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"COMPETITIVE POSITION AND FUTURE OPPORTUNITIES OF THE EUROPEAN MARINE SUPPLIES INDUSTRY"

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0 Executive summary

It is the objective of this study to give a detailed overview of the marine supplies industry in all Member States of the EU covering basic economic and company characteristics, including available products and services. It evaluates the competitive market position of the European marine supplies industry and identifies opportunities for strengthening its sustainable competitiveness. The study ends with some initial recommendations for implementation with the help of supporting policy instruments.

The main sections of the study are:

1. A description of the marine supplies industry, its end-use markets, types of companies, structure and supply chains and a categorization and benchmarking of suppliers
2. A statistical "top down" and retrospective analysis averaging 2006-2010 data in order to determine the size of the marine supplies industry on the basis of statistical production values of the global shipbuilding and boatbuilding industries. The results are presented in national portfolios for the EU Member States, Norway and Turkey, and additionally the figures have been aggregated into portfolios for EU-28 and EU-28 plus Norway and Turkey.
3. A discussion of developments in the industry in the last years including a brief discussion of changes in the different markets, brief discussion on M&A activities, market consolidation and, globalization by means of examples of globally active leading players from Europe and by analysing the trends in certification and type approvals
4. A "bottom-up" market projection until 2017 by identification and combination of basic economic drivers, market outlooks and forecasts. First, the study estimates the size of the marine supplies market on the basis of shipbuilding forecast models for the period 2013-2017, differentiated by different marine supply trades on the basis of reference cost models for different shiptypes. This market projection is complemented by indicative identification of market sizes for marine supplies for ship repair and conversion, retrofitting of ships, naval ships, offshore units (as far as not covered by the shipbuilding forecast) and boatbuilding. Chances and risks for European suppliers in the various market sectors are discussed.
5. The study ends with a discussion on the position and future potential of the European marine supplies industry including a SWOT analysis and some recommendations.

Main results

Marine supplies industry is heterogeneous in many respects, such as:

- Diversified markets (shipbuilding, shiprepair, naval shipbuilding, boatbuilding, offshore oil & gas, offshore wind, underwater etc.),
- generalists or firms focussed on one market; different in size (big, medium sized and many small companies), global market leaders versus regional workbenches, and
- A broad and varied customer base (shipyards, shipping companies, governments, private owners, offshore majors, research institutions).

Marine suppliers deliver materials, systems, 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 for more than 20 different ship-types of a broad spectrum of sizes, from small research vessels via large bulker and container vessels to giant cruise ships with more than 500.000 m³ volume and on top all offshore systems. The industry provides equipment and services from a single bolt to the biggest engines in the world and jobs from simple cleaning to high sophisticated scientific engineering. All that makes it difficult to identify the marine supplies industry as one entity, well-structured and working according to predefined patterns. Nowadays, customer orientation, a broad product portfolio and organisational flexibility is the key to success. The

study proposes different approaches to structure the industry in order to define it better and to allow measuring economic parameters and employment. This provides the basis for the subsequent calculations of the production volumes in a retrospective view and market volumes in the perspective view.

On the basis of the limited statistical data available in combination with data from associations, extrapolations and interpolations it has been possible to determine the main economic data on the industry as an average over the period 2006 to 2010. The average annual world demand for marine supplies was in the range of 149 billion EUR. The Asian frontrunners China and Korea are by far the biggest national markets, followed by Japan, USA, Singapore, Norway, Italy, India, Germany and Brazil. European marine supplies industry served this global demand with an average production value of 52,5 billion EUR (EU-28) of which about 33% went into export outside of EU-28, and 61,8 billion EUR production value (EU-28 plus Norway and Turkey). The overall production volume represents a market share of the world market in the range of 35% for EU-28, respectively 41,5% for EU-28 plus Norway and Turkey. It is worth to be noted that these market shares take into account production values in Europe and not necessarily production values of European based companies which are generated at overseas production sites.

The five major EU-28 marine supplies production countries, i.e. Germany, UK, Italy, Netherlands and France represent about 75% of the total marine supplies production volume. By the same time these countries represent major export countries with more than 67% of the overall EU-28 export production (about 88% by including Denmark and Finland as additional major export countries for marine supplies).

For the period 2006 to 2010 EU-28 marine supplies industry' 1st tier enterprises employed in average about 257.000 persons in ~23.500 companies. Including 2nd tier suppliers the total employment for marine supplies in EU-28 sums up to about 390.000 persons. Including Norway and Turkey the overall employment calculates to 451.000 persons (1st+2nd tier[1]) working in about 30.000 companies. The figures include a high share (more than 70%) of very small companies with 1-9 employees. Without these very small companies, the number of enterprises in EU-28 is about 6.900 (8.380 including Norway and Turkey). These statistically calculated figures have been benchmarked with a company count of companies possessing an approval certificate with a classification society or another official certification instance. With 5.905 companies from EU-28 (6.553 including Norway and Turkey) this company count is in the same range and proves the validity of the statistical analysis made. By the same time it gives a clear indication that these companies are suppliers of marine equipment or systems in the narrower sense. Germany is leading the company count on the basis of type approvals, closely followed by Italy, United States, South Korea and Japan. Other major European countries in this count are UK, France, Norway and the Netherlands.

Looking at the developments in the years 2008-2011, it needs to be seen that according to the statistical figures the purchasing volume of shipbuilding, boatbuilding and repair in total has dropped from 2008 as the peak year to 2011 by 27% to about the level existing before the financial crisis in the year 2005. Following that the marine supplies production volume for EU-28 in 2011 is calculated to 43,8 billion EUR (including export production) providing employment for about 342.000 persons.

However, the economic development did not affect maritime businesses in the European countries in the same way. Some countries suffered more than others with annual negative growth rates between 4% and 25% for the period 2008-2011. As positive exemptions, UK and the Netherlands even managed to maintain their shipbuilding/boatbuilding production and related purchasing power on a stable level or even show some growth. This seems to be caused by the fact that both countries have almost no orderbook on larger merchant ships, but are concentrating on offshore, naval ships, smaller vessels and special ships (dredgers,

[1] Shipbuilding, boatbuilding, repair of boats and ships add another 375.000 employees (as average figure for 2006-2010)

yachts). The statistical figures in general also show for the end of the period that negative growth has been stopped for some countries or even developed some positive trends.

With regard to the marine supplies industry it can be said that local or regional marine suppliers which are working in the vicinity of the shipyards and are dependent on this limited demand are 1:1 hit by the decline of the business. Other marine suppliers which are acting globally and serve different markets with numerous products are likely less hit by the crisis. Potentially they have even been able to compensate some of the decline in the shipbuilding sector by serving the strong markets in offshore oil & gas and also offshore wind. The study provides a list of about 125 major companies with headquarters in Europe, which likely fall into this category of "good survivors" of the crisis. These companies with globally distributed production sites represent a joint annual sales volume of 41-43 billion EUR which allows them to serve ~40% of the world market with their product portfolio alone. More than 30 of these companies have been described with their marine product portfolio and international company development in more detailed in an annex.

Having a look into the closer future, the study provides a market outlook for seven marine supplies markets. For the shipbuilding market a comprehensive analysis has been carried out in order to identify the expected market volume for 21 different shiptypes (including offshore ships), even distinguishing different size classes or subtypes. Cost structures of the different shiptypes have been used to calculate the different market volumes for 10 different supply trades (external services, steel, ducts and pipes, paintings and coatings, equipment ship operation, equipment cargo handling, equipment accommodation, equipment propulsion and power generation, equipment for auxiliary systems and electrical plants, electronics, automation).

As a result, the marine supplies market out of the shipbuilding orderbook/forecast for the period 2013-2017 sums up to 252 billion USD (50,4 billion USD/a) with an estimated share of 70% for systems and components, 24% for materials and 6% for external services. This volume is substantially lower than in the previous period. More than 50% of that demand is coming from China and Korea, followed by EU-28, Japan, rest of Asia and the rest of the world with about equal shares of 12%. From the systems side the dominant trades are propulsion and power generation with about 45 billion USD, followed by cargo systems (35 billion USD), steel and auxiliary systems (both 30 billion USD) and accommodation with 21 billion USD. Interestingly Korea shows the highest single demand for cargo systems, caused by the huge orderbook on offshore production and drilling vessels with extremely costly processing plants. Europe on the other hand shows the highest demand on accommodation systems, caused by the strong orderbook for cruise ships and super yachts.

In order to get a complete picture on all marine supplies markets the study has examined the markets beyond merchant shipbuilding on the basis of desk research and/or own calculations. As a result the total annual market volume for marine supplies in the period 2013-2017 is suggested to 135,2 billion USD/a (102 billion EUR/a). The biggest single market for marine supplies in this projection is created by the ship newbuilding market for merchant ships, representing about 37% of the total market volume. This includes supplies for offshore markets for vessels (floaters) serving oil and gas and as well offshore wind industry. The second biggest market for marine supplies is represented by naval shipbuilding, including repair, maintenance and overhaul for these ships. This is representing a market share of ~25%. In third position we value supplies for shiprepair and maintenance of the merchant fleet with an estimated share of ~14%, respectively ~16% including special market demand for retrofitting caused by new environmental regulations. The remaining demand for marine supplies is coming from boatbuilding (~9%), offshore oil and gas (fixed installations) (~6%) and offshore wind (~7%).

The data for the forecasting period build on a shipbuilding market forecast represent a significant lower market volume, but also a different shiptype portfolio. This forecast shiptype portfolio is of higher specific value, which creates demand/forecast figures for marine supplies where the proportional market value is increasing in relation to the shipyards. Boatbuilding as private consumer market has declined as well, but is presently levelling out

and shows again potential for growth. The naval market has also seen some decline due to the pressure on public households, but on a global scale can be seen as a reliable market with again potential to grow. The offshore markets for oil and gas and as well for offshore wind are an actual driver of the market prosperity with forecasts for substantial capital expenditures in the following years. This is also cushioning the pressure on the marine markets in due to compensating demands especially on the supply side. The development for these offshore markets are on the one hand depending on the energy demand and price development in the context of GDP growth (for oil and gas) and on the political commitment to change the energy mix in favour of renewable energies (offshore wind and others). The same applies to the special market of retrofitting of the existing fleet, which very much build on the timely implementation of new environmental legislation. This will have an impact on either an increasing demand for conversion of existing ships or early scrapping and newbuilding activities. Although the authors feel confident with the order of magnitude of the given market projections, it should be noted that some of the maritime market forecasts used as information source for projections of marine supplies demand appear to be quite optimistic. However, there are other substantial marine markets of substantial size , which have not been considered in the course of this study, but which may merit consideration, e.g. offshore subsea markets, harbour technologies, shipyard technologies, surveillance. These markets are often served by the same enterprises which produce marine supplies.

