibliography

Alderton T., Winchester N., *Globalisation and De-Regulation in the Maritime Industry*, in *Marine Policy*, 26, 2002, 35-43;

Baldauf M., Kitada M., Mehdi R., Dalaklis D., *E-Navigation, Digitalization and Unmanned Ships: Challenges for Future Maritime Education and Training*, in *Proceedings of the INTED2018 Conference*, Valencia, 2019, available at https://library.iated.org/view/BALDAUF2018ENA?re=downloadnotallowed;

Baldauf M., Benedict K., Krüger C., *Potentials of e-navigation – enhanced support for collision avoidance*, in *International Journal on Marine Navigation and Safety of Sea Transportation*, 4, 2014, 613-617;

Bebber A., *Digitalization and labour market: the role of profiling in occupational transitions*, in *Italian Labour Law e-Journal*, 17, 2024;

Boczek B., *Flags of convenience. An International legal study*, Harvard University Press, Cambridge, 1962;

Calafà L., *Le politiche del mercato del lavoro nel PNRR: una lettura giuslavoristica*, in *Lavoro e Diritto*, 2, 2023, 163-192;

Cardillo C., *Nuovo collocamento della gente di mare*, in *Il Diritto marittimo*, 3, 2007, 951-961;

Carril Vázquez X.M., Fotinopoulou Basurko O., *Breves consideraciones sobre el impacto de los avances tecnológicos aplicable al buque desde una prospectiva iuslaboralista*, in Garcia-Pita y Lastres J.L, Diaz De la Rosa A., Quintans Eiras M. (eds.), *El derecho maritimo, las nuevas tecnologias y los retos del progreso*, Aranzadi, Cizur Menor, 2021, 225-247;

Chaumette P. (ed.) *Gens de mer: un marché international du travail*, Gomylex, 2016;

Chaumette P. (ed.), *Economic challenge and new maritime risks management: what blue growth?,* Gomylex, 2017, available at https://ideas.repec.org/p/hal/journl/hal-01793050.html;

Chaumette P., *Navire du futur: les conditions de travail des navigants au commerce, avant leur mise à terre*?, in *Neptunus*, 1, 2019, available at www.cdmo.univ-nantes;

Chaumette P., *Recrutements, formations et carrières dans la marine marchande en Europe*, in *Annuaire de Droit Maritime et Océanique. Tome XXX*, 2012, 287-318;

Chaumette P., *De l'évolution du droit social des gens de mer. Les marins sont-ils des salariés comme les autres? Spécificités, banalisation et imbrication des sources*, in *Annuaire de Droit Maritime et Océanique. Tome XXVII*, 2009, 471-499;

Choi J., Lee S., *Legal status of the Remote Operator in Maritime Autonomous Surface Ships (MASS) under maritime law*, in *Ocean Development and International Law*, 52, 2021, 445-462;

Cicek K., Akyuz E., Celik M., *Future skills requirements analysis in maritime industry*, in *Procedia Computer Science*, 158, 2019, 270–274;

Ciucciovino S., *L'intermediazione alla prova dello skill mismatch*, in *Lavoro e Diritto*, 2, 2023, 309-332;

Colasanto M., Lodigiani R. (eds.), *Il ruolo della formazione in un sistema di welfare attivo*, Fondazione Pastore, Rome, 2007;
Comitato Interministeriale per le Politiche del Mare (CIPOM), *Piano del Mare 2023-2025*, July 31st, 2023, available at https://www.gazzettaufficiale.it/eli/gu/2023/10/23/248/so/36/sg/pdf;
Consejo Economico y Social, *Report: Fisheries, Aquaculture and the Processing Industry in Spain*, 3, 2023, available at https://www.ces.es/documents/10180/5232164/Inf0323_conclusiones-EN.pdf/dba048cb-5002-827c-40ea-4a5bcc794e25?version=1.1;
Corbett J., Winebrake J., *The Impacts of Globalisation on International Maritime Transport Activity. Past trends and future perspectives*, in *Global Forum on Transport and Environment in a Globalising World*, OECD, 2008, available at https://www.oecd.org/greengrowth/greening-transport/41380820.pdf;
Corbino E., *Il mercato del lavoro della gente di mare e l'azione dei sindacati operai*, in *Giornale degli Economisti e Rivista di Statistica*, 9, 1925, 473-491;
Dujardin B., *Le facteur humain dans la conduite du navire*, in *La Revue Maritime*, 2008, 96-115.
European Commission, *Horizon 2020 – Work Programme 2018-2020: Smart, Green and İntegrated Transport*, Brussels, 2019, available at https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-transport_en.pdf;
European Environment Agency, *European Maritime Transport Environmental Report*, 2021, available at https://www.eea.europa.eu/publications/maritime-transport/;
European Maritime Safety Agency, *The EU Maritime Profile. Overview of the EU maritime economy*, 2022, available at https://www.emsa.europa.eu/eumaritimeprofile/section-1-overview-on-the-eu-maritime-economy.html#:~:text=Maritime%20transport%20and%20trade&text=Although%20it%20contains%20just%205,out%20of%20the%20EU%2D27;
EUROSTAT, *Maritime transport reference metadata in Euro SDMX Metadata Structure (ESMS)*, 2022., available at https://ec.europa.eu/eurostat/cache/metadata/en/mar_esms.htm ;
Fabbri D., *Italia, penisola senza mare*, in Caracciolo L. (ed), *L'Italia è il mare*, in *Limes*, 10, 2020, 47-56;
Faggioni C., *The International Ship-Registers in Europe: An Analysis from the Labour Law Perspective*, in *Ljubljana Law Review*, 83, 2023, 59-77;
Faioli M., *Matchmaking. Tecnologia avanzata, regole e mercato del lavoro*, in *Lavoro e Diritto*, 2, 2023, 333-352;
Giasanti L., *Codice della Navigazione. Il lavoro marittimo*, in Del Punta, R, Scarpelli F. (eds.), *Codice Commentato del Lavoro*, IPSOA, Milan, 2020, 752-761;
Heidkamp C.P., Germond Duret C., Edward Morrissey J., *Blue Economy. People and Regions in Transitions*, Routledge, London, 2022;
International Maritime Organization, *Takes First Steps to Address Autonomous Ships*, May 28th, 2018, available at http://www.imo.org/en/MediaCentre/PressBriefings/Pages/08-MSC-99-MASS-scoping.aspx;

