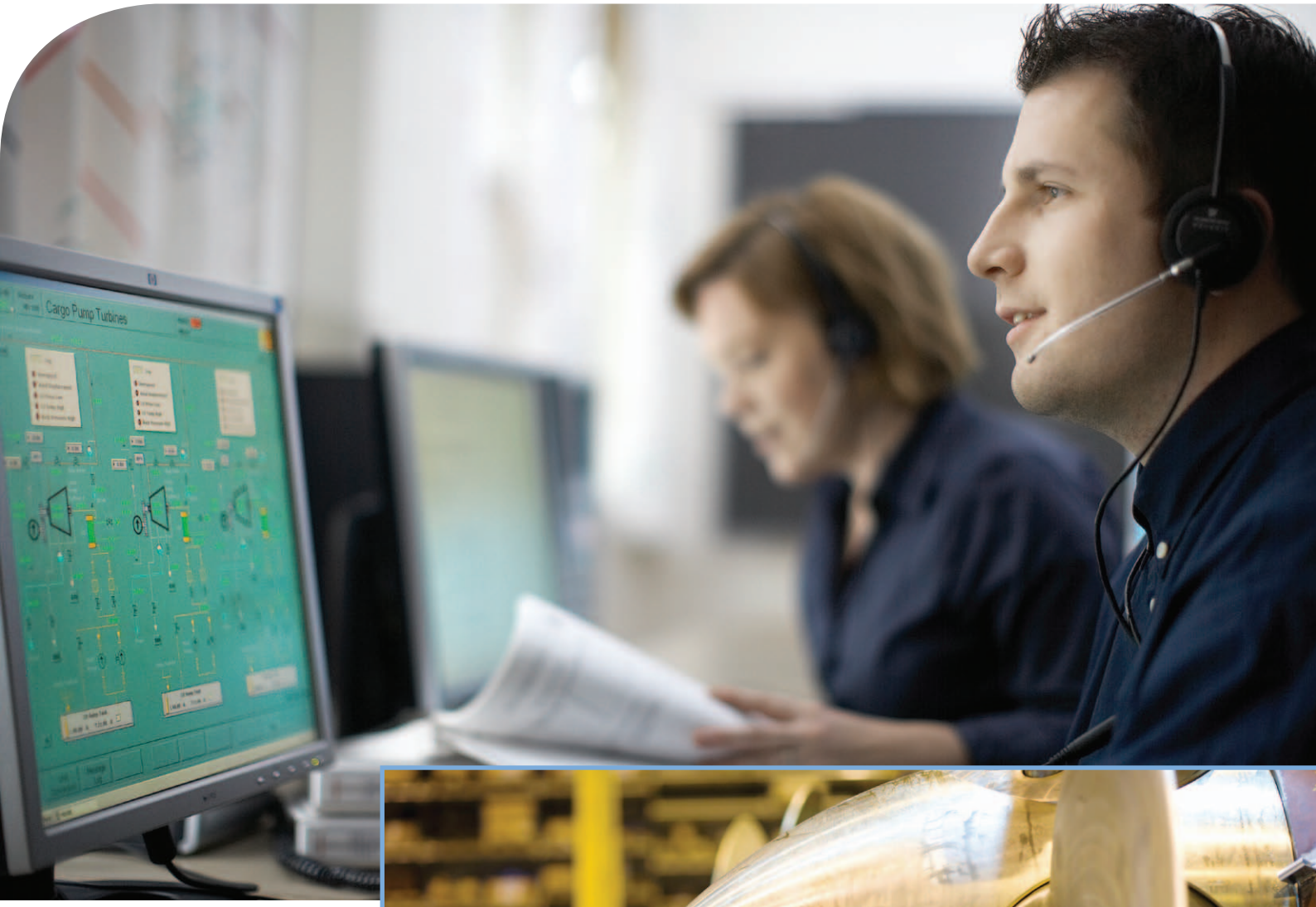
EVOLUTION OF SUPPLY, EMPLOYMENT AND SKILLS IN THE EUROPEAN MARITIME TECHNOLOGY SECTOR



SEA Europe
Ships & Maritime Equipment Association

industriAll
EUROPEAN TRADE UNION

European Commission

With the Support of the European Commission

Final Report of the EU-Funded Project "Creating a European Skills Council for the Maritime Technology Sector" (2014-2016)

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1 Introduction

Over the last decade, the European maritime technology industry has developed towards designing, building and repairing the most advanced and specialized systems, technologies and vessels. In order to improve its position in the market, the industry is continuously introducing innovative technologies and processes and therefore, the competitiveness of the sector relies on its highly skilled workforce.

However, the increased complexities of the products have created additional demand for highly skilled staff. A wide swath of the industry is suffering from a pronounced scarcity of skilled personnel, challenging the growth of the sector and risking the loss of a critical mass of skills and technological competences.

In order to support the facilitation of future skills, training and mobility, the industry and workers' representatives at the European level (SEA Europe and IndustriALL, with the support of the European Commission) are working towards the creation of a European Skills Council for the Maritime Technology Sector. This report has been prepared in support of this initiative and to provide intelligence about the status of the industry, the employment situation, skills needs and shortages and to identify tools to improve the skills supply in the industry.

The creation of European Skills Council for the Maritime Technology Sector is one of the recommendations of LeaderSHIP 2020[1] strategy, adopted by the European Commission and industry stakeholders in February 2013 and endorsed by the European Competitiveness Council in May 2013.

LeaderSHIP 2020 strategy contains the vision of the maritime technology sector for a strong, sustainable and competitive European maritime industry in 2020, employment and skills being one of the pillars of the industry's 'strategic vision' for 2020.

In the context of the Sectoral Social Dialogue, the social partners for the shipbuilding industry (IndustriALL Europe and SEA Europe, representing respectively the trade unions and maritime technology industry) jointly took the lead in creating a European Skills Council to more effectively anticipate the need for skills in the maritime technology sector and achieve a better match between skills and labour market needs.

In October 2012, the Social Partners finalised the EU-funded project "Identifying the actors in the shipbuilding sector in view of setting up a European Shipbuilding Council on Jobs and Skills". This feasibility project identified and mapped almost 200 organizations involved in training and education for the shipbuilding and repair sectors across Europe. It was found that these organisations work independently, focused in their respective geographic areas, and do not collaborate or exchange information with similar organizations in other countries. This reality leads to the existence of very different training programmes and certificates that constrain the mobility of workers and students throughout Europe. It is also difficult for the regional and national actors to monitor and anticipate market and industry needs at the European level and effectively implement educational offers for them. The study concluded that there was a strong interest amongst the maritime stakeholders on the creation of a European Skills Council for the sector and that it would provide real added value to existing activities.

On the basis of the outcomes from that project, it was decided to move ahead with the creation of the European Skills Council for the sector. Upon the call for proposals 2013 (VP/2013/010), the current project was granted with a double objective:

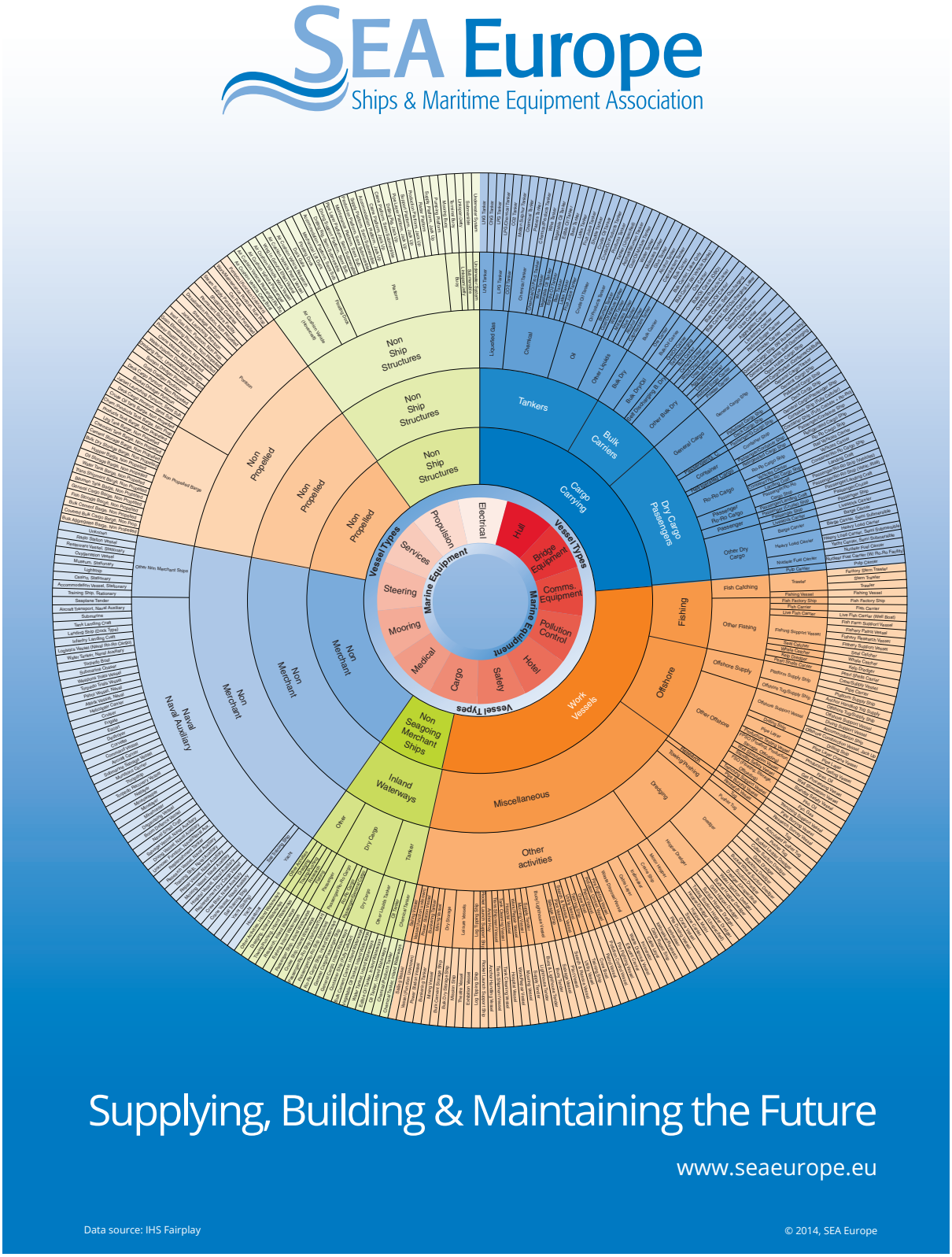
1. Establishing the structure of the European Skills Council: roles, responsibilities, organisation, cooperation and dissemination mechanisms

2. Synthesising labour market intelligence in the sector

The current Report contains the outcomes of the research and work carried out during the life of this project.

[1] http://ec.europa.eu/growth/sectors/maritime/shipbuilding/ec-support/index_en.htm

2 The European Maritime Technology Sector



The European maritime technology industry encompasses all the enterprises involved in the design, construction, maintenance and repair of ships and other maritime structures, including the complete supply chain of systems, equipment and services supported by research and educational institutions (Figure 1).

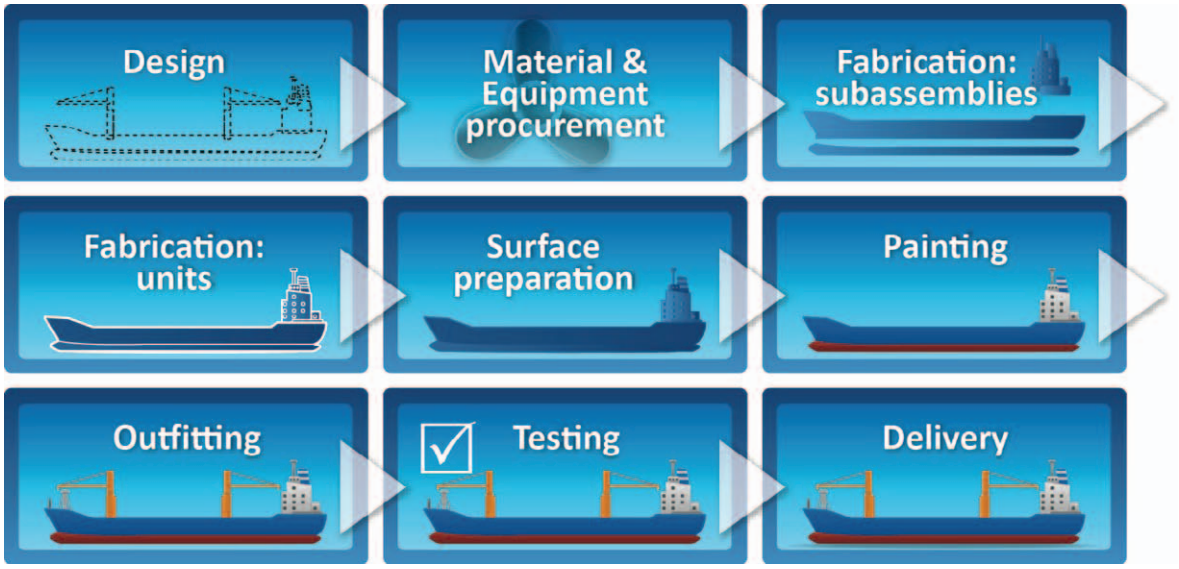
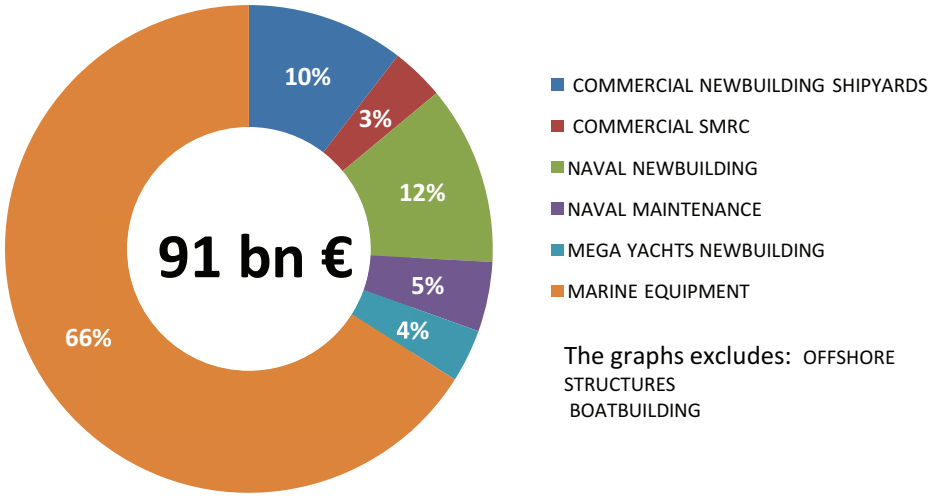


Figure 1: The European maritime technology industry

With an annual turnover of EUR 91 billion, the sector provides more than 500,000 direct jobs all over Europe (Figure 2).