It needs to be noted that compared to the statistical evaluation for the global annual demand in period 2006-2010, the world market marine supplies forecast for 2013-2017 suggests a market size which is about 30% lower than the average size of the industry in the period 2006 to 2010. The downsizing of the overall marine market is continuing since 2008. For European shipyards and boatyards this resulted in a decline of the ship and boat production volume and related purchasing volumes, which are as well in the range of 30%, presently down to the level existing in 2005. However, it may be expected that the industry has already seen the bottom of the market decline and is adapted to the market expectations for the following years.

SWOT analysis

Because of the strong diversity of the industry and its markets it has been very difficult to perform a SWOT analysis which is valid for all players. Furthermore, European countries do not provide the same framework conditions in terms of cost basis, finance, academic and educational system etc. All this leads to the situation that some arguments are valid in a reverse sense for different European countries and companies. However, strong market position and technological leadership are identified as major strengths at least for globally active European marine supply companies. They build their position on a strong infrastructure and co-operative partners, skill of their employees and close relationship with their customer base. The declining European shipbuilding markets, the cost level in Europe and the heterogeneous structure of the industry with many SMEs are identified as major weaknesses which hinder in some cases attempts to follow the markets by globalisation strategies. The industry identifies good opportunities in new emerging markets in order to make ships safer, better performing and environmental friendly and in new emerging markets in offshore oil & gas and offshore wind. There is optimism that on the basis of advanced skills technological leadership for systems and components serving these markets can be built, maintained and further developed. Major threats are seen in the attempt of overseas countries to close their markets and to approach high tech market segments by accelerated strategic expansion in conjunction with increasing export activities also to the European market.

Recommendations

The study shows that the European marine supplies industry plays a strong role in the very heterogeneous global marine markets. Nevertheless, the heterogeneous structure of the industry with a comparably high number of companies including many SMEs does not make it easy to create harmonised and focussed strategies. Furthermore strategies of individual

single companies, especially global players with a tendency to relocate production to Asia, may deviate from a strategy applied by European policy in order to support competitiveness of marine suppliers and finally to create growth and employment in Europe. In order to address these latter objectives, we come to the following recommendations for the suppliers and subcontractors themselves, but also jointly with key customer industries (shipyards, shipping companies, offshore operators) and policy makers.

Improve Market Access - Maintenance and/or development of global market shares - For globally acting suppliers with competitive systems and components in their supply portfolio the global market counts. Nevertheless, European markets provide suppliers with a base-load for their products. Furthermore they are also serving most of the different marine markets and therefore are not necessarily depending on newbuilding of ships only. In order to maintain and improve their market position it is essential to ensure international market access and to keep close contacts with the final customers, e.g. shipping companies, offshore firms, governmental purchasing instances etc. In order to cope with this important aspect three recommendations are given

- It would be beneficial if technically oriented joint groups (suppliers, shipyards, shipping companies, offshore operators) could be formed at European level. Maybe the marine supplies system groups as defined in the report can give a first orientation for that. These groups should discuss innovation needs, impacts of present and future regulation and operational needs in engineering, production and after sales services. This kind of co-operation could strengthen the market position of European suppliers, improve the relation between the stakeholders in the value chain and trigger future activities including contributions to the research agenda.
- It is recommended to think about opportunities for joint European initiatives to strengthen extra EU-28 export activities and to facilitate access to new emerging markets, especially offshore. The added value of such initiatives in comparison to the value of activities from national associations should be discussed and evaluated. Initially activities could focus on Brazil, the Gulf countries (Middle East) and India and discussions could address the difficult aspect of local content.
- A third recommendation can build on the first two by strengthening the ability of European suppliers to offer competence and products with regard to entire ship and offshore systems. Some major market stakeholders already are doing this for some system groups and by integrating components in their own companies by intensive M&A actions (e.g. in propulsion systems). The possibility to support consortia of maritime suppliers to integrate products and services towards systems solutions in form of co-operations should be considered. In analogy to the “smile curve” it must be clearly a European objective to build, maintain and consolidate high value adding functions in the context of ship systems; i.e. research, engineering, branding, sales and after sales services. In other words, support system building by strengthening of supplier co-operation and management and as well new business models for joint sales and after sales activities. This may also include joint initiatives towards highly efficient and flexible production value chains in Europe in order to counterfeit exodus of production to low cost countries.

Support emerging markets I – presently the marine industry is facing an exceptional situation of emerging or quickly evolving high-end markets for marine supplies. This is true for the offshore markets, where oil and gas exploration and production moves to deep sea and polar areas requiring new and deep sea related products. It also applies to offshore wind markets and other ocean based renewable energies which face challenging times to develop suitable products in order to serve policies focussing on energy change. In both markets European marine suppliers have already a strong position, but need to consolidate this and develop further opportunities to serve with their products also overseas markets. Since these markets are not represented by the shipbuilding and ship supplies industry associations networking and establishment of strategic partnerships with representatives of related markets is of vital importance.

Support emerging markets II – new requirements due to environmental legislation aiming at a reduction of ship emissions create a market of significant size and will cause for a timeframe of probably 10 years, a special business cycle of ship conversions (retrofitting) and/or they will trigger ship new-buildings. At least for this period European repair/conversion shipyards and suppliers offering products in the area are recommended to team up for the development of tailored conversion solutions. This also may include engineering activities and financing packages.

Maintain excellence in innovation and technology – This is the key issue besides high product quality, long term system reliability, after sales services and cost competitiveness for the globally acting European suppliers in all marine markets. Apart from the marine knowledge, they build their products on the grounds of fundamental know-how in mechanical engineering and electrical engineering. To maintain their global position it is essential to keep this level high and to maintain a position at the forefront of innovation. It also requires good knowledge of the market (customer) needs, technological trends, co-operation with shipyards etc. This applies to all ship-types, boats and offshore products, because the product portfolio of European suppliers is not limited to niche products. However, for normal merchant ships co-operation with shipyards has fully moved to Asia and co-operation is developing there. For some special shiptypes including high-end NCCV, cruise ships, megayachts; etc., European yards are still the leading edge development partners. This applies as well to offshore products. However, it can be seen that also design offices and research centres are gradually moving out of Europe, following end-user markets. In order to fight this trend it is recommended to focus on European joint industry projects to drive technology and innovation in marine technologies, to continue building a European, commonly shared technology platform rather than promoting national initiatives and to create rules for better protection of IPR and to avoid unintentional know-how transfer.

Maintenance and vitalization of European maritime markets including markets in smaller European regions – This issue addresses the needs of those suppliers being more subcontractors, assembly partners or “workbenches” for subassemblies which are more dependent on regional maritime markets and in most cases SMEs. For these suppliers the existence of their marine markets in their closer vicinity is of vital importance. In other words they only survive on the basis of the orderbook and competitiveness of “their” shipyards and boatyards in Europe. It is recommended to look into the situation of subcontractors more closely and to discuss programmes to improve their role in the supply chain, to generate exit strategies towards more trans-regional businesses and to help them participating in RTD measures using special SME funding regimes.

Improve competitiveness in value chains – Apart from technological performance of products, it is more and more essential that suppliers can very competitively integrate themselves into the supply chain of their customers. This is on the one hand true for the subcontractors, which work very closely with shipyards and are involved in the planned building process. On the other hand it is also true for the system and component suppliers which are often also integrated in the building process through planned assembly and testing activities. Besides the shipbuilding or offshore value chains the value chains for shipping with regard to spare part provision is an important issue. It is essential that suppliers manage global spare part and assembly networks which allow serving the shipping industry needs very quickly. All these different value chains need specific attention and it is recommended to support suppliers in their attempt to improve these, e.g. by respective research projects.

Structural improvements in industry (associations, clusters) – The analysis of the marine supplies industry structure shows that the majority of companies and maybe half of the employment is not represented by any industry association. This is due to the fact that many companies are very small and regional companies, but also midsized companies are not necessarily member in an association. It would be beneficial if associations and regional cluster organisations would think about an attempt to get these companies somehow represented or teamed-up, e.g. for joint marketing exercises. Clusters in general should think about strengthening their structures and activities. Industry associations should be involved

in order to accommodate the integration process and to interlink with typically supporting regional clusters. Good examples in Europe show that this has an impact on all maritime players. Co-operation between European clusters should be enhanced by advanced networking activities in order to remove national barriers. This may also include 'unusual alliances' to drive strategy and to establish links with other industries. The European structural funds may provide suitable instruments for this.

Maintain the knowledge base – enhance education and training – European marine supplies industries build their capabilities on a strong academic/educational framework with well developed engineering skills, a strong general industry base and healthy competition in their markets. It is therefore strongly recommended that on the basis of existing programmes education and training in the marine disciplines are enhanced, maintained and if necessary adapted to the demand of new emerging markets and technologies. Industry and universities are requested to jointly develop adequate curricula and to offer related studies. This may also include maritime programmes to establish and support lifelong training measures and as inter European educational exchange programmes.

Strengthen the policy dialogue – The European marine supplies industry is affected by a number of policies on national, European and global level. It is essential that the framework conditions are harmonised on all levels. Even globally a common European view on environmental issues, pro/cons of available technical solutions, taxation, logistic and infrastructure might be appreciated. In order to cope with all these different dimensions of the discussion, a strong European maritime association is essential as discussion partner and lobbying group for the European and international institutions.

Increase visibility as high-tech industry and market – For many years shipbuilding had a difficult public reputation. That has improved over time and shipbuilding is now recognised as a high-tech branch. The contribution of the supplies industry in this context is to a large extent invisible. This needs to be changed and the manifold contributions of mechanical engineering industries or electrical engineering to the ship as a high tech product need to be better communicated. This in the end will also create a better awareness on the fact that marine supplies industry is not only located around the European shipbuilding centres close to the coast.