International Maritime Organization – Maritime Safety Committee, *Circ. 1610*: *Initial descriptions of maritime services in the context of e-navigation*, June 14th, 2019, available at https://www.imo.org/en/OurWork/Safety/Pages/eNavigation.aspx;
International Transport workers Federation, *Seafarers, inland waterways, fishers. Response to the challenges of the future of work*, 2019, available at https://www.itfglobal.org/en/focus/future-work/positions-and-responses;
Janßen T. J., Baldauf M., Müller-Plath G., Kitada M., *The Future of Shipping: A Shore-Based Experience?*, in Bauk S., Ilčev S.D. (eds.), *The 1st International Conference on Maritime Education and Development*, Springer, Berlin, 2021, 51–61;
Jo S., D'Agostini E., *Disrupting technologies in the shipping industry: How will MASS development affect the maritime workforce in Korea*, in *Maritime Policy*, 120, 2020, available at https://doi.org/10.1016/j.marpol.2020.104139;
Jo S., D'agostini E., Kang J., *From Seafarers to E-farers: Maritime Cadets' Perceptions Towards Seafaring Jobs in the Industry 4.0*, in *Sustainability*, 12, 2020, available at https://doi.org/10.3390/su12198077;
Kim J.K., Ahn Y.J., Lee C.H., *A study on the improvement of the system of seafarer education suitable for the 4th industrial revolution*, in *Journal of Fisheries and Marine Sciences Education*, 29, 2017, 1072-1082;
King J., *Technology and the seafarer*, in *Journal for Maritime Research*, 2, 2000, 48-63, available at https://doi.org/10.1080/21533369.2000.9668307;
Kitada M., Baum-Talmor P., *Maritime Digitization and Its Impact on Seafarers' Employment from a Career Perspective*, in *Proceedings of the International Association of Maritime Universities (IAMU) Conference*, Tokyo, 2019, 259-267;
Komianos A., *The autonomous shipping era. Operational, regulatory, and quality challenges,* in *International Journal on Marine Navigation and Safety of Sea Transportation*, 2, 2018, 335-348;
La Torre U., *Navi senza equipaggio e shore control operator*, in *Diritto dei trasporti*, 2, 2019, 487-518;
Leboef C., *De la surveillance des activites humaines en mer. Essai sur les rapports du droit et de la technique*, University of Nantes, 2015, available at https://tel.archives-ouvertes.fr/tel-01150617;
Lefebvre D'ovidio A., Tullio L., Pescatore G., *Manuale di diritto della navigazione*, Giuffré, Milan, 2022.
Lillie N., *Global Collective Bargaining on Flag of Convenience Shipping*, in *British Journal Of Industrial Relations*, 1, 2004, 47-67;
Lopez Varela S., Salgado Don A., Perez Canosa J.M., *Analysis critico de la navigacion-e a bordo: situacion actual y perspectivas de futuro*, in Garcia-Pita y Lastres J.L., Diaz De La Rosa A., Quintans Eiras M.R. (eds.), *El derecho maritimo, las nuevas tecnologias y los retos del progreso*, Aranzadi, Cizur Menor, 2021;
Lutzhoft M., Hynnekleiv A., Earthy J.V., Petersen E.S., *Human-centred maritime autonomy - An ethnography of the future*, in *Journal of Physics: Conference Series*, 1357, 2019, available at https://iopscience.iop.org/article/10.1088/1742-6596/1357/1/012032;
Machì G., *Competenze digitali: contrattazione collettiva e formazione dei lavoratori-cittadini*, in *Bollettino Speciale ADAPT*, 1, 2021, available at https://www.bollettinoadapt.it/competenze-digitali-contrattazione-collettiva-e-formazione-dei-lavoratori-cittadini/;