Source:. SEA Europe

Figure 2: Annual Turnover of the European Maritime Technology Industry

European Shipyards:

The European shipbuilding and Ship Maintenance, Repair and Conversion (SMRC) industry is currently composed of approximately 300 shipyards specialised in building and repairing the most complex and technologically advanced civil and naval ships and other hardware for maritime applications. These shipyards produce an approximate turnover of EUR 31 billion yearly and employ more than 200,000 direct jobs in Europe, where up to 75% of those ships built go to export markets.

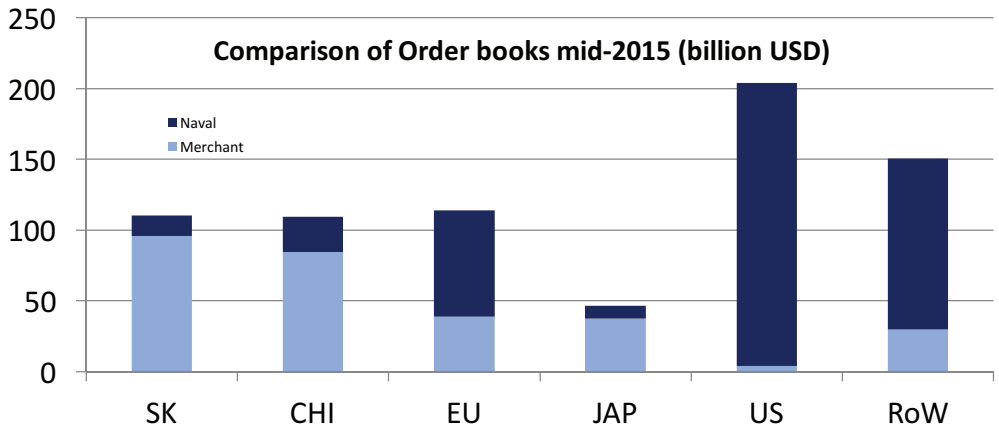
European yards are the only successful cruise builders in the world, building 99% of these vessels. Some attempts from overseas competitors to enter the cruise ships market have failed over the past years, leading to huge losses for the contracting shipyards. The complexity and unique nature of these vessels requires expertise and know-how that today can only be found in Europe. Therefore, it is of outmost importance for the sector to retain this know-how and skilled personnel in Europe.

Of Mega Yachts delivered each year, 65% are built in Europe. In value terms, European-built Yachts account for 80% of the value of annual worldwide Mega Yacht production.

At the forefront of environmental and safety technologies, the most advanced ferries, offshore supply vessels, research vessels, workboats, fishing vessels, dredgers, tugs and other non-cargo-carrying ships are also built in Europe.

In the naval field, Europe is a global leader in the export market. From the point of view of supply, the naval export order book is relatively concentrated in a few shipyards. In the case of surface vessels exports, over 66% of the order book is in European shipyards, proving their competitiveness. The export market for submarines is even more concentrated, where European companies have more than 80% of worldwide exports.

Comparing the value of the total order book both for civilian and naval ships in the main shipbuilding areas, it appears that Europe is bigger than its traditional Asian competitors, and its position as one of the market leaders is unquestionable (Figure 3).



Source:. SEA Europe

Figure 3: Comparison of Orderbooks mid-2015 (Bill.$)

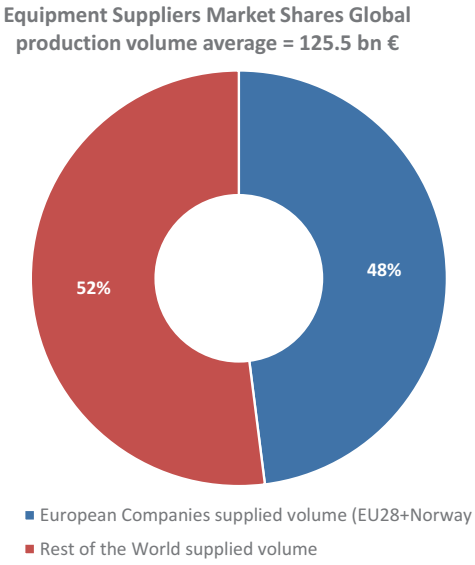
Currently, the shipyards continue to diversify and enter the new Blue Growth markets, building and designing infrastructure and vessels for the offshore

Apart from shipbuilding yards, there are also yards specialized in repair, maintenance and conversion of vessels and platforms. In Europe, such activities take place in at least sixteen countries.

Equipment Manufacturers and Suppliers:

Marine equipment suppliers deliver materials, systems, and equipment; act as service providers in engineering and consulting; or are integrated as subcontractors in pre-product manufacturing and assembly. The industry provides a very wide range of supplies, from 5mm titanium bolts to 50 MW diesel generators with everything in between, for an equally diverse range of vessel types and sizes. The European marine equipment industry generates an average yearly turnover estimated at around EUR 60 billion. It is made up of around 22,000 enterprises, directly employing more than 350,000 workers and generating more than 436,000 indirect jobs. The majority of the companies are small, but it

are led by some large multinationals. Currently, the European industry represents almost 50% of the worldwide market share[2] (Figure 4)



Source:. Balance TC

Figure 4: Equipment Suppliers Market Share

From a technological standpoint, the European maritime technology industry is of outmost importance. As an innovation-driven industry, it is one of the sectors with the highest investment intensity in Research, Development and Innovation (RDI) activities: 8-9% of the industry sales are invested in RDI, compared to 4.2%, representing overall RDI investment in relation to the EU GDP.

Design offices, research centres and classification societies:

Design offices can act as independent companies collaborating with the shipyards in specific projects. But in many cases, these offices are integrated with the shipyards to develop a ship design that matches the operational criteria set by either the yard or the owner. This is a crucial phase to ensure the vessel's operational efficiency.

The design offices, research institutes, classification societies and R&D and design divisions of other actors along the value chain play a very important role in certain innovations (e.g. hull design). Designers also increasingly cooperate with marine equipment manufacturers to take part in joint development projects.

In some cases, classification societies also play an important role in the design and building phases by providing their technical expertise, which can be used for pre-project consulting to assist in building a vessel and establishing and approving safety and security standards. Classification societies are important because they set standards and supervise rules in the shipbuilding industry. In principle, classification societies check whether the products and systems aboard a ship comply or not. They set and apply technical standards relating to the design and construction of ships, and carry out extensive surveys of ships and their main systems.

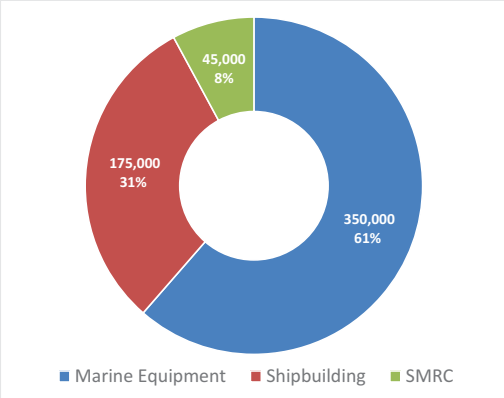
[2] Supplying, Building & Maintaining the Future 2014 Edition Pub SEA Europe

3 Employment situation, forecasts and trends

Although the focus of this report lies on the evolution of skills in the European shipbuilding and maritime technology sector, these developments must be considered against the backdrop of the sector's general employment situation in recent years. The intention of the following chapter is, therefore, to give a synoptic overview on quantitative employment figures, which can have possible impacts on skills-related developments as well.

Employment situation in the shipbuilding and marine equipment industry

In total, over 500,000 people are directly employed in the shipbuilding and maritime technology industries in Europe. While the majority of these work in the maritime equipment industry, almost 40% of overall employment can be attributed to newbuilding, as well as repair and maintenance yards (see Figure 5).



Source: SEA Europe (2014); own illustration

Figure 5: Absolute and relative number of employees in Marine Equipment, Shipbuilding and SMRC in 2013 of SEA Europe Members

Employment is, furthermore, concentrated in four countries, Germany, Italy, France and the UK, which together account for approximately 50 percent of the total European workforce. However, as these numbers are related to the general size of the national economy and labour force, the shipbuilding and marine equipment sector plays also an important role for regional labour markets in other countries, such as Denmark, Spain or the Netherlands (Figure 6).

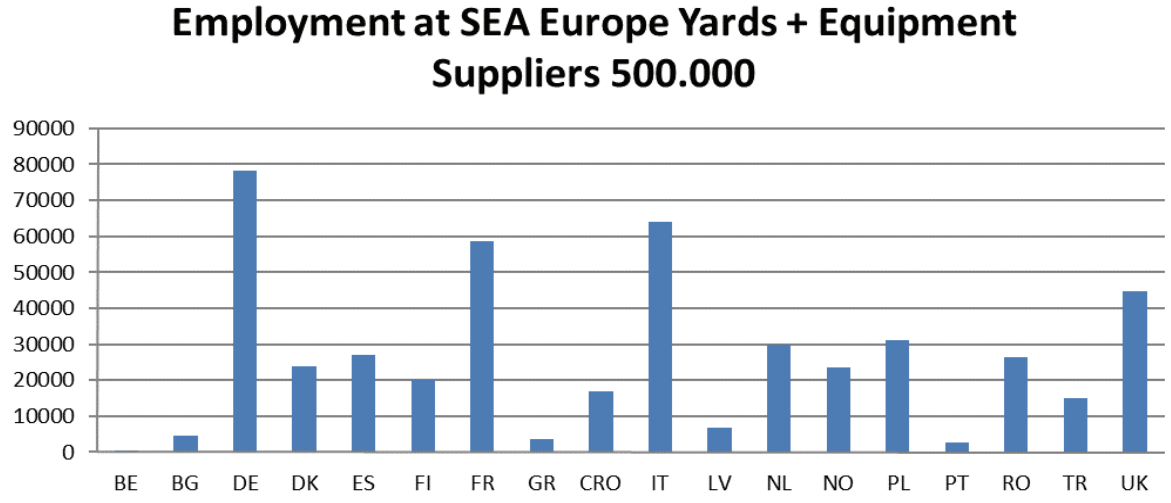


Figure 6: Employment at SEA Europe Yards and Equipment Suppliers by Country in 2013

The maritime equipment industry is characterized by its heterogeneity due to diversified markets, firms' varying sizes and degrees of specialization, and diverse customer bases. Basically, it is possible to distinguish between 1st tier and 2nd tier suppliers. While 1st tier suppliers directly produce equipment (i.e. for shipyards), 2nd tier suppliers are responsible for manufacturing components

utilized by 1st tier suppliers and can, therefore, be considered sub-suppliers[3]. In most European countries, the majority of employees work at 1st tier suppliers, though 2nd tier suppliers have a considerable share in total employment as well (see Figure 7).

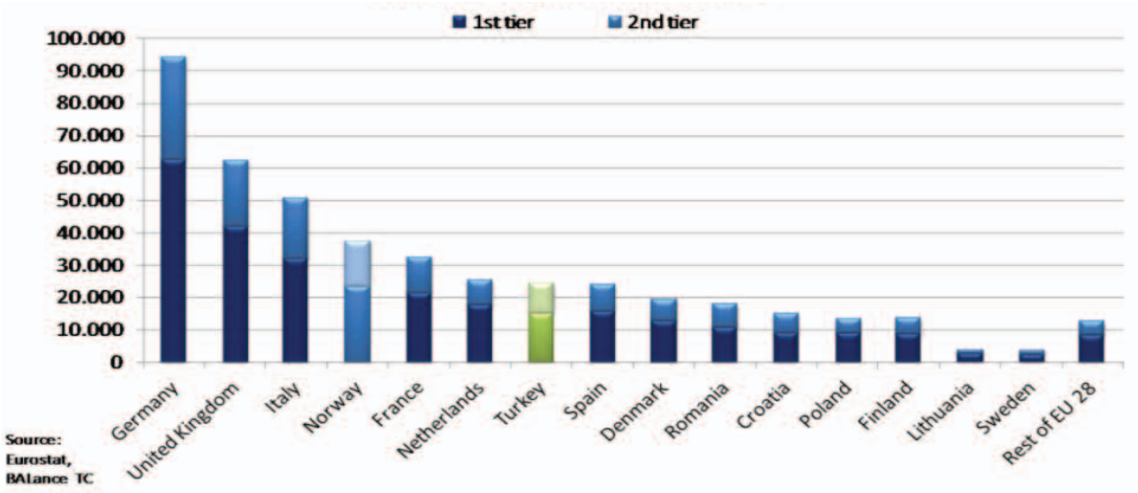


Figure 7: Number of employees in marine supplies per country (1st and 2nd tier) total 452k for EU28 + Norway and Turkey

Employment Developments: The case of European yards

Considering employment developments in the European shipbuilding and ship repair industry in more detail, a decline in overall employment can be observed since 2008 as a consequence of the international financial and economic crisis, after employment had increased from 2000 onwards due to growing order books (see Figure 8).