Align work on regulations and research to create innovation on time – It seems that the uncertainty if and when a market triggered by new legislation will emerge creates sometimes difficult situations for frontrunners of technological innovation. Often it is the case that these markets are not materialising within the expected timeframe, but are postponed due to political discussions. In order to better protect investments of companies it is therefore recommended improving the alignment of RTD measures with the likely development of regulation. Regulation needs to be applied in a way that safeguards a level playing field. This is also essential to minimise risks and to generate better possibilities to finance larger contracts.

In order to follow-up some of the recommendations, European marine industries should consider to further strengthen their co-operation on a European level. Many aspects given above are already addressed in the Leadership 2020 strategy and other strategic papers like the WaterBorne Research Agenda or the concept for a public private partnership under the Horizon 2020 framework focussing on the' Vessel for the Future'. However, in these strategies most activities seem to be more addressed from the client side of the marine supplies industry and from some key suppliers. The strategies could address a larger number of marine systems in view of the large number and variety of European suppliers as outlined in this report. It would be favourable if a larger number of suppliers could be motivated to join the European discussion. On top it needs to be said that the different marine markets are represented by different associations like SeaEurope (shipbuilding, repair, naval shipbuilding), EBI (boatbuilding), EWEA (offshore wind). Offshore Oil and Gas does not have such a European association, but act on the basis of powerful company networks. For shipbuilding and marine equipment in the narrower sense of ship systems and equipment, the new association SeaEurope has been formed in 2012. For this EMEC as the

European association for marine equipment has merged with CESA (shipbuilding) and now represent the marine industry in a broader sense. However, it seems that internal structures in SeaEurope have still to be developed further in order to address marine supplies aspects. Overarching maritime co-ordination activities on European level as provided by the Maritime Industries Forum (MIF) in former years are currently not active. Similarly, it has been observed that some of the national associations are not covering the broad spectrum of the marine supplies industries either, which makes a European co-ordination even more challenging. Especially subcontractors are normally not represented by these associations and also design, engineering and consulting firms are not covered specifically. Similarly, the WaterBorne Research Agenda meets the needs of the marine supplies industry only to some degree.

1 Introduction - Objectives and approach

It is the objective of this study to give a detailed overview of the marine supplies industry in all Member States of the EU covering basic economic and company characteristics, including available products and services. It evaluates the competitive market position and tries to identify opportunities for strengthening the sustainable competitiveness of the European marine supplies industry. Finally the study gives some recommendations for support of the industrial sector or sub-sectors.

As a basis for the work the authors propose a definition for suppliers and sub-contractors and the basic characteristics of maritime supply chains. On top of this the authors build a harmonised structure for systems, equipment components, materials and services which provide the basis for statistical analysis and evaluation. The different product groups identified in the structural view have been mapped into the NACE structure (Nomenclature of Economic Activities in Europe), which is the mandatory industry nomenclature for official statistical analysis in Europe. This allows the study to make use of average statistical data for industrial groups available in different Eurostat databases.

Major sources for the collection of information and data are statistical bodies (OECD, Eurostat, national statistical sources), suppliers, industrial associations, customers and the classification societies. Since no one of the single data sources alone will allow to create comprehensive and reliable results, these different approaches to collect data are applied in parallel.

Based on this and in order to establish the size of the marine supplies industry major sections of the study are:

1. A description of the marine supplies industry, the main categories of marine equipment, its end-use markets, types of companies, structure and supply chains and a categorization and benchmarking of suppliers
2. A statistical “top down” and retrospective analysis averaging 2006-2010 data in order to determine the size of the marine supplies industry on the basis of statistical production values of the global shipbuilding and boatbuilding industries. The results are presented in national portfolios for the EU Member States, Norway and Turkey, and additionally the figures have been aggregated into portfolios for EU-28 and EU-28 plus Norway and Turkey.
3. A discussion of developments in the industry in the last five years including a brief discussion of changes in the different markets, brief discussion on M&A activities, market consolidation and, globalization by means of examples of globally active leading players from Europe and by analyzing the trends in certification and type approvals
4. A “bottom-up” market projection until 2017 by identification and combination of basic economic drivers, market outlooks and forecasts. First, the study estimates the size of the marine supplies market on the basis of shipbuilding forecast models for the period 2013-2017, differentiated by different marine supply trades on the basis of reference cost models for different shiptypes. This market projection is complemented by indicative identification of market sizes for marine supplies for ship repair and conversion, retrofitting of ships, naval ships, offshore units (as far as not covered by the shipbuilding forecast) and boatbuilding. Chances and risks for European suppliers in the various market sectors are discussed.
5. The study ends with a discussion on the position and future potential of the European marine supplies industry including a SWOT analysis and some recommendations.

2 The marine supplies industry

2.1 Markets

Marine supplies industries serve different end product related markets as providers of equipment, systems and many different kinds of subcontracts and services. The major markets and customers can be identified as follows:

- Newbuilding of merchant ships and offshore ships (shipyards, boatyards and shipping companies)
- Ship repair and conversion of merchant ships (shipyards, boatyards and shipping companies)
- Retrofitting - a special conversion market for ships following new regulations (shipyards, boatyards and shipping companies)
- Offshore platforms, jack-ups etc. for oil and gas (offshore- and shipyards, oil and gas companies/operators)
- Offshore facilities, plants for offshore wind applications (offshore- and shipyards, offshore wind operators and wind farm developers)
- Naval shipbuilding, maintenance and repair (shipyards and governments)
- Boatbuilding (boatyards, shipyards)
- Other marine and maritime markets, e.g. underwater services, traffic and environmental surveillance, safety and security markets, harbour technologies, shipyard equipment, special polar markets and (governments, ship/offshore operators, port developer etc.) – these markets are not considered in the course of this study

Although the above listed markets as such can be distinguished quite well, the customer base is overlapping to a certain extend. Some markets also appear along the life cycle of products, e.g. when equipment has to be replaced. Other, like retrofitting may only apply for certain time periods (when new regulation requires special conversion) and are probably difficult to distinguish from the normal repair and conversion markets, driven by regular operational needs. When it comes down to the building of major yachts or smaller specialized vessels, the distinction of boatbuilding and shipbuilding become fuzzy, especially when shipyards/boatyards are operating in both markets. For suppliers, it is also often a necessity to look at the builder of the final product (ship, offshore unit) and at the same time at the operators of these products, since decisions with regard to major outfitting systems and components are taken also by the owners.

Additional Note: Data on purchasing values by shipyards and boatyards in public statistics do not only include end product related equipment, systems and many different kinds of subcontracts and services, but also energy, equipment and services which are needed to operate the manufacturing site. This type of supplies is not part of the study and will not be further discussed. In the statistical analysis further down in the report, purchasing values taken from statistics have been corrected to take this aspect into account.

2.2 Types of companies

The marine supplies industry is a comparably fragmented industry. On the one hand, companies can be identified which are major players in their technological fields of systems and components. These are more specifically marine equipment and systems manufacturers which serve different marine markets and acting internationally, nationally or cross border regionally. Depending on their level of export, they may depend more on the development of the international markets or the markets in the narrower vicinity (country or region). These

are marine equipment and systems manufacturers in the narrow sense of the word and can be identified normally also by the fact that they are manufacturers having type approvals with one or more classification societies. On top of that we can identify a very large number of manufacturers and service providers, which are more active close to their location and either serve local, national or seldom cross border regional marine industries. During the 1990ies many of these companies have been created following extensive outsourcing activities from shipyards and used to be trades in shipyards before. This has decreased the level of value added by the shipyards and by the same time has increased their relative purchasing volume, as can be seen in the statistical analysis in the report. These manufacturers and service providers very much depend on the national or regional economic development of maritime markets.

Further the shipbuilding and offshore system and equipment supplies industry can be divided into the following types of companies:

- Global (maritime) market leaders for one or more technological sub-sectors which basically serve the maritime and offshore market.
- Global technological specialist companies with significant maritime revenue shares, but also significant supplies to other industrial sectors.
- Maritime specialist companies that serve essentially only the maritime and offshore market in Europe as well as worldwide. These companies operate either only one or several maritime sub-markets.
- Industrial generalists with lower maritime revenue shares but still significant global maritime market shares.

2.3 Structure and supply chains

More systematically the following definitions have been made to distinguish marine suppliers and subcontractors:

A. Marine suppliers are characterised by the fact that they develop functions or systems according to their own patents and techniques and they operate by respecting the specifications and terms of references defined by the customer for complete products or subassemblies. Marine suppliers can be distinguished in “system suppliers”, “component suppliers” (to be seen as a subgroup of system suppliers) and “material suppliers”

B. Marine subcontracting exists whenever the customer participates in the conception of the product, even partially providing specifications to the manufacturer ranging from detailed technical plans to looser specifications.

   Marine subcontractors are subdivided in those offering services for “manufacturing and assembly” and those offering services in the areas of “engineering, design and consulting”. Engineering, design and consulting service contracts basically exist for all shipyards employing classification societies, model basins, architects and all kinds of engineering services. Service contracts in manufacturing and assembly are depending on the overall building philosophy of shipyards and to what extent they have applied outsourcing strategies for trades, which originally were internal trades of the shipyards. Further labour services are included in the purchase of material, systems and components which cannot be identified separately. Therefore a grey zone exists between category A and B of the suppliers.