Man Y., Weber R., Cimbritz J., Lundh M., MacKinnon S.N., *Human factor issues during remote ship monitoring tasks: an ecological lesson for system design in a distributed context*, in *International Journal of Ind. Ergonomics*, 68, 2018, 231-244;
McConnell M., *A brief reflection on deconstruction, "digital disruption" and the employment of seafarers*, in Charbonneau A., Fotinopoulou Basurko O., Mandin F. (eds.), *Le travail et la mer. Liber amicorum en hommage à Patrick Chaumette*, Pedone, Paris, 2021, 287-293;
McGuinness S., Pouliakas K., Redmond P., *Skills mismatch: concepts, measurement, and policy approaches*, in *Journal of Economic Surveys*, 4, 2018, 985-1015;
Porathe T., Prison J., Man Y., *Situation Awareness in Remote Control Centres for Unmanned Ships*, in *Proceedings of the Conference "Human Factors in Ship Design & Operation"*, 2014;
Portales J., *El desafío legal de los buques autónomos*, in Petit Lavall V., Puetz A. (eds.), *El transporte como motor del desarrollo socioeconómico*, Marcial Pons, 2019, 303-313;
Repetto S., *Ex Saremar, marittimi nel caos*, in *La Nuova Sardegna*, April 23rd, 2017, available at https://www.lanuovasardegna.it/regione/2017/04/23/news/ex-saremar-marittimi-nel-caos-1.15239598;
Riccardi A., *La riforma dei servizi per il lavoro e il collocamento della gente di mare*, in *Rivista Italiana di Diritto del Lavoro*, 36, 2017, 645-673;
Riccardi A., *Semplificazione in materia di collocamento della gente di mare*, in Ghera E., Garofalo D. (eds.) *Semplificazioni, sanzioni, ispezioni nel Jobs Act 2, Commento ai d.lgs. 14 settembre 2015, 149 e 151*, Cacucci, Bari, 2016, 89-92;
Ricci G., *Gente di mare: la riforma del collocamento*, in *Guida al lavoro. Il Sole 24 Ore*, 32, 33, 2006, 24-30;
Sacchi S., Scarano G., *Digitalizzare le politiche del lavoro. Da dove si comincia*?, in *Percorsi di Secondo Welfare*, February 6th, 2024, available at https://www.secondowelfare.it/primo-welfare/digitalizzare-le-politiche-del-lavoro-da-dove-si-comincia/;
Salomone R., *Rischi e opportunità nelle riforme del mercato del lavoro al tempo del PNRR*, in *Lavoro e Diritto*, 2, 2023, 193-210;
Saxe S., Jahn C., *Digitalization of Seaports – First Ideas*, Fraunhofer, 2017;
Scarano G., Colfer B., *Linking Active Labour Market Policies to Digitalisation. A Review between Remote and Automated Possibilities*, in *International Journal of Sociology and Social Policy*, 13-14, 2022, 98-112;
Shaughnessy T., Tobi E., *Flags of Convenience: freedom and insecurity on the high sea*, in *Journal of international law and policy*, 5, 2006, 1-8;
Signorini E., *La gente di mare. Il collocamento*, in Basenghi F., Levi A. (eds.), *Le semplificazioni procedurali, le sanzioni e le pari opportunità nel jobs act*, Giappichelli, Turin, 2018, 63-95;
Smith J., *Le Passage du blue ticket au Green ticket : le dialogue collectif entre ITF et les armateurs peut-il améliorer le respect des droits des marins*?, in *Annuaire de Droit Maritime et Océanique. Tome XXII*, 2004, 265-283;
Thomas F., *Réflexions sur la descente a terre des gens de mer (escale et transit) dansl'Union européenne*, in *Neptunus*, 1, 2013, available at:
http://www.cdmo.univ-nantes.fr/96053546/0/fiche___pagelibre/&RH=1339768387194&RF=1342096033565;
Vallè C., *La problématique juridique des navires autonomes*, University of Nantes, 2018;

Van Hooydonk E., *The law of unmanned merchant shipping - an exploration*, in *The Journal of International Maritime Law*, 20, 2014, available at: http://www.ericvanhooydonk.be/dut/media/54f318f578e3a.pdf;
Vartdal B.J., Skjong R., St. Clair A.L., *Remote-controlled and autonomous ships*, DNV, 2019;
World Maritime University, *Report "Transport 2040 – Automation, Technology and Employment. The Future of Work"*, 22, 2019, available at https://commons.wmu.se/lib_reports/58/;
Wróbel K., Montewka J., Kujala P., *Towards the assessment of potential impact of unmanned vessels on maritime transportation safety*, in *Reliability Engineering & System Safety*, 165, 2017, 155-169, available at https://doi.org/10.1016/j.ress.2017.03.029;
Zampella P., *Navi autonome e navi pilotate da remoto: spunti per una riflessione*, in *Diritto dei Trasporti*, 2, 2019, 583-602.