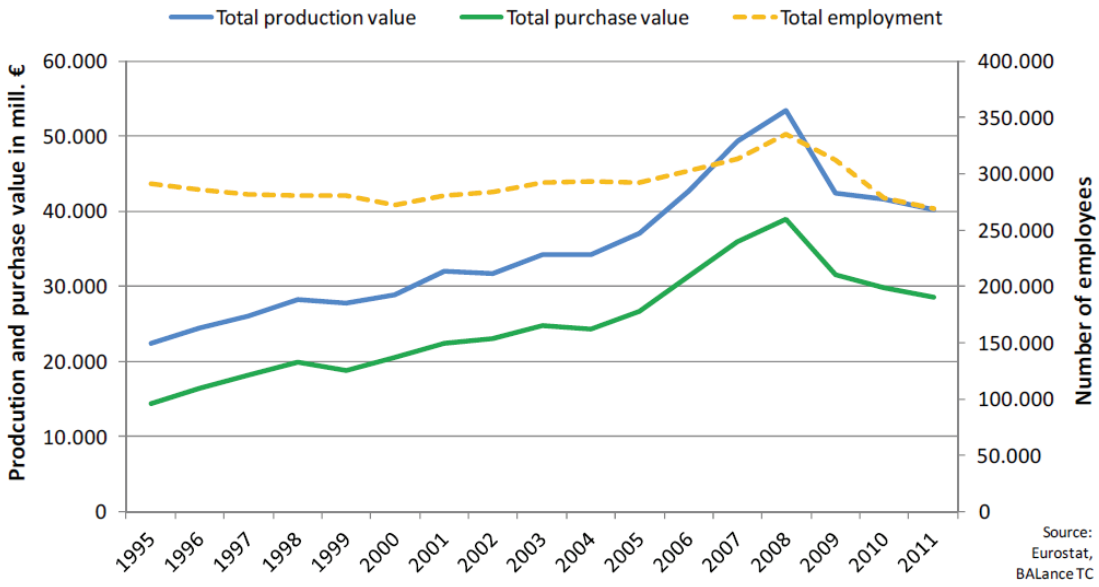
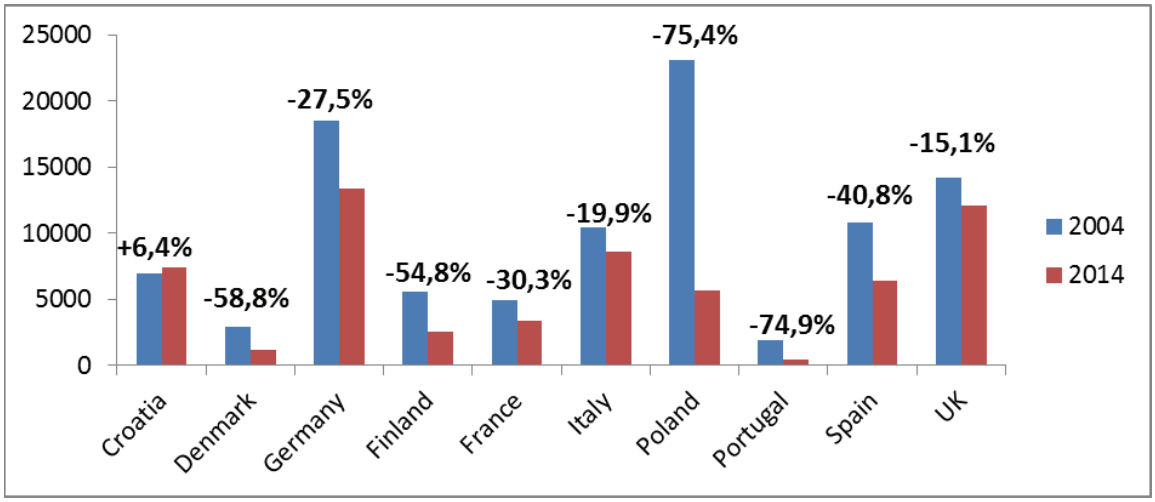


Figure 8: Shipbuilding, boatbuilding and repair of ships and boats - EU-28

A survey conducted on behalf of the Sector Committee for Shipbuilding of IndustriAll Europe sheds further light on direct employment changes between 2004 and 2014 at commercial (civilian) shipyards

[3] Balance Technology Consulting (2014): Competitive Position and Future Opportunities of the European Marine Supplies Industry. Report published for the European Commission, January 2014, p. 34.

in ten main European shipbuilding countries.[4] As reveal, most countries, except Croatia, suffered employment losses between 15 and 75 percent. (see Figure 9).



Source: Sector Committee IndustriALL Europe 2015

Figure 9: Employment Development in Ten European Shipbuilding Countries between 2004 and 2014

The survey data indicates the most severe decreases in employment in Poland. The Polish Statistical Yearbook of Maritime Economy, edition 2004 and 2014 shows that in 2004 15.500 people were directly employed by Polish shipyards. In 2014 the number of workers on the payroll was around 5.200 and 6.824 were working as self-employed . This development was particularly triggered by closures of the two biggest yards. Furthermore, a lot of former directly employed workers are now working on Polish shipyards as so called “self-employed” workers or one-man-companies (mainly in state-owned shipyards).

The employment decline in the Portuguese industry was due to the closure of two shipyards in 2009 and 2010 that were reopened in 2013 with different ownership. According to the Portuguese National Institute of Statistics (INE – Instituto Nacional de Estatística), in the period 2004 – 2014, the number of employees in the Portuguese shipyards reduced by 49.8 percent, but in the last 3 years increased 9.3 percent.

Denmark, Finland and Spain also had to face sharp decreases in the overall workforce in shipyards. Despite the fact that four out of five yards still existing in Denmark even recorded employment increases of 50 percent and more, the decline resulted mainly from the closure of the biggest yard. Bankruptcies and closures played an important role in Spain as well, and 23.7 percent of the loss of employment in the Spanish shipbuilding sector was caused by bankruptcies and closures. The developments in the Finish shipbuilding industry are, instead, mostly a consequence of redundancies on still existing yards. Germany and the UK experienced declining employment on shipyards as well, but during the last five years the situation is comparatively stable. At the majority of German and British shipyards, the number of employees remained unchanged or even increased, whereas layoffs in a few shipyards were mainly responsible for the employment decline. In Croatia, on the other hand, the number of employees working in shipyards increased slightly by 6.4 percent. The development in Croatian shipbuilding was, however, not entirely positive either, since job losses could be observed on

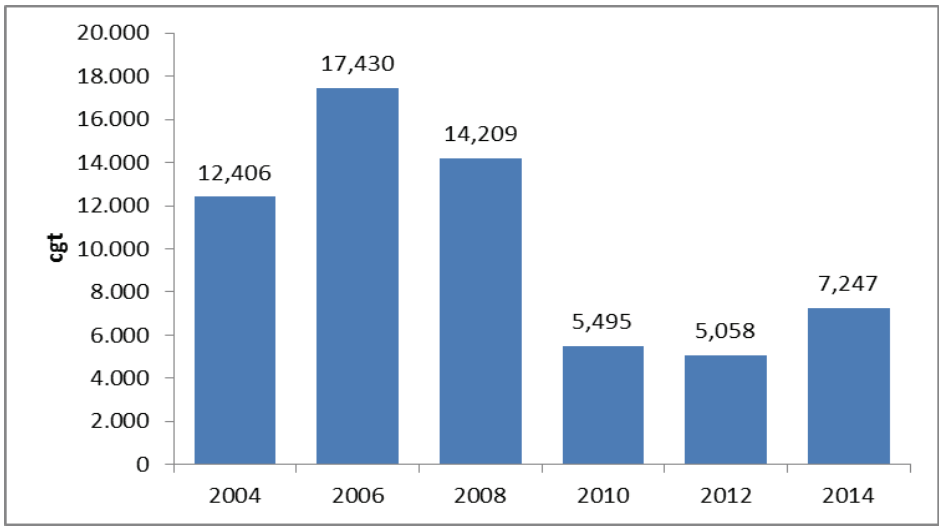
[4] The survey was carried out by Agentur für Struktur- und Personalentwicklung GmbH (AgS) in Bremen/Germany. The summary of the results presented on the following pages is a contribution of AgS to the Sector Skills Council Project. The sample consists of responses from trade union officials from ten major European shipbuilding countries with a focus on directly employed workers in 124 shipyards.

seven out of eight yards, and only one yard increased its number of employees by more than 1,000 employees, which elucidates the overall positive results.

The reasons for shrinking direct employment numbers in the sector are twofold: the bankruptcies (and closures) of 16 yards in six different countries caused a total loss of employment of 16,000 jobs. As aforementioned, not just bankruptcies, but also layoffs at the remaining yards led to this development. A further reason could be found in an adjustments of the make or buy model of some shipyards, which led to the outsourcing of certain activities previously carried out with internal -or direct- manpower.

This quantitative evolution of employment in the European shipbuilding sector must be considered against the backdrop of general economic developments in the industry. Southern European countries, which were hit most severely by the financial crisis, still suffer from the negative economic effects, which also affected the shipbuilding sector. Other countries (for instance, Germany) quickly recovered from the crisis and so its impact on the national sector's employment situation was less dramatic.

Nevertheless, nearly all major European shipbuilding countries have faced declining commercial order books during the last ten years (see Figure 10), resulting in less work on shipyards. In this regard, the total European order book (by Compensated Gross Tonnage, or CGT) decreased from 12,406,000 CGT in 2004 to 7,247,000 CGT in 2014 (-41.6%). The specialisation of European shipyards during this decade was towards building high technology vessels. Leaving behind the large steel-intensive cargo carriers has also impacted employment in the industry, and the structure and organisation of work. As a consequence, the value per vessel and CGT has also increased considerably. By the end of 2004 the shipyards under CESA[5] membership had an order book of 12 million CGT, accounting for a total EUR 23.5 billion with a unit value of 1.960 €/CGT). In 2014, the order book for CESA countries accounted for 7 million CGT and EUR 30 billion, bringing the unit value to 4.300 €/CGT.



Source: Sea Europe Shipbuilding Market Monitoring FY 2014 – Report No.38 – April2015

Figure 10: European Shipbuilding Order book Development from 2004 to 2014

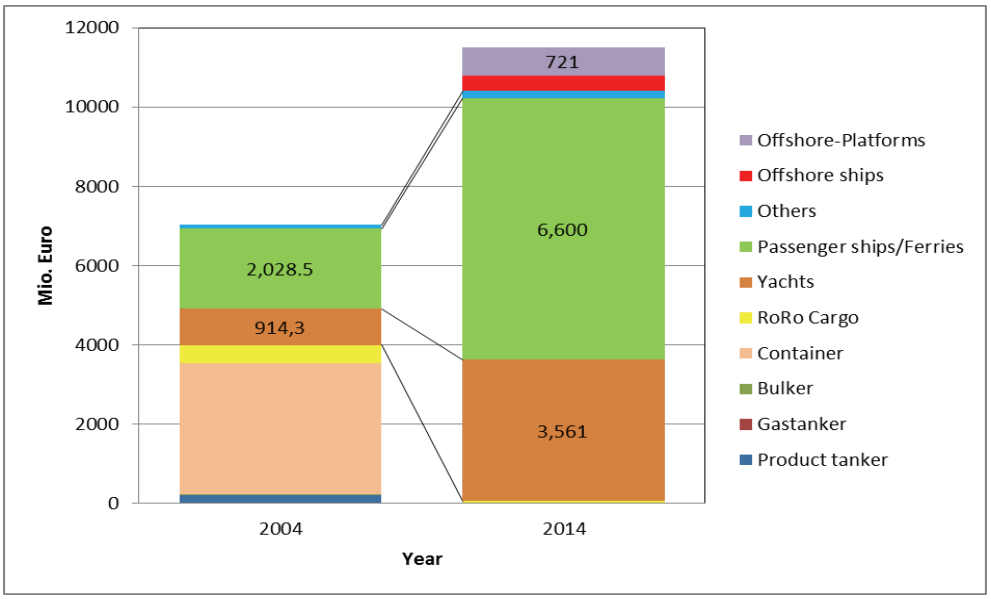
Since 2012, however, the downward trend has reversed and the European commercial order book has started to grow again.

[5] CESA (Community of European Shipbuilders Association) Now integrated in SEA Europe

Moreover, in Poland and Portugal (which were the countries with the most dramatic employment decreases), a political strategy for promoting the evolution of the sector (for instance through financial aid), is still lacking, which may jeopardize further jobs at the yards in the future.

New Skill Requirements and New Contract Forms

Considering the order books of the main shipbuilding countries in Europe, a qualitative change can be observed. A lack of orders – inter alia due to rising international competition and diminishing national orders in the naval sector – forces European shipbuilding companies to diversify and specialize their products-range by entering new markets (e.g. offshore, mega-yachts, etc.). In this regard, the growing commercial order book mostly relies on new orders for passenger ships, offshore vessels and other high-tech non-cargo-carrying vessels such as fishing, tugs, dredgers, research vessels etc.[6] The case of Germany illustrates the trend towards specialized vessels such as passenger ships and offshore vessels, and the overall change in order books (see Figure 11), a very similar trend can be seen in most of European countries.