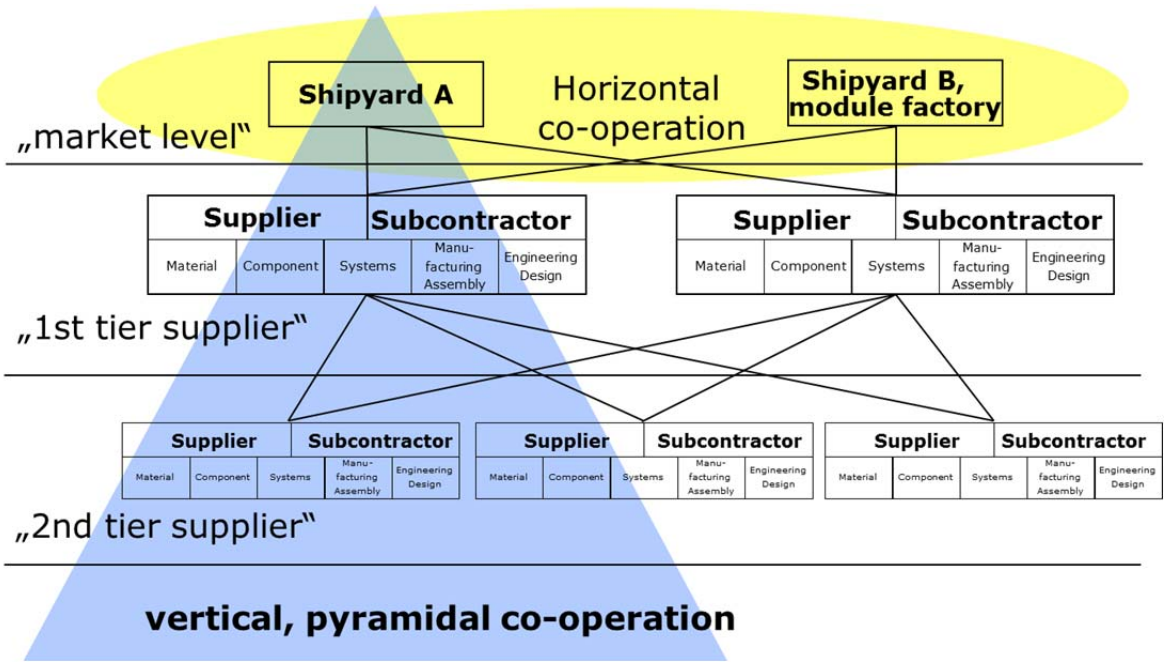


Figure 1: Horizontal and vertical co-operation between shipyards and suppliers, [BALance TC]

Two forms of co-operation (horizontal and vertical) in the form of supplies and subcontracting co-exist in the shipbuilding/marine industry sector. Vertical co-operation exists because of the high complexity and fragmentation of the products and sub-products. Horizontal co-operation between shipyards (or comparable manufacturers of turn-key modules) exists for capacity or delivery reasons *(Figure 1)*.

Horizontal co-operation between shipyards

Horizontal co-operation in the sector is carried out by shipyards more than in other industries. There exists in shipbuilding important flows of subcontracts amongst the main contractors themselves. Hence, a main contractor, after having obtained an important contract, will entrust to other main contractors' part of the work on the contract which his own production capacity cannot meet. Input-output statistics for the shipbuilding industry indicate that 5-10% of the reported turnover has been bought-in from the same industry sector, i.e. artificially increasing the statistical size of the industry sector.

The activity of the sector is in fact characterised by long development phases and long manufacturing cycles (for example 12 – 24 months for merchant vessels, 24 – 36 months for passenger vessels). This means an alteration of periods where the factories operate at full capacity with others where they appear to have, on the contrary, spare capacities. The exchange of subcontracts among shipyards also facilitates the management of manufacturing personnel in terms of levelling temporary over- or undercapacity.

Vertical co-operation

The vertical characteristic enables easy demarcation of the boundary between shipyards and major system suppliers (e.g. engine manufacturers) which make up the population of main contractors at the 2nd level and the other parties on the following levels. However, among the other parties, the distinction is not always easy to establish. Especially, the distinction between equipment suppliers (components and systems) and subcontractors is sometimes difficult. If a technical (existence of a research and development activity) or commercial (capacity to fix breakdowns and repair) responsibility with regard to products or components can be identified in a company it may be better to classify a supplier in the category of component manufacturers rather than in the category of subcontractors.

Equipment manufacturers are therefore characterised by the fact that they develop functions or systems according to their own patents and techniques, and they operate by respecting the specifications and terms of references defined by the manufacturers for complete functions or subassemblies: separators, propellers, radar, navigational equipment etc. These companies in most cases also work for customers from different industrial sectors.

The equipment manufacturers are affected by almost the same economic cycle as shipyards or their maritime customers themselves. When a reduction in orders occurs, they are equally affected, requiring the setting-up of plans to adapt, a decrease in investment and a reduction in subcontracting. However, there is difference for suppliers acting on the global market and a wide range of marine markets which are much more dependent on the global economic development of maritime markets than others who are only acting only nationally or regionally. Those suppliers may benefit or suffer respectively in case their national or regional markets are developing differently than the global market. This is definitely the case for European suppliers.

When discussing the differences between the supply chain structures of the shipbuilding/marine industry with that of other industries, it must be said that the pyramidal significance of the structure shows major differences. A first major difference lies in the number of final producers. Whereas, there are still more than 50 European shipyards with 500+ employees and more than 150 in total, the situation in automotive (~15 manufacturers) and aerospace industry (<5 manufacturers) is significantly different.

In the area of 1st tier suppliers and subcontractors the situation is comparable. Whereas in automotive and aerospace industry the manufacturers more and more concentrate on “platform suppliers” with less than 500 suppliers on that level (Japan 200) the shipyards still work with a high number of suppliers and subcontractors directly. This leads to 1000 – 2500 names in the purchasing database depending on company size and ship types. Of course, products and industry specific requirement are different and supply chains for serial products are more deterministic than for shipbuilding.

Appearing as a very heterogeneous industry, it must be stated that there is no formal structure available which classifies marine supply into dedicated categories. All parties which try to find a suitable categorisation find different solutions which serve more or less their own interests. Therefore, all information about marine equipment and materials provided for example by national associations, classification societies trade fairs etc. is structured differently and therefore difficult to compare. Names of products and services are chosen differently, higher aggregated groupings are assembled differently and also the assignment of individual companies may be seen differently by the interested parties.

Therefore, this study proposes a harmonised structure which is basically following the functional or system oriented view of the customers (shipyards, owners). With some amendments and aggregations especially for materials and the different areas of subcontracting a total of 19 system groups including 69 subgroups for equipment, 10 subgroups for materials and 16 subgroups for subcontracting have been identified.

It has to be admitted that this already quite complex structure may not cover all possible aspects of maritime systems. Especially those for offshore operation (production, processing, drilling, exploration etc.) may not be sufficiently mapped. This structure shows on the one hand the complexity of maritime systems and components and on the other hand provides an access point to evaluate which industry sectors are involved in maritime supplies. It also means that this structure allows a mapping into the systematic statistical systems, which at least allows to identify those statistical industry categories containing maritime supplies. The statistical classification system in use in Europe is called the “General Industrial Classification of Economic Activities within the European Communities” (NACE). This system was in use as version NACE 1.1. until 2007/2008. From then on a revised NACE 2.0. is in use, which, unfortunately, applies a slightly different classification key. Following that, statistical data for the transition year 2008 show still some inconsistencies which are under discussion between the authors and Eurostat.

As a result from this study we provide in addition to the above described and identified system groups for shipbuilding and maritime industries an assignment to the classification system NACE 1.1. and NACE 2.0. It provides a logical link between the system groups and subgroups in the defined structure for the marine supplies industry and the NACE definition *(Table 1)*. This structure and NACE assignment of the industry makes it better possible to analyse the industrial sector and allows using statistical data of companies and industrial sectors available for these different NACE classes from national or European databases for analysis at least on higher aggregation levels.

The full list of the harmonised industry structure for the marine supplies industry including the NACE 1 and NACE 2 assignments is attached as Annex 1 to this report.

Marine Supplies "Systems Groups", "Systems"		Marine Supplies Group "Component", "Service"		Description "Component", "Service"	NACE Revision 1 4 digits		Description	NACE Revision 2 4 digits		Description
1 Propulsion Systems, Power Generating Systems		11	Dieselengine	Complete dieselengine	2911	Manufacture of engines and turbines, exept aircraft, vehicle and cycle engines	Dieselengines	2811	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines (excluding repair)	Manufacture osf patrs of internal combustion pstion engines for marine and railw ay
				Cylinder covers			Parts of dieselengines			
				Spare parts			Marine propulsion compression-ignition engines	3312	Repair of machinery	
				Crank cases						
				Camshafts						
				Cylinder lubricating devices						
				Tachometers						
				Local instrument panels						
				Special tools						
				Turbochargers						
				Vibration dampers						
		12	Steam turbine	Complete steam turbine	2911	Manufacture of engines and turbines, exept aircraft, vehicle and cycle engines	Steam and other vapour turbines	2811	Manufacture of engines and turbines, exept aircraft, vehicle and cycle engines	Steam and other vapour turbines and parts of it
				Speed governors			Steam turbines for generation of electricity			Hydraulic turbines, w aterw heels and regulators thereof and pats of it
				Main condensers			Parts of vapour turbines			w ind turbines and parts of it
				Vacuum pumps				3312	Repair of machinery	
				Vacuum ejectors						
	1. Two Stroke Diesel Propulsion Systems	13	Gas turbine	Complete main gas turbine aggregates	2911	Manufacture of engines and turbines, exept aircraft, vehicle and cycle engines	Gas turbines other than turbo-jets and turbo-propellers	2811	Manufacture of engines and turbines, exept aircraft, vehicle and cycle engines	Gas turbines other than turbo-jets and turbo-propellers
	2. Four Stroke Diesel Propulsion Systems			Pow er turbines			Parts of gas turbines (excl. turbo-jets and turbo-propellers			Parts of gas turbines (excl. turbo-jets and turbo-propellers
	3. Steam Turbine Propulsion Systems			Combustion chambers				3312	Repair of machinery	
	4. Gas Turbine Propulsion Systems			Compressor machines						
	5. Diesel-, Turbo Electric Propulsion Systems			Starting machinery						
	6. POD Systems	14	Gears and couplings	Turning gear	2914	Manufacture of bearings, gears, gearing and driving elements	Gears	2815	Manufacture of bearings, gears, gearing and driving elements	Gears
	7. CODAG Systems			Starting gear			Gear boxes and other speed chargers			Gear boxes and other speed chargers
	8. COGES Systems			Complete main reduction gears			Clutches and shaft couplings			Clutches and shaft couplings
				Main reduction gear casings, foundations, bolts				3312	Repair of machinery	
				Central gear plants						
				Central gears						
				Central gear couplings						
		15	Propeller	Propulsion propellers	2875	Manufacture of other fabricated metal products n.e.c.	Ships' or boats' propellers and blades therefor	2571	Manufacture of other fabricated metal products	Ships' or boats' propellers and blades therefor
				Controllable pitch propellers				3311	Repair of fabricated metal products	
				Propeller nuts						
				Rope guards						
				Propeller blades						
		16	Shafts and bearings	Thrust shafts/bearings	2914	Manufacture of bearings, gears, gearing and driving elements	Ball bearings	2815	Manufacture of bearings, gears, gearing and driving elements	Roller bearings and Roller bearings and parts of
				Turbine shafts			Roller bearings			Cranks and crankshafts
				Turbine main/trust bearings			Cranks and crankshafts			Bearing housings and parts of
				Propeller shafts			Other transmission shafts			Other transmission shafts
				Shaft bearings			Bearing housings			Other transmission elements
				Shaft seals			Other transmission elements	3312	Repair of machinery	
				Gear w heels, shafts, bearings			Parts of ball or roller bearings			
							Parts of bearing housings			
		~~31~~ 17	Electrical Engines		3110	Manufacture of electric motors, generators and transformers	DC motors and generators	2711	Manufacture of electric motors, generators and transformers	DC motors and generators
				Propulsion el. motors			AC motors and generators			AC motors and generators
				Gyropropeller el. Motors						AC/DC
				POD Sets						
								3314	Repair of electrical equipment	Repair and maintenance of electrical motors
		18	Alternate Propulsors	Water Jets	2912	Manufacture of pumps and compressors		2813	Manufacture of pumps and compressors	Non-hydraulic equipment; except repair
								3312		Repair of machinery

Table 1: Marine supplies industry structure (Example, Full List in Annex1) [Source: (1)]

The defined structure of system groups, however, is too complex for market analysis purposes, especially when it comes down to single ship types and the possibilities to obtain data in that high degree of resolution from shipyards or owners. Therefore the authors decided for this study to simplify the structure and only distinguish 3 classes (services/subcontracts, materials, systems/equipment) and 10 system groups of marine supplies for the evaluation of market volumes, basically focussed on the ship newbuilding market. This summarises numerous systems and equipment components as indicated in brackets as prominent examples:

0. **External services and subcontracts** - only engineering, design and consulting services are covered, because subcontracts for manufacturing or assembly in most cases are integrated in post-calculation data of material supplies or system/ equipment supplies, i.e. these are included in the following subcategories.
1. **Materials – Steel** (half raw materials, subassemblies)
2. **Materials – Pipes and ducts** (half raw materials, subassemblies)
3. **Materials – Paint, coating** (paints, painting services)

4. **Systems / Equipment – Ship operation** (steering gear, anchor, deck machinery, life saving equipment, MARPOL equipment, general outfitting components)
5. **Systems / Equipment - Cargo handling equipment and special cargo plants** (cranes, sucker, conveyors, cargo lift, hatch covers, Ro-Ro doors and ramps, trailerlifts, cargohold outfitting and fittings, HVAC for cargo holds, LNG/LPG plants, fishing vessel equipment, special equipment for dredgers, offshore ships equipment - production, processing, drilling, exploration, etc.)
6. **Systems / Equipment – Accommodation** (pre-prepared cabins, doors, windows, walls, ceilings, coverings, floor coverings, carpets, staircases, railings, lifts, sanitary rooms, swimming pool equipment, accessories, equipment for pantry, bar, restaurant, food storage, laundry, furniture and decoration etc.)
7. **Systems / Equipment - Propulsion, power generation** (diesel engines, boiler, steam turbines, gas turbines, gears and couplings, propeller, shaft and bearings, accessories, auxiliary engines (diesel), auxiliary boilers, etc.)
8. **Systems / /Equipment - Auxiliary systems, apparatus & accessories for engine operation, ship operation, cargo handling, accommodation** (seawater cooling, fresh water cooling, fuel systems, lub oil systems, exhaust system, engine starting system, steam systems, heating systems, ballast water, fire fighting, deck washing, pressurized air, tank heating, cargo hold heating and cooling, cargo pumps, inert gas plants, tank cleaning, tank heating, drinking water, sanitation hot/coldwater/sewage, HVAC, waste disposal, swimming pool technology, general engine room outfitting, roll-damping, anti heeling systems, active stabilizers, etc.)
9. **Systems / Equipment - Electrical plants and electronic systems** (main plants, generators, batteries, cable trays, cables, fittings, e-engines, lighting (all rooms and decks), electrical heating, alarm and control systems (ship automation, remote engine control, monitoring, heating, cargo control, communication systems, nautical equipment (compass, radar, log, sat receiver, ECDIS, weather plotter), navigational lighting, entertainment systems (audio, video, cinema, theatre, meeting rooms, hotel management, clocks))

For this simplified structure, the authors have developed ship cost models for 21 shiptypes, based on a number of built ships and further information from shipyards and publication. These cost models are used to evaluate the relative values of ship supplies per shiptype based on the orderbook/forecast scenario as outlined further down in the study.

2.4 Categorisation and benchmarking of marine suppliers

Discussions with shipyards as the main customer for marine supplies and the analysis of available background materials lead to the definition of a strategic purchasing portfolio for marine equipment products. This was possible due to the fact that European shipyards have very much improved the knowledge about their supplier base. In former times it was very often an unstructured and not maintained set of data which was hardly ever used for strategic planning or to develop broad knowledge on the supplier base. Since the awareness about the profit impact of bought-in-items has increased and subcontracting became a subject of increasing importance this has changed. Shipyards started internal projects to learn more about their supplier structure, average purchase values, purchasing efforts, geographical location etc. On this basis it was possible to classify suppliers in a structured way and to develop a strategic purchasing portfolio according to an approach applied also by other industrial branches *(Figure 2)*. This portfolio can be used to assign marine equipment respectively the shipyards subcontractors and suppliers eventually per shiptype into the different portfolio sectors.

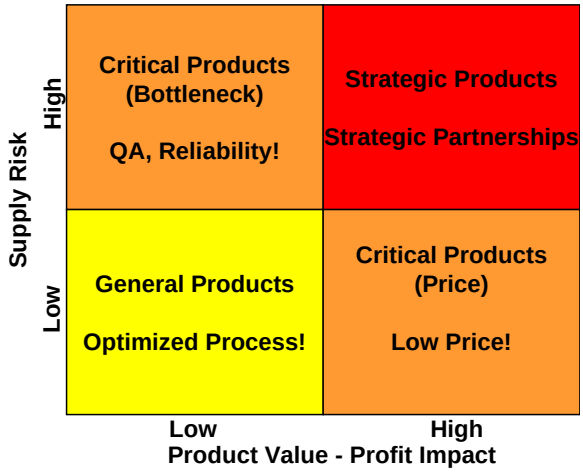


Figure 2: Strategic purchasing portfolio, [BALance TC]

The portfolio structure has been used to define performance indicators for marine equipment products respectively suppliers assigned to the four portfolio sectors. Consequently, the following examples of marine supplies typically fall into the different sectors of the portfolio. Further indicators are given, describing the critical factors of the marine supplies for the end product, the performance indicators to evaluate the offers received for the product and the competitiveness of the supply partner and as well typical management approaches to build up relations between shipyards and suppliers. As shipyards more and more have to apply intensive QA systems and management procedures (especially with increasing offshore businesses), internal evaluation, qualifications schemes and benchmarking are becoming more important in maritime industries as well. This, however, is not only a burden, but also a chance to establish close relationships and to build strategic alliances within the supply chain, which can generate sustainable competitive advantages, especially for complex ships and offshore structures.

Strategic products

Examples: turn-key supplies, system-supplies, main engines, integrated bridge equipment, products which may give a differential advantage to the end-product

Critical factors: cost are high, impact to the quality of the final product is high, few manufacturers, long term sourcing, delivery lead time is critical

Management approach: strategic alliances, increase liability of suppliers, accelerate early availability of specifications, co-operative design, long-term contractual agreements apart from single contracts.

Performance indicators: technological leadership, co-operative engineering, reasonable price

General products

Examples: Of the shelf (catalogue, standard) products, no special-to-type specification, may come in large quantities, e.g. pumps

Critical factors: cost of acquisition and ordering process

Management approach: standardise products, reduces number of suppliers, formalise/simplify/improve purchasing process, volume frame contracts, internal maker/supplier list

Performance indicators: low price, quick market response, sustainable quality, ability to integrate processes, quick delivery

Critical products (bottleneck)

Examples: products of relatively low value, but critical for the final product, e.g. propeller, fire doors

Critical factors: delivery in time, sustainable product quality, good co-operation during engineering, failure may either increase process cost or jeopardise timely delivery.

Management approach: application of quality assurance mechanisms, strong auditing of suppliers, standardise (simplify) products to decrease risks, develop alternatives, long term partnerships but contract per product relations.

Performance indicators: reliability in products and processes, good quality record, experienced team-workers, flexibility, timely delivery, reasonable price

Critical products (price)

Examples: products which are of relatively high value, but maybe not critical for the performance of the end-product, standard catalogue products, e.g. diesel-generators sets, deckcranes

Critical factors: price

Management approach: internal makers list, reduce number of suppliers, supplier audits, individual negotiations

Performance indicators: low price, sustainable product quality

All products with a **high supply risk** (upper row of the metrics) need a closer co-operation between the yards and the suppliers/sub-contractors than products with a **low supply risk** (lower row of the metrics) which results in different process chains *(Figure 2)*.

3 The size of the marine supplies industry (statistical analysis)

An estimate of the total size of the marine supplies industry and some additional analysis has been made on the basis of available statistical information. The top-down (statistical) approach has been discussed taking into account existing studies and analysis from some national sources. Where necessary the project team has made appropriate assumptions and suitable inter- and extrapolations.