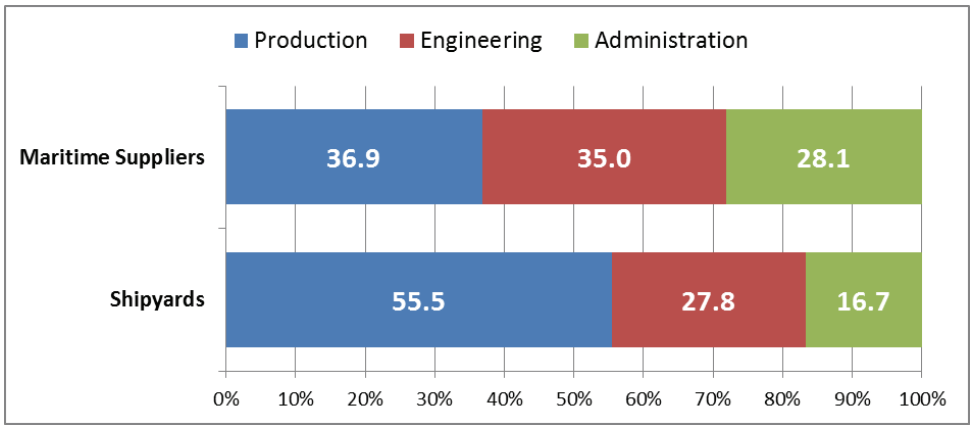


Source: VSM 2015, presented onthe parliamentary evening in January 2015, Berlin

Figure 11: Order book Composition by Ship Type in Germany – evolution from 2004 to 2014 (in Millions of EUR)

Consequently, the skill requirements for working in the maritime sector increases, as expressed by higher shares of engineers as part of the total workforce, for instance. The share of employees working in the engineering departments is particularly high in the maritime supply industry (35%) when compared to that of shipyards (27.8%) (see Figure 12). By contrast, in the Korean shipbuilding industry, the percentage of workers involved in engineering is significantly lower (13.1% in 2012) than, for instance, in Germany.[7]

[6] cf. Sea Europe Shipbuilding Market Monitoring FY 2014 – Report No.38 – April 2015, p. 2
[7] cf. OECD – Council Working Party on Shipbuilding (2015): Peer Review of the Korean Shipbuilding Industry and related Government Policies, p. 19

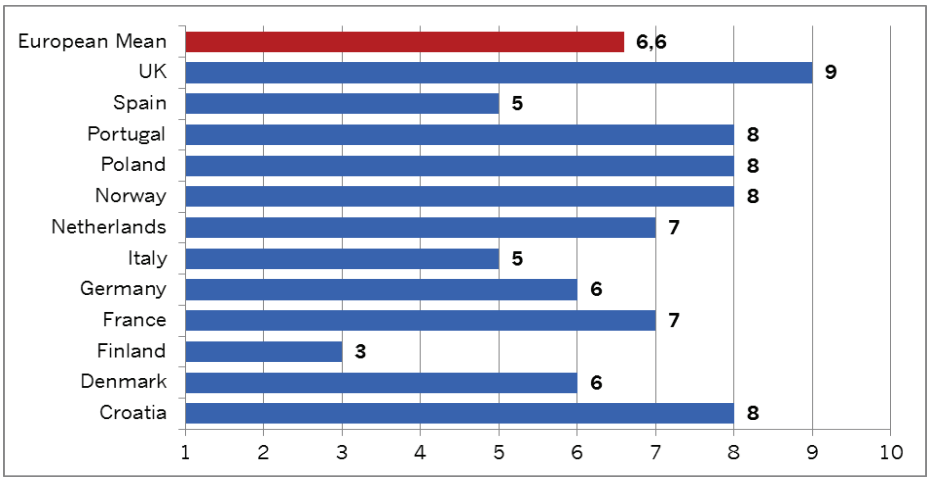


Source: IG Metall Shipbuilding survey 2015, p. 7

Figure 12: Composition of staff in the German shipbuilding industry by area of work (in %)

This development poses a challenge for the sector's employment situation, as companies have to adapt the skills profile of their workers to the new technological advances in order to compete successfully. Vocational training thus becomes even more important. And even though yards still have to cut jobs, the availability of skilled workers represents one of the main employment related challenges throughout most European shipbuilding countries (see Figure 13). The pressure arising from the lack of skilled labour is apparently not directly related to national training systems, since the data points to high problem pressures in different economic models. Particularly in Poland, Portugal, Norway, Croatia and the UK the problem pressure is significantly higher than the average value. As for Croatia and Poland this phenomenon can be explained by the expatriation of workers made redundant at home, due to more attractive wage levels and employment perspectives abroad.

Recruiting skilled personnel, however, is problematic in most European shipbuilding countries. Only in Spain, Italy and Finland is the pressure considerably below the overall mean (see Figure 13). Especially in Finland and Spain, this result can be explained by the fact that, due to the huge number of redundancies in the shipbuilding sector in recent years, the required skilled workers are (still) available on the national labour markets.



Source: Sector Committee IndustriALL Europe 2015

Figure 13: Problem Pressure for the Supply of Skilled Workers from 1 (no problem) to 10 (big problem)

Drawing on the German example again, a survey among German works councils on shipyards revealed that 60 percent of the yards participating in the survey had problems filling job vacancies. In this case, the problem is not solely limited to jobs requiring specialized skills, but can be observed across the

whole spectrum of jobs in the shipbuilding sector.[8] Within the survey carried out by the Sector Skills Council, 67% of the shipyards participating confirmed that they experience important recruitment issues. The share is lower for equipment manufacturers, classification societies and design offices (see Figure 17).

A further employment-related challenge is the increasing number of sub-contractors on European shipyards. On German yards, for instance, nearly one third of all employees working at the shipyards (29%) are employed by a sub-contractor, while a further ten percent are agency-workers.

In comparison, the share of workers who are sub-contractors in the Korean shipbuilding industry is even higher, and increased from 33 percent in 2000 to more than 60 percent in 2012.[9]

In conclusion, this brief overview on employment development in the European shipbuilding and marine equipment sector demonstrated that the firms are facing quantitative decline in direct employment as well as qualitative changes in skills requirements and employment contracts and that there is need to manage this situation by increasing cooperation between employees and employers' organizations, education and institutions and more proactively use anticipation of change instruments.

[8] cf. IG Metall Shipbuilding Survey 2015, p. 8, 9

[9] cf. OECD – Council Working Party on Shipbuilding (2015): Peer Review of the Korean Shipbuilding Industry and related Government Policies, p. 19

4 Evolution of the European Maritime Technology Sector. Drivers and trends influencing future skills needs

Over the last decade, European order book has completely changed. In 2004 75% of the order book in CGT terms was composed by steel intensive vessels (containerships, tankers, bulkers and other cargo carriers). In 2014 the picture has completely changed, cargo carriers accounting just for 20% of the order book, and 80% being advanced technology high value vessels, such as passenger ships, offshore vessels, research vessels, workboats, mega-yachts or fishing vessels (see Figure 14).

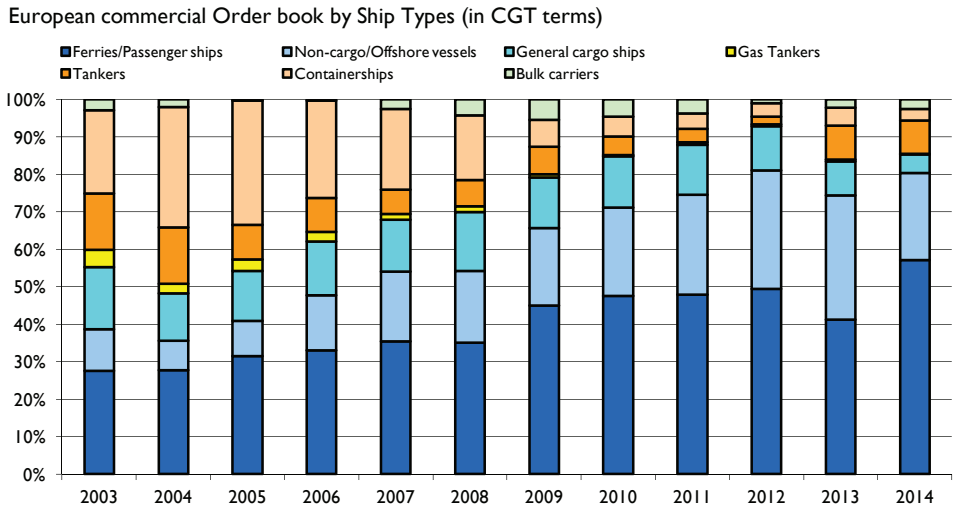


Figure 14: European commercial Order book by Ship Types (in CGT terms)

There are several drivers influencing the market and from which some skills needs can be anticipated:

Fuel efficiency, cost reductions and environmental regulations

Prices and costs are important competition factors in shipping (and hence shipbuilding). Historically, high oil prices over the last decade and the overcapacity situation in the cargo shipping market have led to an attempt to lower transport costs. Since 2012, demand for new vessels has been driven by fuel efficiency improvements, with the aim of reducing the costs of shipping, but also those of other activities such as offshore, transport of passengers, fisheries, etc. Although this is not a greening trend in itself, lower fuel consumption results in lower emissions of both CO2 (greenhouse gas) and air pollutants such as SOx and NOx. Hence, an improvement in fuel efficiency results in an improvement of the environmental performance of ships. Stakeholders confirm that cost reduction through fuel efficiency is the main market driver for greening in the sector at present.

Despite the current downturn in oil prices, international experts forecast a recovery of prices by 2017, and the trend to replace old fleet with more energy efficient vessels is expected to continue driving the market.

Recent environmental regulations, coming from both the IMO and the EU, are also benefiting the European maritime technology industry, in the sense that they stimulate the demand for new vessels and technologies to ensure greener shipping. The targets to reduce emissions of CO2, NOx and SOx, and recent and upcoming regulations (such as the establishment of Emission Control Areas or the Ballast Water Treatment Convention), led to an investment in RDI activities and the development of new technologies and to an increase in the need for new, greener vessels and more retrofits.

The use of LNG as bunker fuel, installation of scrubbers, dual-use engines and batteries is already improving the environmental footprint of maritime transport. Diesel emits 73.2 kg of CO2 per Million

Btu, while natural gas emits only 53.1 kg per Million Btu. Moreover, SOx emissions can be reduced (to 0 with LNG), as well as NOx (40%-90% depending on the engine) and particulate matter (95%-100%).

At the end of 2015, there were more than 70 LNG-fuelled vessels in operation, while 80 are in the order book. European shipyards will build 55% of the order book and 86% of the operational vessels are owned by EU and Norway operators.

LNG is already an option as a bunkering fuel in Europe, thanks to bunkering facilities in 8 European countries and 21 new facilities under construction, expanding its availability to 14 countries. The maritime technology sector is at the forefront of a new opportunity, namely the retrofitting of old vessels and newbuilding with state-of-the-art technology that will be built in Europe.

In order to achieve EU and UN environmental targets by 2020/2050, the implementation of new environmental regulations (MARPOL Annex VI, BWM Convention, Hong Kong Convention, Biofouling and Noise Guidelines) and related safety requirements (IGF Code, Damage Stability) is necessary, and the industry will need to develop further green technologies. The new instruments have a significant influence on ship design, ship production and the competences required at shipyards and ship equipment manufacturers. Future ships will be designed and constructed with more and more complex equipment based on functional requirements using a goal-based approach, which requires highly educated naval architects and crews capable of coping with more new equipment and the interaction of it with the ship and its operation.

In order to ensure that European companies invest in RDI activities and lead the development in pioneering innovative and greener technologies, there must be certainty about the enforcement and implementation deadlines of those regulations. Delays and postponements in the enforcement of regulations can have a negative effect on first movers.

Offshore Oil & Gas

The key driver for the demand of offshore oil and gas technology and vessels is the prevailing oil price and the perception of future oil price development vs. actual and expected cost development. With higher oil prices, we get a higher number of profitable offshore fields, more exploration activity and thus higher spending and a higher demand for rigs and ships. The current low oil prices are affecting the maritime technology industry and challenging some European companies that are specialised in this market segment. However, most international experts consider that the current oil price (around $30 per barrel) is not regarded as sustainable in the longer term. Most observers see higher oil prices in 2017, or already in 2016.

Within oil and gas production, there is a trend towards offshore growing faster than onshore, and within offshore, deep-water is growing faster than shallow-water production. This trend is expected to continue. Since 2008, 60% of offshore oil and gas discoveries have been in deep-water. In addition, distances from shore are increasing, leading to higher demand for more efficient vessels. Moreover, there are new requirements and a need for more rigs and ships capable of operating in these areas in the most efficient and safe way. More cost-efficient vessel designs and systems are also important drivers, since vessels will then have a competitive advantage, obtain higher utilisation and thus be preferred in the market. In the short term, most offshore markets will take a hit, while a few others may be picking up, but increased activity is again expected towards 2020.

In summary, aside from the current difficulties for the companies specialised in offshore oil and gas, a recuperation is expected in the coming years. With the recuperation the oil prices, a sharp increase is expected in the demand for new vessels and technologies capable of working more cost efficiently in deeper, more distant waters and in adverse environmental conditions. For a successful development of those technologies and vessels, skills in this regard need to be developed.

New Markets: Blue Growth activities

The scarcity of resources onshore is prompting the need to significantly develop industrial activities at sea. These businesses will be as diverse as renewable energies, aggregate mining, shallow & deep sea mining, offshore oil & gas, shipping, yachting and marinas, cruise tourism, coastal tourism, fisheries, maritime security, biotechnologies, desalination, aquaculture, fish farming, etc.

Renewable energy sources

EU energy and environmental policies aim to rely more on renewable energy sources, given the expected population growth in coastal areas, saturation of the shore and climate change. In particular, by 2030, renewable energies should represent 27% of the European energy mix. In addition to the contribution to the long-term objectives of the EU with respect to the reduction of greenhouse gas emissions, the target of self-sufficiency and reduced dependency towards volatile and unsecured energy sources is a strong identified trend that will lead to an acceleration of renewable energy deployment. In the next two decades, renewable energy will be one of the world's fastest-growing energy sources, increasing at over 5% per year.

Marine renewables (MRE)

Marine renewables (MRE) is a major constituent of this, and there will be an increasing market for energy devices for wave, wind (both floating or gravity-based), tidal current and OTEC along with vessels to support maintenance and monitoring of these devices (many of which are predicted to be unmanned, if not totally autonomous).

The development of MRE will help reduce the EU's dependency on fossil fuels for the production of electricity and reinforce its energy security. This aspect could prove to be particularly important for island states and regions where ocean energy can contribute towards energy self-sufficiency and replace high-cost electricity produced by diesel power stations.

All the available technologies will have to contribute toward achieving this ambition, which shall allow Europe to keep its leadership in this field. In 2030, marine renewable energies will have started their commercial deployment phase, with a forecast 100 MW plus installed for wave power and tidal current power alone, and over 30 GW for offshore wind farms.

Offshore biomass production and desalination

Among other marine resources, **offshore biomass production and desalination** will become other key drivers. These two industrial offshore developments will support human shore-based activities concentration, with less and less area dedicated to agriculture and more and more to clean water requirements.

Aquaculture

These trends are also being observed in aquaculture. Continuously expanding, it is expected that aquaculture production in Europe will nearly double to reach 4.5 M tons of food production by 2030, and increase by 50% the number of workers directly employed, reaching 150,000 in direct workforce and 100,000 indirectly involved.

This is being realised through a continuous modernisation of this industry. Current farms are already installed further out at sea and require even more advanced technologies. Automation, monitoring systems and advanced processing machine have started being used or entering the market.

Mutualisation and Colocation

The separate development of these industries brings along another trend. The development of new offshore activities is looking towards the **mutualisation of costs through the utilisation of multi-use**

offshore platforms. This will lead to even more complex systems of systems at sea that will have to be appropriately handled by a competent workforce.

Be it for MRE, Aquaculture or other related activities, it is expected that there will be a sharp increase in the demand for specific or cross-sectoral new vessels and advanced technologies capable of working more cost efficiently in deeper, further waters and in adverse environmental conditions. For successful development of those technologies and vessels, the relevant skills need to be developed.