The main statistical data sources have been:

- Eurostat SBS – Structural Business Statistics
- OECD STAN Database 2008
- Input / Output Tables from OECD, Eurostat and National Statistical Bodies

The official statistics provide data on the "Total Production Value" for "shipbuilding" containing ship newbuilding, repair, naval shipbuilding, boatbuilding, offshore vessels and platforms, and ship scrapping. The statistics further provide a value for the "Value Added" by the shipyards. The difference between "Total Production Value" and "Value Added" provide us with the "Bought-in-Value" or "Purchasing-Value".

This "Purchasing Value" must be further discussed in order to generate the national values of the Marine Supplies Markets. At first the value has been corrected for "Shipyard and Energy Cost" including e.g. fees for lease and rent, licenses, agents, transport cost, etc. A further correction has been made for "Purchasing-Values" by other customers than shipyards. Whereas the newbuilding cost for ships, naval vessels and offshore platforms are contained in the statistical value given above, those for maintenance and repair directly performed by the marine supplies industry and the shipping and offshore companies themselves are not covered. Therefore a correction has been made for direct "Purchasing -Values" of shipping companies and as far as possible also for offshore companies.

By applying this approach on a global scale to define the total size of the marine supplies market appropriate data has been found in the statistics only for the OECD countries. For new shipbuilding nations which are not OECD countries, at first for China, but also for countries like Philippines, Vietnam, Brazil, Indonesia, Singapore, Malaysia etc. data has been obtained from secondary sources and have been based on qualified evaluations.

3.1 Average size of the global marine supplies industry 2006-2010

The global market on marine supplies has been generated by a combination of data from different sources and where necessary estimates have been made, especially for some countries where we have to accept a lack of data. The core of the data is coming from Eurostat for the EU and other European countries. Other data are coming from the OECD STAN database and some other publications.

On this basis, the average size of the global marine supplies industry has been calculated as an average figure based on the period 2006 to 2010, which includes the final phase of strong growth before the financial crisis and the period of after crisis decline. So, the average figure on the global production value should give a fair view on the average size of the industry when it is in healthy condition. On this basis the overall global production value, which by the same time represents the average world market figure for marine supplies is calculated to 149,06 billion EUR (~202,6 billion USD). See the figure below for a distribution of the value over the different countries. We assume that eventually the calculated figure is still too small, because new emerging shipbuilding nations may have produced more than taken into consideration in the calculation. Furthermore, other marine markets like direct purchases from offshore and shipping industries and as well governments may have been underestimated.

Compared with global purchasing figures of the shipbuilding market, it can be clearly seen that other major marine supplies markets must be included in the given numbers. The very high market values of the USA, Norway and UK are predominantly caused by navy and offshore markets, whereas Italy has a very strong boatbuilding market. In contrast to this Japan, China and Korea are dominated by merchant shipbuilding. However, since many companies offer products for all or the majority of marine markets this overall estimation of the world market provides a fair idea on the average size for the period 2006-2010.

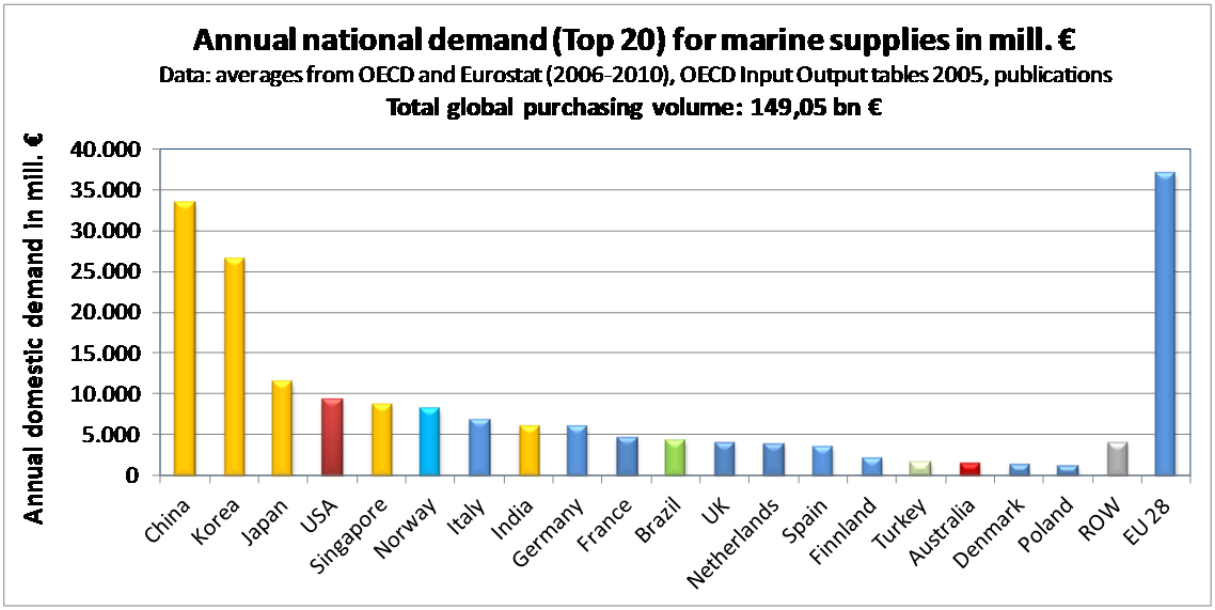


Figure 3: National distribution of the world market for marine supplies [million EUR], [Sources: (2), (1), BALance TC calculations, 2013]

As another estimate on the basis of the global demand projection, we have discussed the overall market size against the different trades by applying the same pattern as for the shipbuilding orderbook/forecast. The calculated result is given in the diagram below, but only provides a possible distribution. According to that, the total global purchasing value for materials is 34,5 billion EUR equal to 22,1% of the total market volume, for external services 10,3 billion EUR or 7,1% and for systems and components 104,7 billion EUR or 70,8%. The Asian market on marine supplies creates a demand of 87 billion EUR, equal to 58,4% of the total market. Europe has a market of 47 billion EUR, equal to 31,5% of the total market and the rest of the world create a demand of 15 billion EUR, equal to 10,1%.

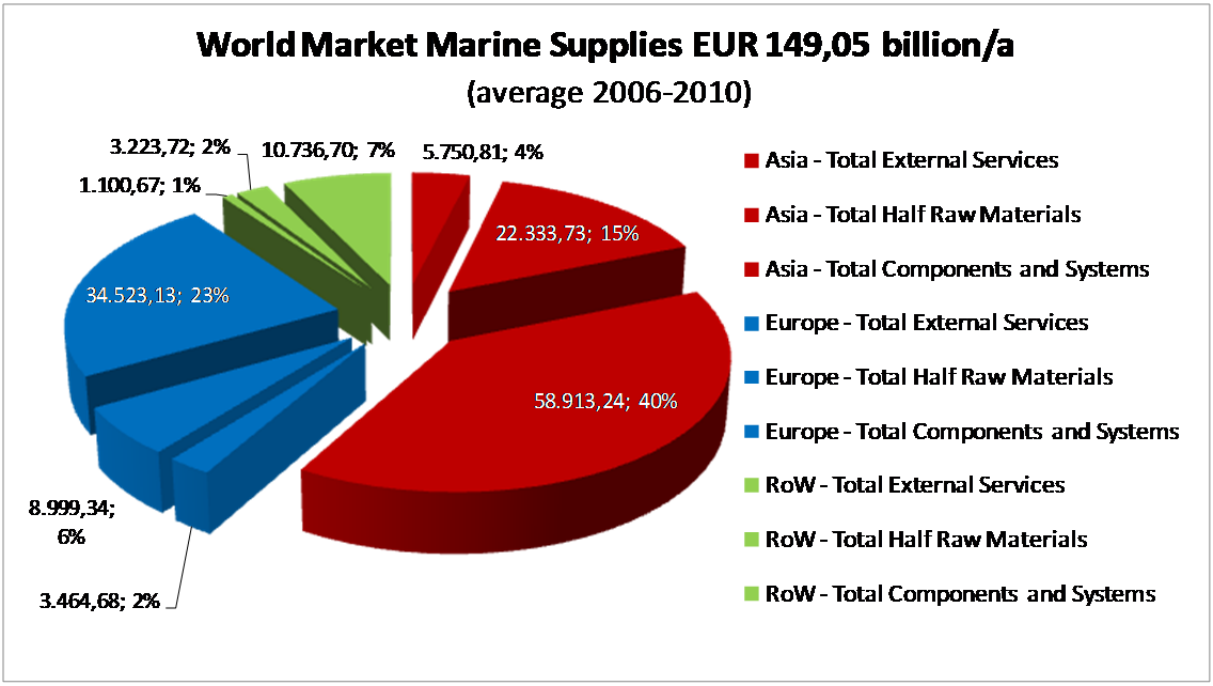


Figure 4: Distribution of the world market for marine supplies into different trades [million EUR]

3.2 European supplies industry - Development over time

For the European Member States a more detailed analysis has been performed. This is possible because the availability of statistical data is much better than for the OECD or even non OECD countries. At first we have collected, combined and where necessary inter- or extrapolated over the period 1995 to 2011. For the years 2008-2011, we had the special difficulty of the transition from the industrial classification system NACE1.1 to NACE 2.0. This created some inconsistencies which have been streamlined also with help of the colleagues from Eurostat. The two figures below *(Figure 5 and Figure 6)* give the development of the production value for shipbuilding boatbuilding and boat/shiprepair for the period 1995 to 2011, in the first figure for EU-15 and in the second figure for EU-28. By comparing the two diagrams, it becomes obvious that the 13 Member States which have joined the EU since 2004 are not necessarily very maritime oriented countries with the exception of Romania, Poland, Croatia and Lithuania. Altogether the 13 Member States add ~5% to the total European production value, but ~25% employment, which proves a low level of wages and also a lower productivity in these countries.

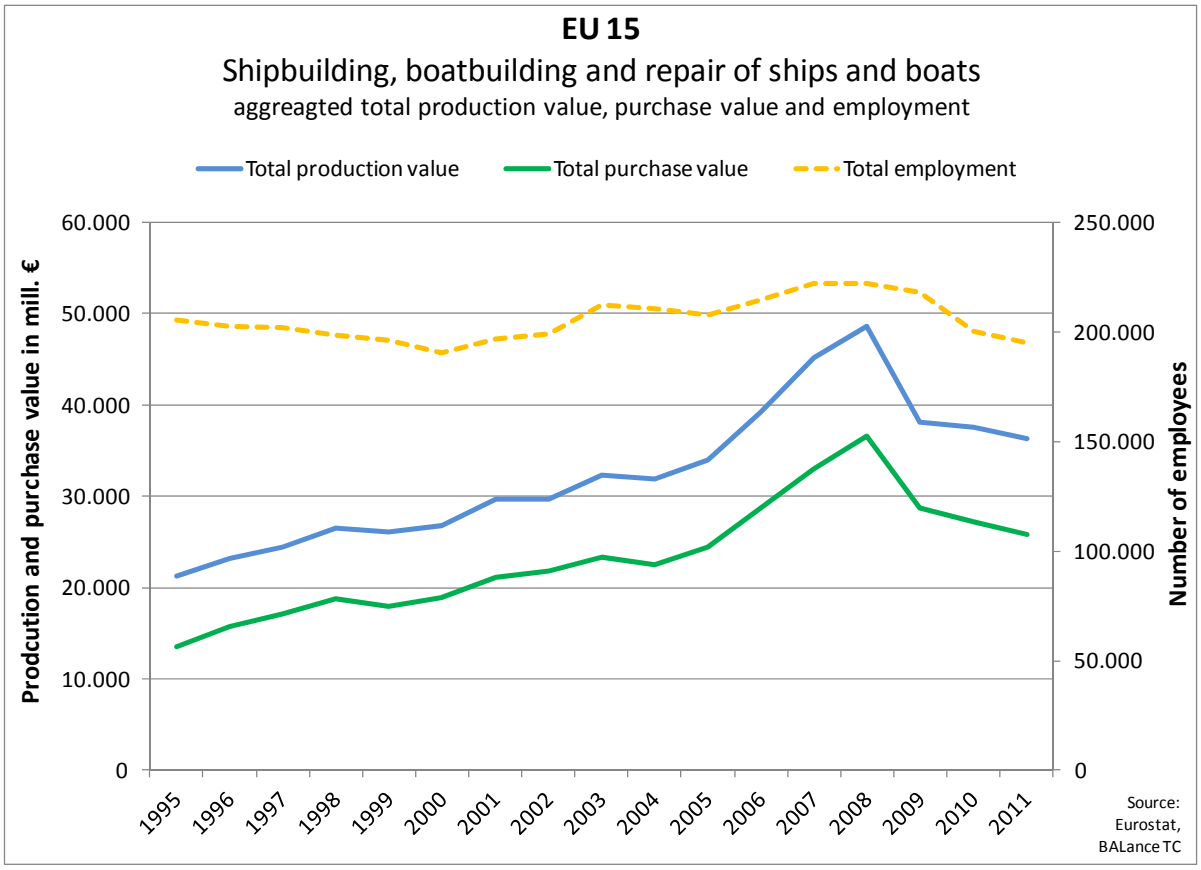


Figure 5: Shipbuilding, Boatbuilding and repair of ships and boats - EU-15, [Sources: (1) BALance TC calculations, 2013]

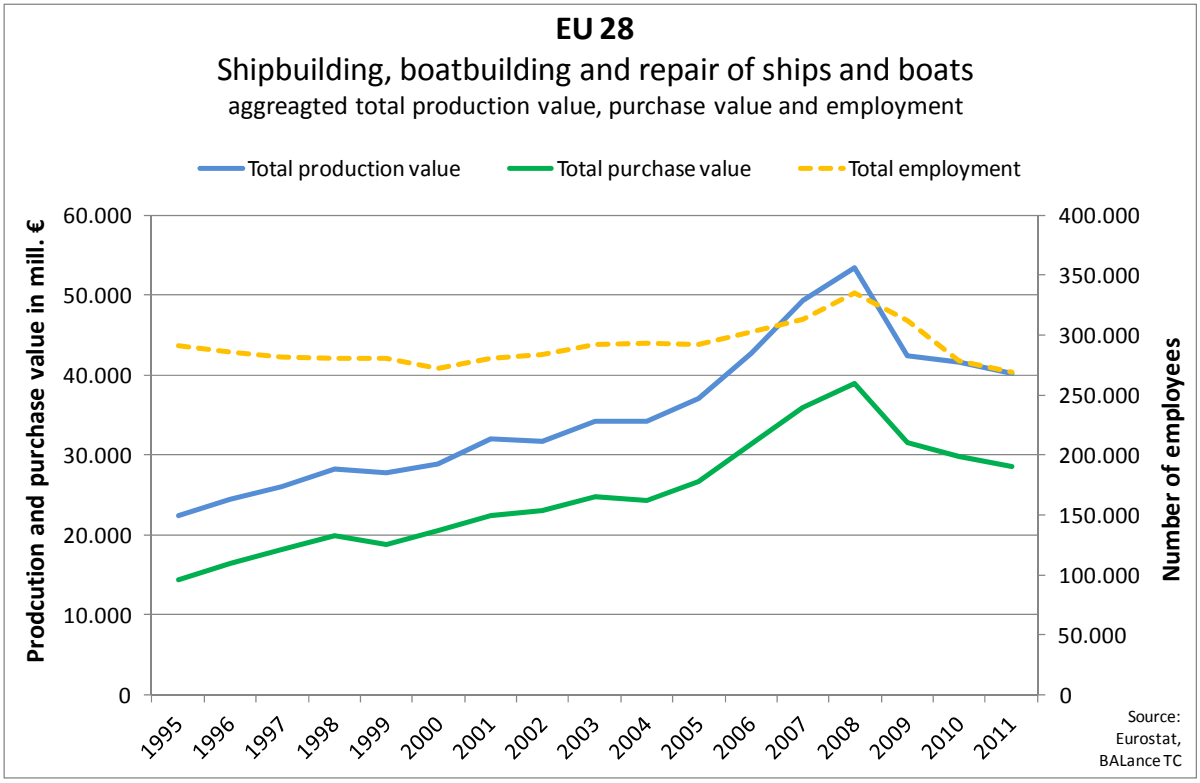


Figure 6: Shipbuilding, boatbuilding and repair of ships and boats - EU-28, [Sources: (1), BALance TC calculations, 2013]

Looking at the development of the ratio of purchasing values and the production values over time, some interesting observations can be made *(Figure 6)*. In the 1990ies, we have seen

major outsourcing strategies by shipyards, which materialised statistically in increasing purchase/production quotients. Since the trends towards more outsourcing at shipyards continued, present levels of total purchasing values arrive at ratios between 70 to 80% with EU, Japan and Korea are at a similar level since 2005. Only the US who have been always higher in adding value to the production, are also now on the way to increase the purchasing values. Outsourcing strategies initially have been followed to reduce cost and to slim down production in shipyards. In the booming years before the financial crisis with increasing shipbuilding activities (2002-2005), purchasing ratios have further increased in order to compensate lack of production capacities. A reverse trend can be clearly seen in figure 6 with decreasing purchasing rations after 2007 due to relatively higher utilisation of own capacities.

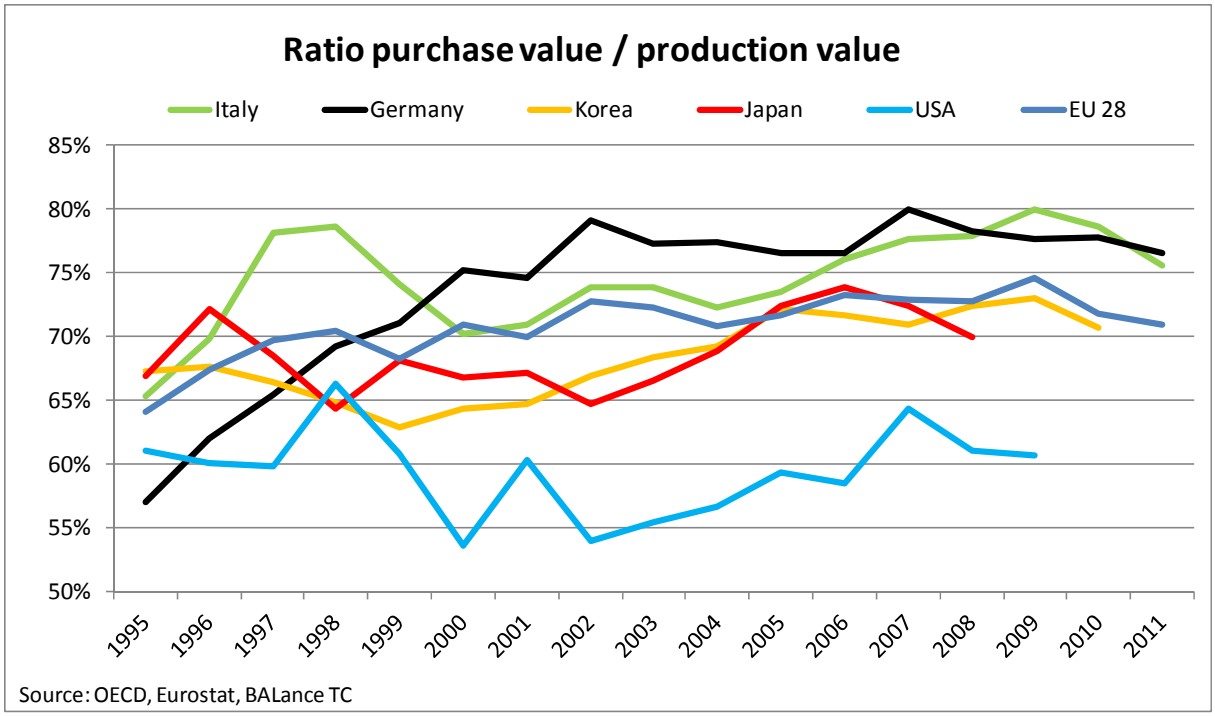


Figure 7: Ratio purchase value / production value, [Source: (2) (1), BALance TC calculations, 2013]

Not surprisingly, the figure for total production and related purchasing volumes peaked in 2008, slightly crossing the 50 billion EUR barrier. However, the post crisis effect of major declines in all of the industry is clearly visible although for 2011 statistical figures are not completely available yet and were to some extent extrapolated. In general the overall production value since 2008 went down by about 26,8% until 2011 and is today at a level of production in 2005/2006. It seems that since then the production volumes are stagnating. Slight signals of improvement suggest that industry has reached the bottom of the downturn.