ICT

The new offshore activities and the increased complexity of vessels will lead to a **rise in the need for ICT.** New technologies are being developed in the fields of manufacturing and automation. The industry is looking at robotics and additive manufacturing and 3D printing as cutting-edge technologies that will contribute to the innovation of production processes, a significant reduction of costs and improved efficiency. The development of 3D printing will significantly increase the ability of ships' staff to carry out component replacement and maintenance tasks.

The development of ICT is also forecast to have a significant impact on vessel operations, on the improvement of communications between ship and shore, vessel monitoring, improved vessel safety and security and well-being of seamen, including medical treatment. The contribution of ICT towards vessel control may potentially lead to unmanned vessel operation.

The Arctic Dimension

As global temperatures rise, the Arctic areas of the world are opening up to shipping and exploration and extraction of natural resources (oil and gas in particular). The market potential is massive: the value of the Arctic Maritime Transport Market could run up to EUR 30 billion through 2020 (Source: Team Arctic Finland). The Arctic Society of Finland estimates that, in the next 10-20 years, around 20-40 new icebreakers will be needed to replace existing ships alone. Further vessels will be needed to guide ships through the Northern Passage and to pave the way for offshore energy operations. Icebreaking offshore support vessels and icebreaking construction vessels are expected to see increasing demand. The oil and gas reserves in Arctic areas are located under ice-covered, deep water, and extraction will have to take place in very harsh conditions. Hence, Arctic offshore energy operations will require top-of-the-range vessels.

5 Qualitative analysis of Skills and Occupations

Contrary to the old conception of a manual, non-sophisticated industry, European maritime technology is an innovation-driven, technologically advanced industry that provides quality, highly skilled jobs.

Together with the specialisation of the industry in high technology, complex products (the most advanced vessels and technologies) the innovative manufacturing processes and globalised market and supply chain require more and more highly skilled technical people and sellers, and fewer and fewer lower-qualified people.

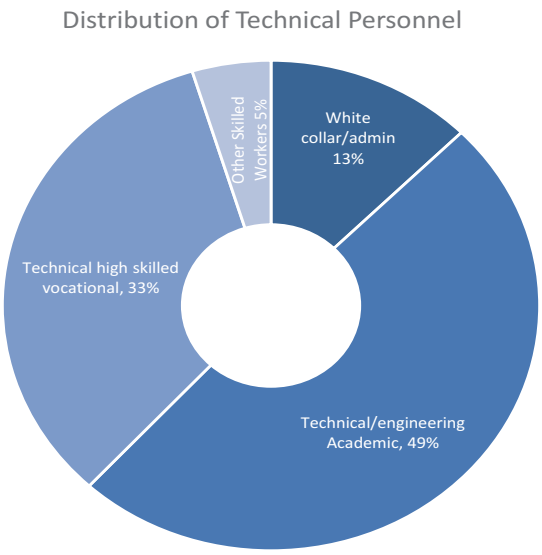
This level of employment of highly qualified and highly skilled personnel supports the view of the report "Competitive position and future opportunities of the European marine supplies industry" (Funded by the EC DG Enterprise and Industry Contract No. SI2.630862) that the long-term future of the sector is dependent on the utilisation of key strengths, such as a strong market position, technological leadership, strong infrastructure, co-operative partners, the skills of employees and the ability to identify opportunities in new emerging markets as well as maintain a close relationship with their customer base.

Nowadays, it is estimated that 50% of the employees in the industry come from a higher education background, with a technical university degree. These personnel are essential for the companies, covering intermediate management and design positions. Another 30% are highly skilled workers with vocational education and training, doing work such as welding, painting, electricity, boiler- and pipe-making, etc. White collars doing administrative, management, financing, etc. account for 13% of the total staff (see Figure 15).

Figure 15: Distribution of Technical Personnel – % of Technical Personnel Employed

Looking more closely at the profile of employees by company type (see Figure 16), it can be seen that:

- 35-40% of the workers in Shipyards and equipment manufacturing companies have a technical/engineering education, and 40-50% are technical workers with a VET background.
- Companies which are not involved in manufacturing goods and mostly provide services (i.e. classification societies, consulting offices etc.) tend to employ a higher percentage of highly



skilled personnel with higher academic qualifications and degrees

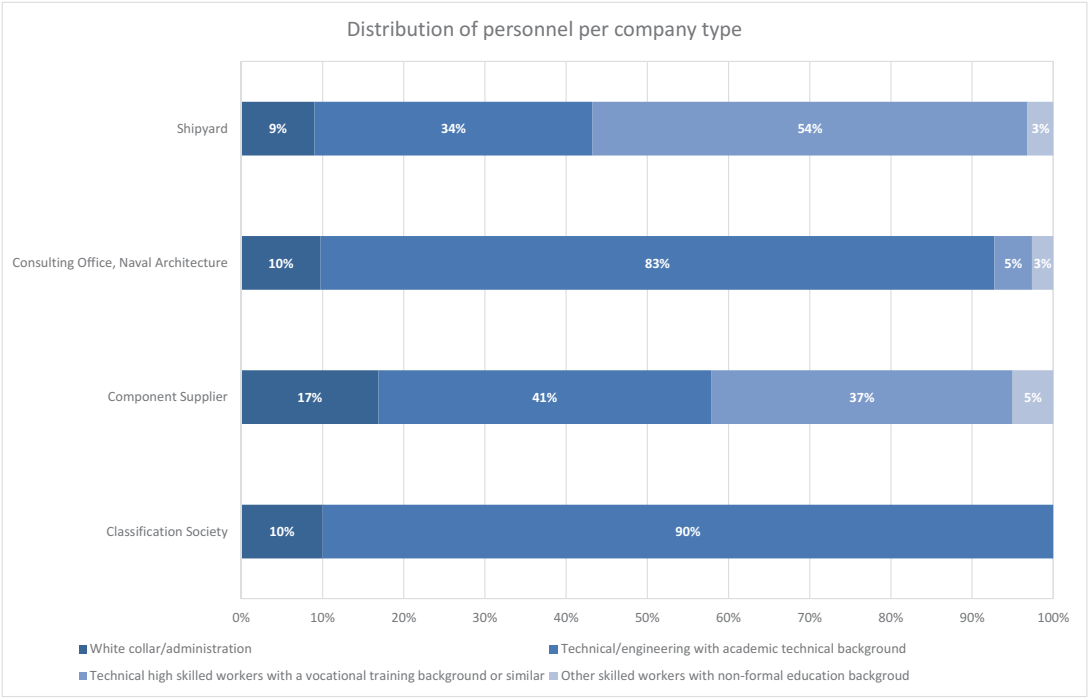


Figure 16: Distribution of Technical Personnel per company type (four main categories)

The economic and financial crisis that started in 2008 brought drastic reduction in demand for new orders globally, impacting both shipyards and equipment suppliers in Europe. The loss of experienced workers who left to other sectors is challenging transmission of knowledge to new generations. Each vessel built is a unique prototype. For each new order, companies design a unique product according to the needs of the customer (the ship-owner). The complexity and unique nature of the products makes it necessary to count on the most highly skilled and experienced workers. However, many companies are experiencing difficulties recruiting workers with adequate skills.

This challenge was already mentioned by the experts group on skills and employment issues in the frame of the LeaderSHIP2020 strategy. Within the survey carried out by the Sector Skills Council, 44% of the respondents confirmed that they experience important recruitment issues. Figure 17 illustrates in more detail the recruitment issues per company type

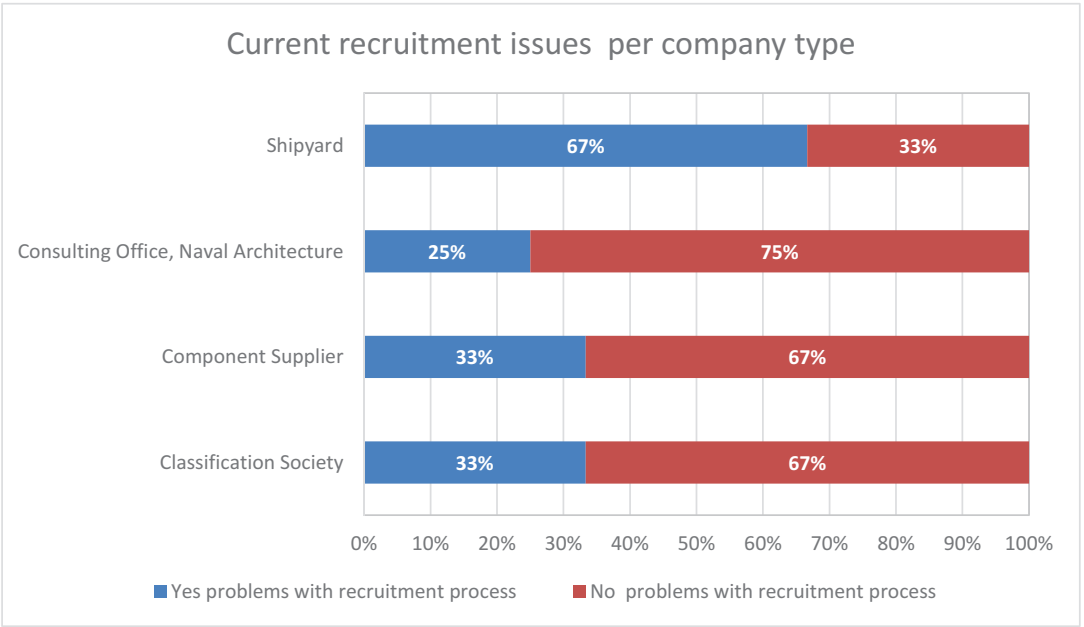


Figure 17: Recruitment issues per company type

Among the reasons identified by the industry as drivers to the difficulty in recruitment of workers with an adequate set of skills, a main issue is the lack of appropriately experienced and appropriately qualified staff trained and readily available on the job market (see Figure 18).

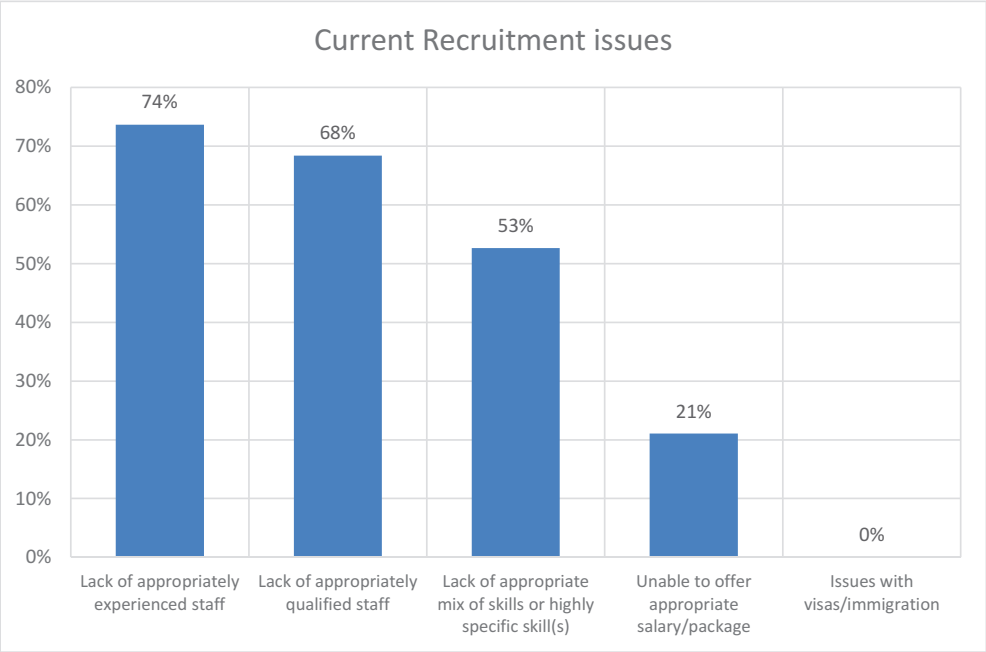


Figure 18: Current recruitment issues

The type of products built in Europe make having a highly skilled workforce with extensive experience and know-how essential. The loss of experienced workers during the crisis years and the aging of the workforce make it challenging to retain know-how in the sector. Among the main reasons to recruit in the medium term (2 to 5 years), the expected large number of retirements is one of them (see Figure 19). Ensuring the transfer of knowledge between generations is, therefore, of outmost importance for the industry in the coming years.

The diversification of the industry into new emerging markets, such as offshore renewable energies, and supporting business development and technological evolution are also main drivers for future recruitment.

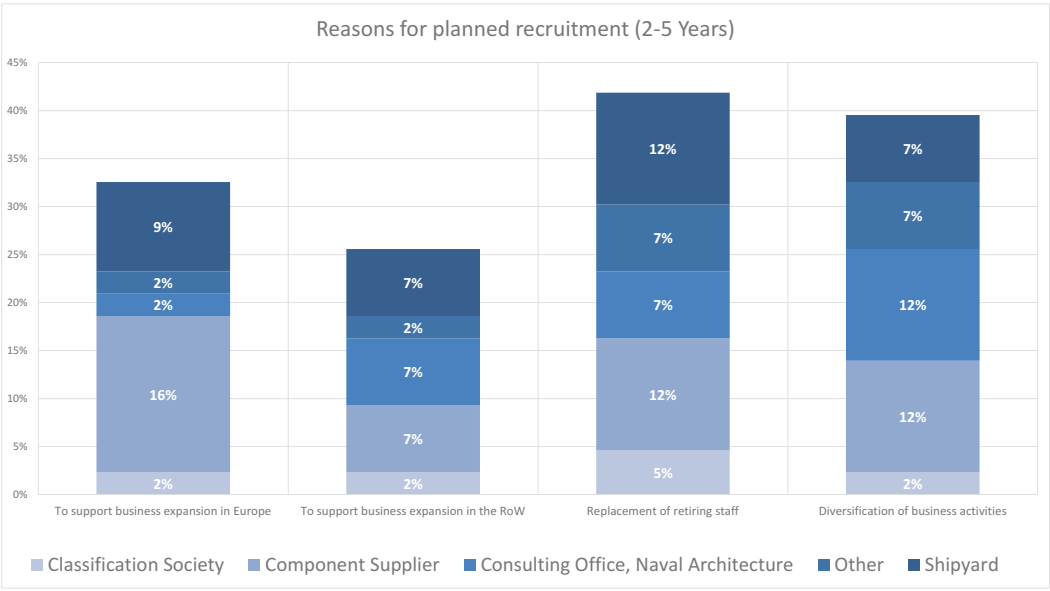


Figure 19: Reasons for Planned Recruitment in the Medium Term

In the Skills Council´s survey, 81% of respondents (4 in every 5 companies) expected to recruit new technical staff, seeing an employment increase in the next 2-5 years, and 12% anticipate the numbers to remain the same, while 7% are expecting a decline in the number of jobs (see Figure 20).

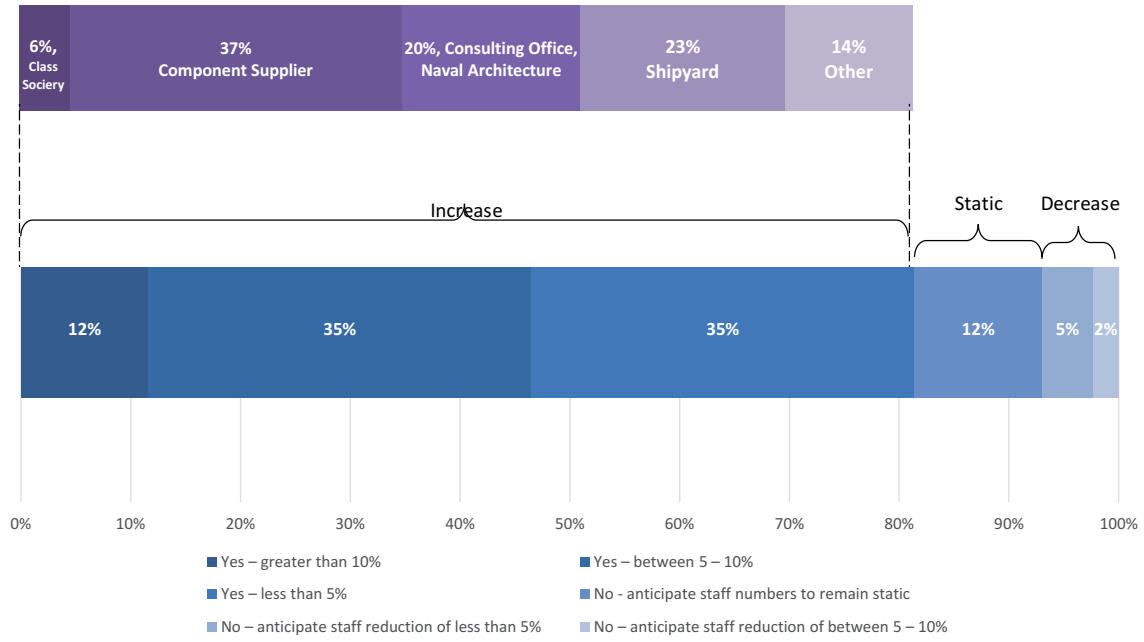


Figure 20: Medium-term staff forecast

The majority of the respondents who expect an increase in staff numbers anticipate this increase to be less than 10%, while none of the respondents who anticipate a decrease believe the decrease will be larger than 10%. This is very encouraging news for the future of the sector, which was strongly affected by the economic crisis of 2008.

The demand for experienced technical and professional workers exceeds the demand for recruiting graduates (see Figure 21). The mismatches between educational curricula and business needs could be compensated by offering more practice during academic courses, alternating learning-by-doing periods (practical training) with classical courses to learn theory (formal training).

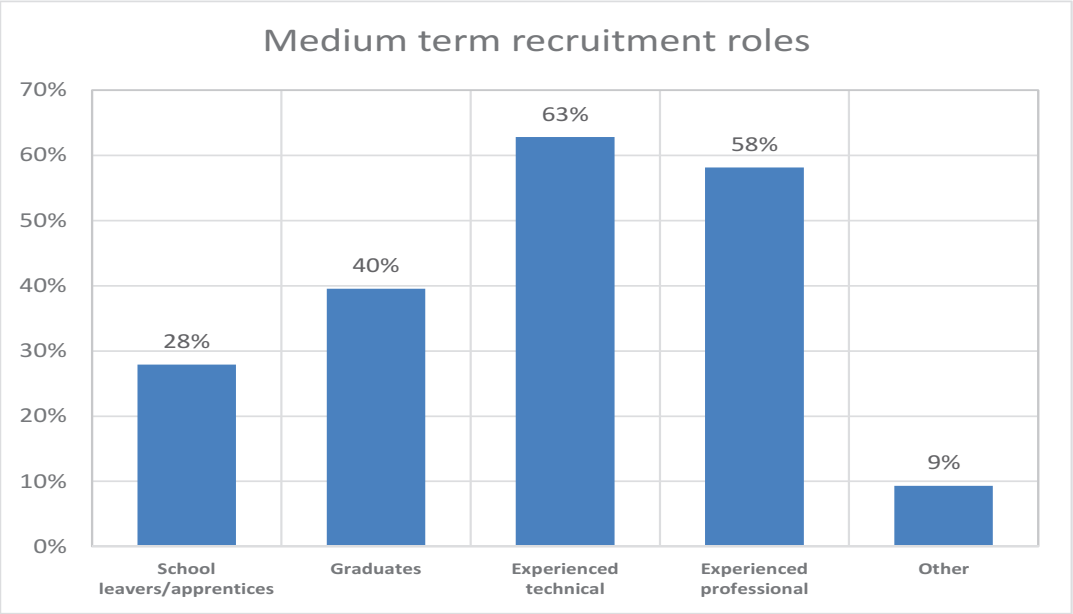


Figure 21: Medium Term Recruitment Types of Personnel to be employed

Among the respondents mentioning their intention to recruit school leavers and apprentices, shipyard companies and component suppliers represent the majority. Their business needs are focused on skilled operators and technicians to replace highly skilled, retiring staff (see Figure 22).

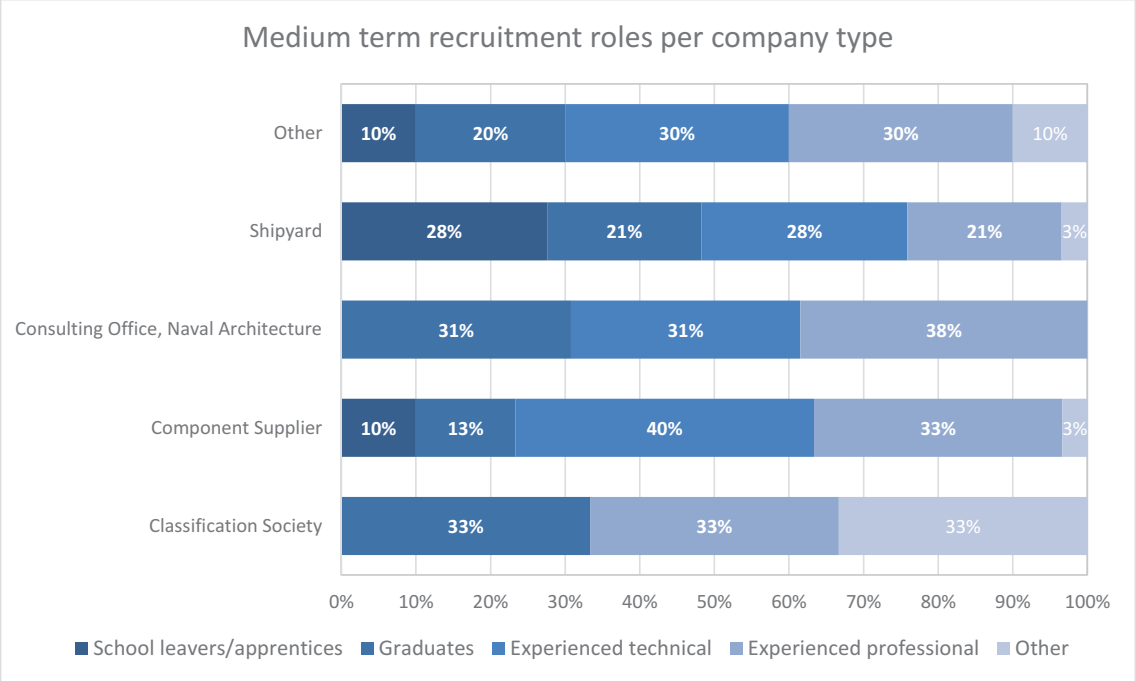


Figure 22: Medium Term Recruitment Types of Personnel to be employed

Skills demand analysis

Among the most demanded skills and occupations, as shown by the results of the Skills Council survey, we find the following:

Engineer	Naval Architect	Designer	Project Manager
Welders	Fitters	Electrical Engineers	3D Design experts

The table below provides an overview of the responses received per company type.

	Component Suppliers	Consulting Office, Naval Architecture	Shipyards	Other
Permanent Staff	Technologist Naval Architect Marine Engineer Engineering/Design/Production Electronics Project Managers Mechanical Specialization Designer Service Engineer Quality Manager CNC operator Administrator	Naval Architect 3D Modeller Hull and Strength expert Aeronautical Engineer	Assistant Manager Mechanical engineer Designer Steel Fitters Project managers	ICT Expert Welders Electricians Electro-Mechanical Engineer Cutters Offshore engineers Sustainability experts Mechatronics operators
Fixed Term Staff	Welders	Stability Expert OHSAS 18001 manager Electrical systems engineer 3D Piping designer 3D Mechanical designer 3D Hull designer	Welder Paint & Scaffolding Supervisor Pipers / Pipe fitters Manual Supervisors	Offshore engineers Sustainability experts

Type of skill and/or position required

Specific skills shortages envisaged in the medium term were also identified by the Skills Council´s survey. The question prompted the respondents to describe in their own words what they felt the skills problems they would be faced with in the medium term were. The responses received could be grouped in two main categories: Company Related, where the responses were describing skills shortage issues specific to the respondent's company and Sector Related, where the responses were describing more generic, medium-term skills issues that the sector and their company are encountering. Below are the responses:

Company Related	Sector Related
More personnel needed due to Company growth Practical experience and skills shortage in the following disciplines: production stability calculations electrical systems shipping and ports sales personnel quality engineers technical writers FEM engineers technical Staff	Difficulties to attract people in the industry Mismatches between the Educational System and the employers requirements leading to loss of competitiveness. Vocational schools do not produce ready-to-work employees for shipyards. Shipbuilding of complex vessels (i.e. Cruise Ships) requires relatively long experience and that type of people are not among job seekers. Personnel with poliqualification (design, in service operation, conformity assessment) Level of competence in different areas - Welding, electricity, boiler making

Specific skills shortages envisaged in the medium term

Skills gap in new recruits

The question on whether new recruits in the organization often do not have the skills required for the role was also investigated. Of respondents, 67% confirmed that there is a skills gap for new recruitments (see Figure 23). This is a substantial response rate for a crucial issue, which demonstrates there is a need for sectoral action in order to address this.

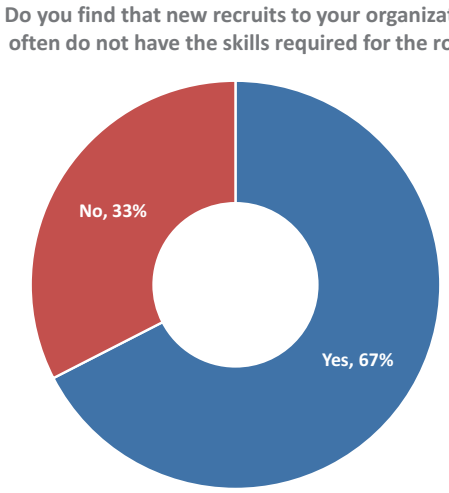


Figure 23: Skills Gaps in New Recruits

Analysing the skills gap for new recruits further shows that the companies which suffer more from the skills gaps for new recruitments are shipyards, which already face bigger issues for recruiting (see Figure 24).

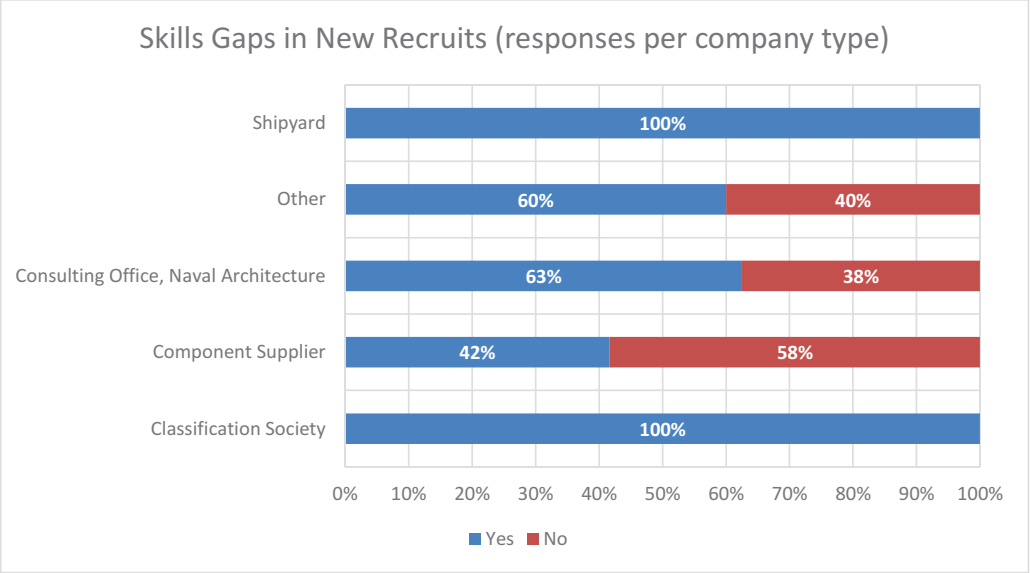


Figure 24: Skills Gaps in New Recruits per company type

Future actions

In order to assess further how the organisations would address the skills gap issues, they were asked what actions they plan to take. The majority of respondents plan to take specific actions, which reinforces the perception that there is a sectoral view that a skills gap exists, and also demonstrates that the companies in the sector are willing to do something in order to improve the situation.

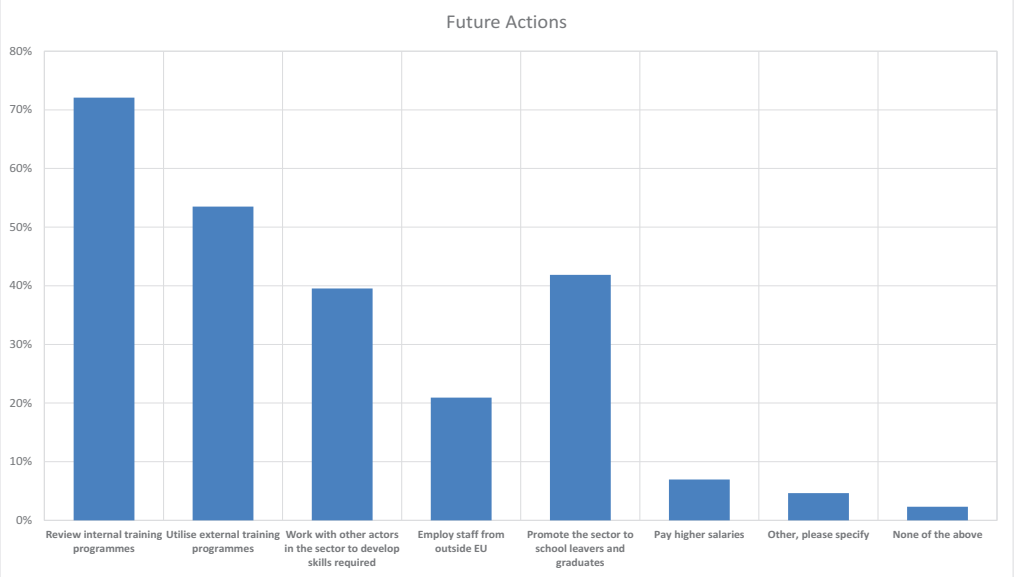


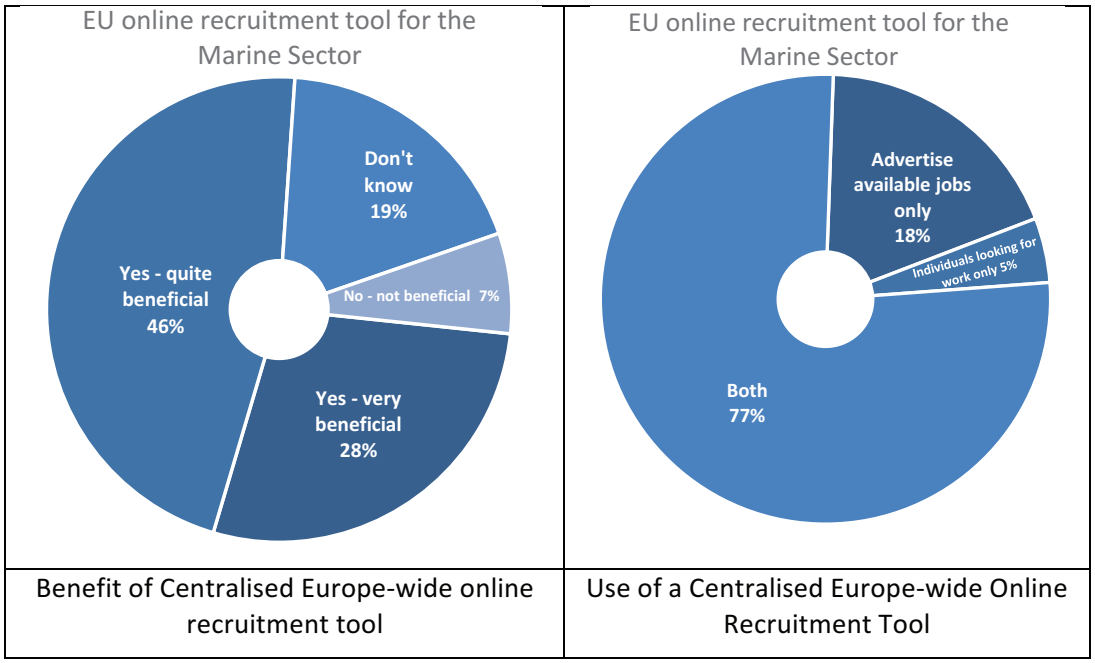
Figure 25: Future Actions to Address Shortfall in Skills

Among future actions to address skills gap, four initiatives appear to be most popular: "Review internal training programmes", "Utilise external training programmes", "Work with other actors in the sector to develop the skills required" and "Promote the sector to school leavers and graduates" (see Figure 25). Some of these actions have been presented during the workshops as best practices or recommendations for common initiatives at a European level.

Recruitment strategies

Respondents were asked if they considered a centralised Europe-wide online recruitment tool for the marine sector would be beneficial for recruiting staff and also if this platform should be only for job seekers or for companies, or for both.

By far the majority of respondents felt that a centralised Europe-wide online recruitment platform would be beneficial, and that it should include details of both available jobs and profiles of individuals looking for employment (see Figure 26).



Benefit of Centralised Europe-wide online recruitment tool	Use of a Centralised Europe-wide Online Recruitment Tool

Figure 26: Centralised Europe-wide online recruitment tool

6 Innovative Tools and Strategies to Monitor Skill Needs and Address Skills Mismatches in Sector

Three thematic workshops were organized to present, discuss and analyse, amongst experts and stakeholders, the sector's employment situation, including forecasts and trends, the qualitative evolution of skills in the sector, innovative tools and national, regional and local initiatives tools and strategies to monitor skills needs and to address the question of skill mismatch and gaps in the sector. Annex 1 includes a thorough documentation of the three thematic workshops that took place in 2015 and all the presentations and relevant files that were presented in these three events can be downloaded from http://wegemt.com/skills/

This section provides a short summary, outlining in four different categories those Innovative Tools and Strategies to Monitor Skill Needs and Address Skills Mismatch successfully implemented by various companies in the sector (as examples of good practice).

Company Level

The case of Royal IHC

Royal IHC, the market leader in the design and manufacture of efficient and integrated dredging vessels and equipment, employs more than 3,900 staff, the majority of them being permanent. The average education level at IHC is increasing, and this trend is expected to continue on in the future. A recent skills evaluation at Royal IHC resulted in the following findings:

- There will be a future need for more highly educated employees in the disciplines of Sales, Engineering and Production.
- A change in the structure of the company's sales force would be necessary in order to adapt to the changing needs of the customers.
- There is an increasing need for basic engineers and a decreasing number of detailed engineers.
- It is expected that there will be less demand for production employees in the coming years due to the shift to countries outside the Netherlands, such as: Poland, Romania, Croatia, China and Vietnam.

In order to address the skills requirements of the workforce, the following strategies and best practices are employed at Royal IHC:

- The company operates its own school, where they offer a 2-year welding and ironworking education programme to approximately 30 young people every year.
- The company intends to increase the entrance level of young people that enter the school in order to be able to train them to a higher level, such as (service) engineers.
- The company is closely cooperating with local universities like TU Delft in order to attract their students.
- The company is planning to shift one of their R&D departments to the campus of one of the local Universities (TU Delft) in order to cooperate more closely with them.

The case of Factorías Vulcano

Factorías Vulcano is a shipyard in Vigo, Spain with expertise in product carriers, offshore vessels, research vessels, as well as other miscellaneous vessels, such as trawlers, RORO containerships, cement carriers and LPG's. Currently, the shipyard encounters the following skills-related issues

- There is a serious training problem, as the old highly specific training schools have disappeared. The current qualifications are not specifically tailored to the needs of the shipbuilding industry.
- The synthesis shipyard needs professionals able to perform analysis, diagnosis, reporting and decision-making tasks in large, complex projects.
- Most degrees don't make significant reference to the industry and, in some cases, none at all. This becomes a serious issue when considering the abilities that a middle manager must have to do his/her job as a manager.

In order to address the skills requirements and to define the skills which are essential for a shipyard, Factorías Vulcano has considered three kinds of skills required to develop a professional career in the company for the correct performance of high level functions:

- Access Training: this is the training and/or minimum qualifications required for the adaptation of a person to a job/role.
- Additional Access Training: this is the professional training recommended for the person with aspirations to access a job/role. This includes training programs related to the most prestigious business schools in the country.
- Transversal and/or Additional Training: this improves the ability of the worker to develop his/her skills, without constituting an access restriction.

The case of the French Naval Industry

The naval industry and yachting, together with oil and gas, constitute an industrial branch of the French Maritime Cluster, which employs 100,000 people in France. The French naval industry is a major economic partner in local territories as it provides work for 69 shipyards and about 480 companies (2012 statistics).

The skills situation is quite complex, with more than 300 different positions existing within naval industry companies, mostly in technical areas such as welding, mechanics, electro-technics, maintenance, design and engineering.

In order to address the skills requirements needed by business, several strategic initiatives are undertaken by the French Naval Industry, such as:

- A group of industrial members (HR personnel) meet every month (One Hour Conference Call) and work on common projects relating to skills needs.
- Another group of vocational training (VT) providers helps structure and offer initial training that is closely adapted to business needs.
- Projects have been launched with French National Education to adapt diplomas which concern mostly operators and technicians in mechatronics, vessel conception and welding.
- Launched during EURONAVAL at the end of 2012 by GICAN, the French Naval Campus is a way for the key training actors in the naval industry to get direct information regarding business needs and to work with companies on short- and long-term solutions. The main goals of this campus are to provide an effective structuring of "bottom-up" training paths for specific skills required by the naval industry (from operator to engineer) with professional (and when possible, international) certificates, as well as to promote careers through a website (www.campusnavalfrance.fr) where videos and documents are publicly available.

Cooperation between industry and education

The case of IRT (Institut de Recherche Technologique) Jules Verne

The Institut de Recherche Technologique Jules Verne is dedicated to advanced composites production technology, metal and hybrid structures, and aims to become, within the next ten years, a global technological innovation campus. The institute is active in 4 main areas: strategic technological development, research projects, training, technology transfer and integration of SME's.

The Jules Verne Manufacturing Valley consists of a technological cluster of more than 300 companies, a research cluster with more than 1,000 researchers, a campus with more than 2,000 students and covers an area of more than 60,000 m². This creates a relatively complex environment, as far as skills and expertise needs are concerned.

In an attempt to respond to the expertise needs expressed by companies in the sector (such as difficulties in recruitment now, preparing for the future and the industry of the future) and in order to improve the quality of the training, the IRT Jules Verne federates and supports development via training and has initiated a Manufacturing Academy on its site in Nantes that will accommodate 1,000 students and will support advanced training.

The Manufacturing Academy is closely cooperating between academic partners and local communities in the region, with educational goals defined by companies. The IRT Jules Verne and its partners are working on the construction of this campus, which will establish a network of education centres charged with providing training which fulfils the demands of industry as well as a mutualised campus dedicated to apprenticeship training, and which is expected to welcome students from the 2018 academic year.

The Vasco Da Gama Project

One excellent example of cooperation between industry, education and public authorities is the Vasco Da Gama Project. The aim of the VDG-TGSMT project (co-financed by the EU) is to contribute to achieving the development of high professional skills and the development of Education and Training within the EU. In particular, its aim is improve the skills of persons employed in European shipping, with a view to addressing specific challenges, such as maritime safety and reduction of environmental damage, and to lay the foundations for mobility within Europe, involving education and training institutions (along the lines of a 'maritime Erasmus').

The project leader is the CPMR, an organisation that brings together some 160 regional authorities. Many of them are involved in the generic Vasco Da Gama initiative, for which main objectives are:

- To promote the quality of education and training in the maritime transport sector
- Enhance European mobility for students, teachers and seafarers in line with the "Maritime Erasmus Concept"
- Encourage networking between regions, educational and training institutions and the private sector

The structure and different work packages of the project were presented. The project aimed to also address the skills gap in the maritime transport sector by:

- Developing innovative modules with a focus on "key" issues;
- Encouraging participation of students and seafarers in mobility schemes;
- Harmonisation of programmes and semesters in EUMETs;

- Designing innovative hardware and software;
- Developing "transnational cooperation" exercises; and
- Identifying that students should spend more hours in simulators means there is a need for more investments in "infrastructures" and more "teachers".

The case of Marine Valley Klaipėda University

In Lithuania, the "Baltic Valley" Association was established in order to coordinate research, academic and business activities within the "Integrated Science, Studies and Business Centre (Valley) for the Lithuanian maritime sector". The founders of the association are public scientific and academic institutions and business entities. The Marine Valley Programme is aimed at creating a cluster of maritime, knowledge-based economy by consolidating the existing potential and promoting integration of maritime research, academic studies and businesses. Main objectives of the Programme include:

- Creating a modern infrastructure for the general needs of Lithuania's maritime research, academic studies and technological development;
- Encouraging more active application of scientific output in production and business;
- Promoting the occurrence of new economic entities with technological profile and based on the practical application of scientific output; opening possibilities for cooperation between knowledge-demanding maritime businesses, academic institutions and research teams;
- Strengthening the competitiveness of Lithuanian maritime research and technologies on international markets; creating conditions for attracting more foreign investment to business and research activities within Lithuania's maritime sector.

Projects of the Programme include:

- Development of the Marine Valley Nucleus and Renewal of Study infrastructure
- Development of Study Infrastructure
- Development of the Laboratory of the Fishery and Aquaculture
- Development of the Engineering Networks and Communications
- Development of the Infrastructure of Klaipėda Science and Technology Park
- Strengthening of the "Baltic Valley" Association
- Development and Upgrade of the 1st and 2nd Level Programmes for Maritime Studies
- Upgrade of doctoral studies, qualification of academic staff and stimulation of Mobility
- Establishment of the National Centre for Marine Science and Technology

Inter-sectoral cooperation

Proposals of the French National Council for Industry

The French National Council for Industry has set up a working group with representatives from strategic industry committees, union confederations, ministries for education, employment, economy and industry and regional councils

The working group met once a month in order to share experiences and discuss how to address skill mismatches and gaps between job demands and offers, and to elaborate proposals.

The purpose of these proposals, focusing only on initial professional training, is to improve the interaction between industrial skills-related needs and educational systems, providing initial

professional training and developing an attractive professional and technological training policy, including a communication campaign aimed at teenagers, parents, teachers and media.

The Strategic Industry Committees will share, within the French National Council of Industry, specific information regarding the evolution of jobs, skills, technological tools and working organizations. A road map focused on Professional and Technological Education and Training will be defined and supported by all the parties involved in the working groups.

To improve interaction between Industry and Educational and Training Systems, a shared and unique method will be applied by each Strategic Industry Committee in order to produce a prospective vision of jobs and competencies needed, resulting from real situations and transformations observed in their territories. This common reference will help build a national industrial vision of jobs and competence needs and can evaluate how many people the system should educate and train, and how many of them get a job in the industry

To establish exchanges on a regular basis between industry and educational system at the national and regional levels, each Strategic Industry Committee gets a referee within the Ministries for Education, Employment, Economy & Industry, and the regional Strategic Industry Committee develops contacts and initiatives at the local level.

Sectoral cooperation at the EU level

European Sectoral Skills Council (ESSC) for the Textile Clothing Leather and Footwear industry (TCLF)

The TCLF ESSC aims at improving the level of education, skills and employment in the Textile Clothing Leather and Footwear sector, addressing (among others) issues regarding training, qualifications and skills in the European labour force in these industries, the appeal of the sector for attracting young professionals and the assistance needed by enterprises for being more flexible in meeting changing competitive demands.

By bringing together key industrial stakeholders, educators, bi-partite and tri-partite organizations dealing with education and skills development, and interested government representatives, the TCLF ESSC aims at addressing a wide range of issues related to image and technological change, qualification standards and practices, planning, and human resource development. Through their participation, the EU social partners pledge to cooperate actively and loyally with the EU TCL SKILLS COUNCIL and to contribute to its success in a spirit of openness and transparency. The overall missions of the EU TCL SKILLS COUNCIL are:

- To monitor labour market developments in the TCLF industries and contribute to the active networking/information exchange of the involved sectoral national ISPs and/or the respective social partners at European level regarding Education Training and Employment;
- To carry out reports/surveys/analyses to construct and maintain the interaction with the reference market related to Education Training and Employment of the TCLF Industries;
- To foster alliances within the TCLF Industries and also with related sectors (e.g. machinery manufacturers, chemical industry, distribution, etcetera.) in order to maximise synergies with them;
- To develop and promote an effective innovation policy, in keeping with sustainability and flexibility, to include technical research, technology transfers, vocational training, etc.;
- To promote the image of a dynamic and forward-looking industry with public institutions, the media and economic decision-makers regarding Education Training and Employment of the TCLF Industries; and
- To provide the members with relevant information

7 Conclusions:

The European maritime technology industry encompasses all the enterprises involved in the design, construction, maintenance and repair of all types of ships and other maritime structures, including the complete supply chain of systems, equipment and services, as well as research and educational institutions.

The maritime technology industry is the key industry for achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth, in particular through 'blue growth'.

- **Smart:**
  The European maritime technology industry is a pioneer in the development of the most advanced technologies and vessels. Investment in R&D&I and a highly skilled workforce are essential for the success of the industry. The sector contributes to Europe´s smart growth and knowledge-based economy.

- **Sustainable:**
  - The most efficient technologies are developed in Europe to ensure the reduction of environmental emissions from waterborne transport. The industry is forming a comprehensive research strategy to work towards zero emission and towards zero-accident vessel concepts.
  - The industry contributes to development of offshore renewable energies, providing the technologies and structures for their production, transmission and storage.

- **Inclusive:**
  With an annual turnover of EUR 91 billion, it comprises more than 22,000 companies, most of them SMEs, providing in excess of 500,000 direct jobs and thousands of indirect jobs, contributing to the economic development of the regions in which they are situated (more than 200 regions in at least 18 European countries).

The 'blue' economy represents around 5.4 million jobs and generates a gross added value of almost EUR 500 billion a year. However, further growth is possible, and the maritime technology industry is the key enabler, providing the technologies, vessels and structures needed to ensure the sustainable development of all the maritime activities (maritime transport of goods and passengers, promotion of oil and gas, offshore renewable energies, aquaculture and fisheries, security and defence, etc.).

Over the last decade, the industry has experienced a meaningful evolution. European companies have specialised towards building the most innovative and advanced technologies and high-value vessels. The European maritime supplier industry produces 50% of total marine supplies worldwide, and in civil shipbuilding, European shipyards represent 20% of the global order book value, ranking 3rd after South Korea and China. Of global investment in newbuilding, 40% comes from European ship-owners. Furthermore, several studies forecast growth in the demand for vessels and technologies in the coming years, providing a positive outlook for the sector.

However, the sector in Europe is facing challenges as a direct result of the ongoing financial and economic crises, and unfair competition from overseas, where protective legislations and trade barriers are put in place in order to support maritime technology industries.

In order to maintain its leading position and to continue contributing to Europe´s innovative, sustainable and smart growth, the sector needs to count on a highly skilled workforce who can drive the industrial innovation.

The maritime technology industry is one of the sectors with higher RDI intensity in Europe. Approximately 9% of the turnover is invested in RDI activities. As an innovation-driven sector, with one of the highest investment intensity in RDI, it is difficult to anticipate the skill needs and adapt the

education, training and re-training programmes accordingly. Moreover, nowadays, the industry continues leading technological development in the emerging markets, designing and building the technologies, infrastructures and vessels to enable the development Blue Growth activities (offshore renewables, green and safe shipping, maritime surveillance, deep-sea mining, etc.).

Some companies experience difficulties finding workers with the right skills, and find that mismatches between the industry's demand and the existing skills supply is a real challenge for the development of the sector. Several initiatives are being developed all over Europe to solve the shortage of skills and the challenge that it constitutes for the industry. However, these initiatives are implemented at the national, regional, local or company levels, and there is no coordination among these initiatives at the European level.

In the framework of the actions taken to create a European Skills Council for the Maritime Technology sector, it has been proven that the stakeholders see the need to act at the European level. The following objectives are seen as necessary to improve skills, employment and education in the sector:

- Improve the cooperation among different stakeholders all over Europe, mainly cooperation between education and training providers and the industry, in order to design programmes which address the actual needs of the industry in terms of skills and knowledge. The adaptation of innovative programmes for the sector should include high education (university), VET and lifelong learning programmes.
- Harmonisation of certificates across Europe to improve the mobility of workers.

In order to achieve the above mentioned goals, the Skills Council will take the following actions in the coming 2-3 years:

- Based on outcomes from the current Report, in-depth analysis and identification of key skill needs;
- Coordinate joint activities and workshops, bringing together actors from different European countries to improve the exchange of good practices and innovative tools to anticipate skills needs and solve existing mismatches, and to foster communication and collaboration among organisations in different countries;
- Analysis of existing education programmes for key occupations within the sector, comparing contents and identifying possible improvement, cooperation and harmonisation of certificates; and
- Support projects and activities in the field implemented at the national, regional or local levels.

Based on the outcomes of these activities, the Skills Council will have the information required to further develop findings in order to deliver new and innovative education programmes (VET, high education and LLL).

8 Policy recommendations

The maritime industry is the economic backbone for many coastal regions throughout Europe. Its workforce is highly specialised and highly skilled and it is crucial that Europe maintains a critical mass of activity in order to remain competitive on the global market. In an effort to contribute to achieving this crucial goal, this report puts forward a set of recommendations for policy makers working on the future of Europe's maritime industry.

1. A European strategy

The European Union requires a holistic industrial strategy for the maritime sector based on a shared vision of how to be stronger together by developing high value products and systems. In particular, the shipbuilding industry has evolved into a field in which only a few countries compete on a global scale. National strategies, which are not in place in all EU Member States, cannot sufficiently address the challenges of such a scale. Therefore, further European action is necessary.

- In order to support and foster European expertise, the Commission needs to place further emphasis on advancing an ambitious, but nevertheless realistic, industrial policy strategy for the sector, as was suggested in the LeaderSHIP 2020 document, devised by the Commission, the EU Member States, the Social Partners and further stakeholders.
- Supporting the installation of a Skills Council for the Maritime Sector that promotes the training and development of the necessary skills needed to compete in this sector would be a welcome step.
- Encourage the establishment of cross-border maritime clusters that bring together competences from throughout the value chain and education.
- Facilitate the mobility of the European workforce through harmonisation of certificates while ensuring that social standards, as agreed by the European Sector Social Dialogue, are respected throughout the EU.

2. Promotion of environmentally sustainable legislation

Legislative and financial incentives from the Council of Ministers and the Commission must be put in place to encourage ship owners to order new, environmentally friendly and energy-efficient ships and to dismantle or retrofit outdated ships of more than 30 years of age. This must include measures to ensure these ships are built or retrofitted in Europe. Besides serving the purpose of stimulating demand, considerable headway would be made in addressing environmental and safety concerns in this way. The maritime industry would also be provided with a stable perspective to further invest in 'greening' the sector. Thus, it is absolutely crucial that investments made by European yards to improve the environmental performance of their ships and to expand their know-how are finally accompanied by a legislative framework rewarding these green innovations. Consequently, a new strategy should include following measures:

- Agree as quickly as possible on the Vessels for the Future contractual public-private partnership (CPPP), supported by the WATERBORNE-TP through its research association (Vessels for the Future), with the aim of focusing research toward zero-emission, energy-efficient, and zero-technical-accident vessels and emerging-market opportunities.
- Support the role of the industry through dedicated R&D programs in the development of 'Blue Growth' opportunities and maximising the sector's role in harnessing economic potential from the oceans and seas, as described in the WATERBORNE-TP Blue Roadmap.
- Encourage pioneering companies to invest in new technologies with an effective policy benefiting first movers, as agility on the implementation of new regulations is a must.

- Link ship taxation to their respective environmental track record.
- Ship-owners and their clients must be held responsible for the environmental performance of their ships.
- Environmental aid must be granted to shipbuilders that produce and develop emission-reducing technologies in Europe.
- SECA/ECA regulations should be expanded to all EU coasts.
- Promote environmentally sustainable technologies for shipbuilding enterprises in Europe.

3. Planning security

The economic and financial crisis, and the resulting worldwide credit crunch, have significantly impaired the chronic problem of ship financing in Europe. This development is particularly worrisome, since the sector is exposed to global competition that is supported by its national bank sector and can offer technological as well as financing solutions. Withdrawing further from the sector of ship financing would diminish the EU's capacities as a relevant actor and present a critical loss to know-how. In order to remain leaders in innovation and development, it is essential that:

- There be sufficient incentives to allow the industry to maintain a sustainable market share and to exploit the full potential of current capacities. For this reason, it is necessary to reconsider some restrictive interpretations regarding competition law in accordance with EIB Guidelines;
- Revision of financing instruments for the sector, especially EIB, in order to improve access to finance independent of the regional/national economic situation, be studied;
- Ensuring that any financing being provided by the European Commission to undertake 'retrofitting' or similar projects to stimulate the uptake of technology by ship-owners be given to the European maritime technology to support home-grown technology development and not be provided to overseas competitors; and
- The guarantee that EU financial support will benefit the production and service abilities in Europe.

4. Fair competition and Attraction of Skilled Talent

In the light of the lack of international regulations for shipbuilding, the burden lies all the more on the European Commission and its Member State governments to ensure that, in bilateral or multilateral negotiations, European shipbuilders are shielded from unfair competition. Such an effort is crucial so that a signal is sent to the younger generation, that a career in shipbuilding will not be threatened by unfair trade practices, or fall victim to ever-increasing price pressure that negatively influences salaries or working conditions or funds available to be invested in skills development.

- The EU Commission should deploy all the resources at its disposal in a bid to impose fair global competitive conditions. This position should be reflected in any free trade agreement between the EU and the Asian countries in question.
- It is no mystery that the competitive advantages of Far-East shipbuilding stems to a great extend from state aid, disregard for protection of the environment and violation of human and workers' rights and social dumping, among others. Steps must be taken to correct this negative image in Europe, where working conditions are good, salaries attractive and investments in R&D and a skilled workforce are the basis of value creation.

- Unfair trade practices need to be eradicated and good global standards should be promoted, so that young people are encourage to seek a career in the maritime industry.

5. Education and Lifelong learning

Finally, education and skills are the key drivers for growth and jobs because they provide the foundations for innovation and value added, in particular in a high-technology, high-precision sector like the maritime industry. The sustainability of Europe's position depends on designing and building high-end products that are leaders in their field. Therefore, this report recommends the implementation of following practices.

- Timely anticipation of employment and skills needs coupled with re-skilling/re-training programs that address emerging skill gaps and shortages where identifiable. In this respect, the establishment of a Sectoral Skills Council and the creation of sectoral training institutes should be encouraged.
- The promotion of lifelong learning and transfer of competences between junior and senior staff should be promoted.
- The setting up of transfer systems between education and industry: systems of dual education and apprenticeships with high quality standards for young people.
- Dual education systems (VET and the simultaneous pursuit of a university degree) should be extended, in particular in regions with maritime clusters. Cooperation between universities and on-site training centres needs to be deepened and extended.
- The curriculum of training centres in Europe should be reviewed and harmonized to such extent as to establish a common European standard that facilitates the award of EU-wide recognized degrees. An EU Skills Council could play an essential role in such a process.
- Extension of the competences of the European Globalisation Fund in order to upgrade the skills of workers in sectors/supply chains that are suffering from off-shoring and international competition.

Editorial Credits

Organisations that contributed for the creation of this report:

SEA Europe Ships & Maritime Equipment Association	Ships and Marine Equipment Association
industriAll European Trade Union	IndustriAll European Trade Union
DCNS sea THE FUTURE	DCNS Group
AgS Agentur für Struktur- und Personalentwicklung GmbH	Agentur für Struktur- und Personalentwicklung GmbH (AgS)
WEGEMT	WEGEMT Foundation, EU Marine University Association

This publication is supported by the European Union Programme for Employment and Social Solidarity – PREGRESS (2007-2013). This programme is implemented by the European Commission. It was established to financially support the implementation of the objectives of the European Union in the employment, social affairs and equal opportunities area, and thereby contribute to the achievement of the Europe 2020 Strategy goals in these fields. The seven-year Programme targets all stakeholders who can help shape the development of appropriate and effective employment and social legislation and policies, across the EU-27, EFTA-EEA and EU candidate and pre-candidate countries.

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Pictures cover page: Courtesy of Kongsberg, Rolls Royce

SEA Europe
Ships & Maritime Equipment Association

Rue Marie de Bourgogne 52-54
1000 Brussels, Belgium
tel.: +32 2 230 27 91
fax: +32 2 230 43 32
info@seaeurope.eu
www.seaeurope.eu

industriAll
EUROPEAN TRADE UNION

Bd roi Albert II, 5
1210 Brussels,
Belgium
tel +32 2 226 00 50
www.industriall-europe.eu