Limiting the analysis to the purchasing value only as displayed in the following two diagrams we have added the information about the related shares of the different trades shipbuilding, boatbuilding and shiprepair *(Figure 8)* and about the shares of the different countries *(Figure 9)*. After the change of the NACE regime from 2008 onwards, we can see in *Figure 8* that boatbuilding and repair are representing a significant share in purchasing power, namely about 35% of the total.

The second figure gives an idea the distribution of the production value over the European countries. This analysis on country basis is continued in the following chapter and extended to production values of the marine supplies industry.

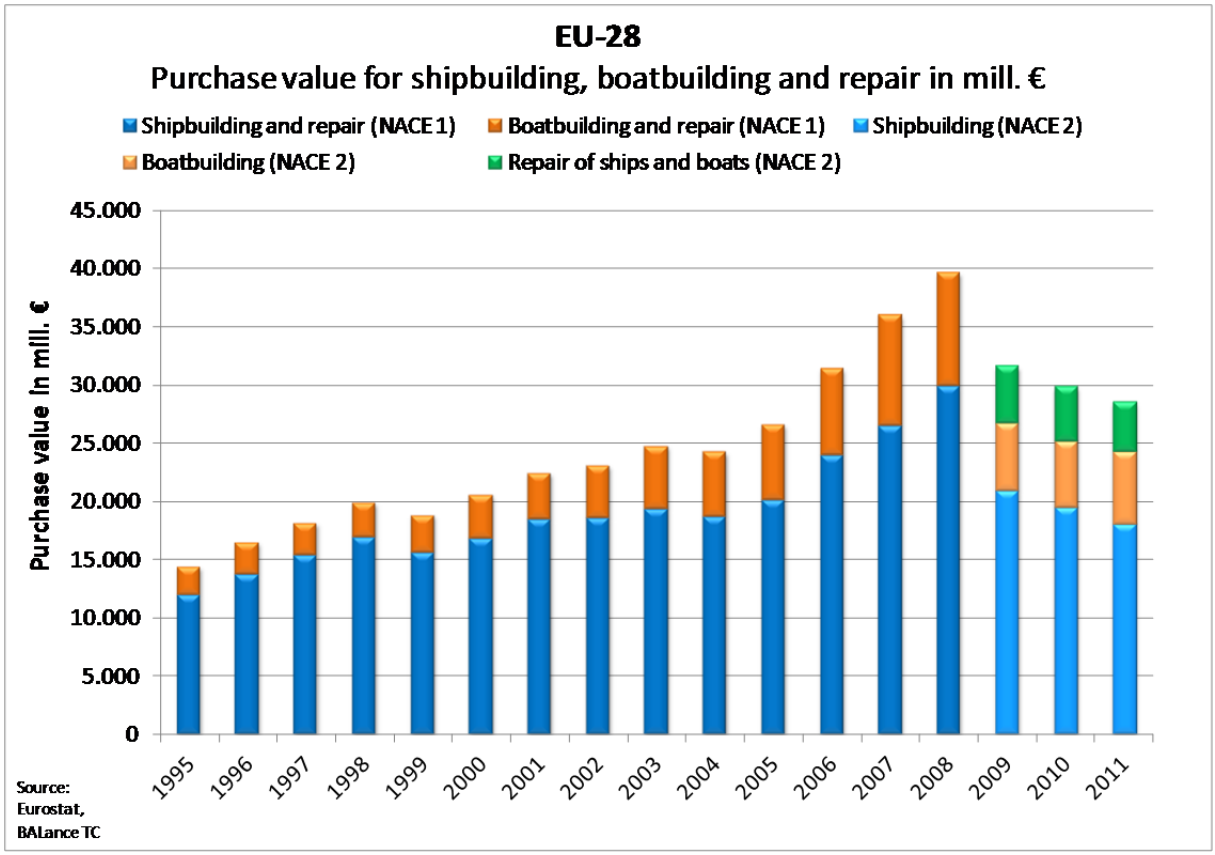


Figure 8: Purchase value for shipping, boating and repair in million EUR (2011 estimates), [Source: (1), BALance TC calculations, 2013]

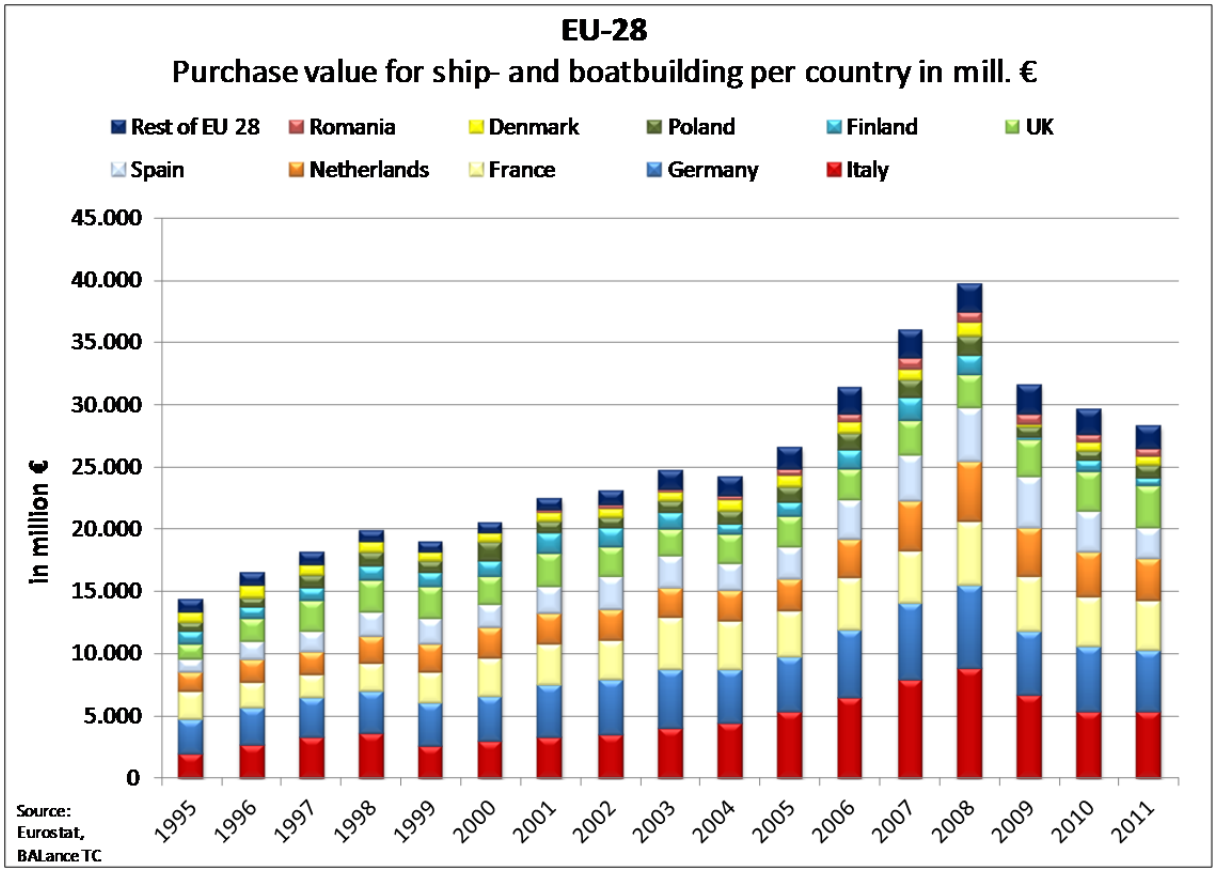


Figure 9: Purchase value for ship- and boatbuilding per country in million EUR (2011 estimates), [Source: (1), BALance TC calculations, 2013]

3.3 European national portfolios of marine supplies industry (average value 2006-2010)

The value of the domestic markets for marine supplies does not necessarily represent the size of the marine supplies industry in the respective countries. For this the figures have been further discussed by means of import/export analysis for the individual countries. Respective information has been taken from the statistical import/export ratios becoming available from Eurostat or national statistical offices. Further information was taken from national studies performed for some of the EU Member States. Altogether this led to the development of so called "National Portfolios" *(Figure 10)*. These national portfolios for the EU Member States, Norway and Turkey are enclosed in Annex 2. In addition to the evaluation of the total production value of the marine supplies industry in the individual Member States the national portfolios contain calculated estimates on the number of persons employed by the industry and the number of enterprises working in the field of marine supplies. Both calculations have been performed by using statistical figures available from Eurostat for the average turnover/employee and the average number of employees per enterprise. It has been assumed that on average companies are having a 50% share of marine related production value. All calculations distinguish between the following 8 categories of marine supplies according to the structure available from input output statistics:

- External Services, Subcontracts (Engineering)
- Material – Steel, Pipes and Non-Ferro Materials
- Material – Coatings
- Goods – Steel Products
- Goods – Engines
- Goods – Mechanical Engineering
- Goods – Electrical Engineering, Electronics
- Goods - Others

It must be noted that due to the given variances of statistical calculations, the accuracy for the national portfolios is most likely, better for those countries with bigger production values than for those which have marginal production values, e.g. Luxembourg and Ireland. Variances may occur through corrections for other markets than the purchasing market of shipyards. Corrections have been made for purchasing by shipping companies and offshore companies directly, which are not included in production values of the shipyards. Further corrections would have been necessary for direct purchasing of the navy for maintenance and repair, but could not be performed due to a lack of data. However, this takes the calculation to the safe side.

Annex 2 shows aggregated portfolios for EU-28 and EU-28 plus Norway and Turkey. Further it has been limited to those country portfolios, which have a visible marine supplies sector, i.e. for the 14 strongest maritime economies in Europe including Norway and Turkey. These overview tables contain information on total production values, size of production for the domestic market and export and calculations on number of employees and enterprises. The Member States portfolios are the result of detailed statistical analysis based on EUROSTAT SBS data, national input/output statistics and own calculations. The following figure shows, how the Member States portfolios appear.

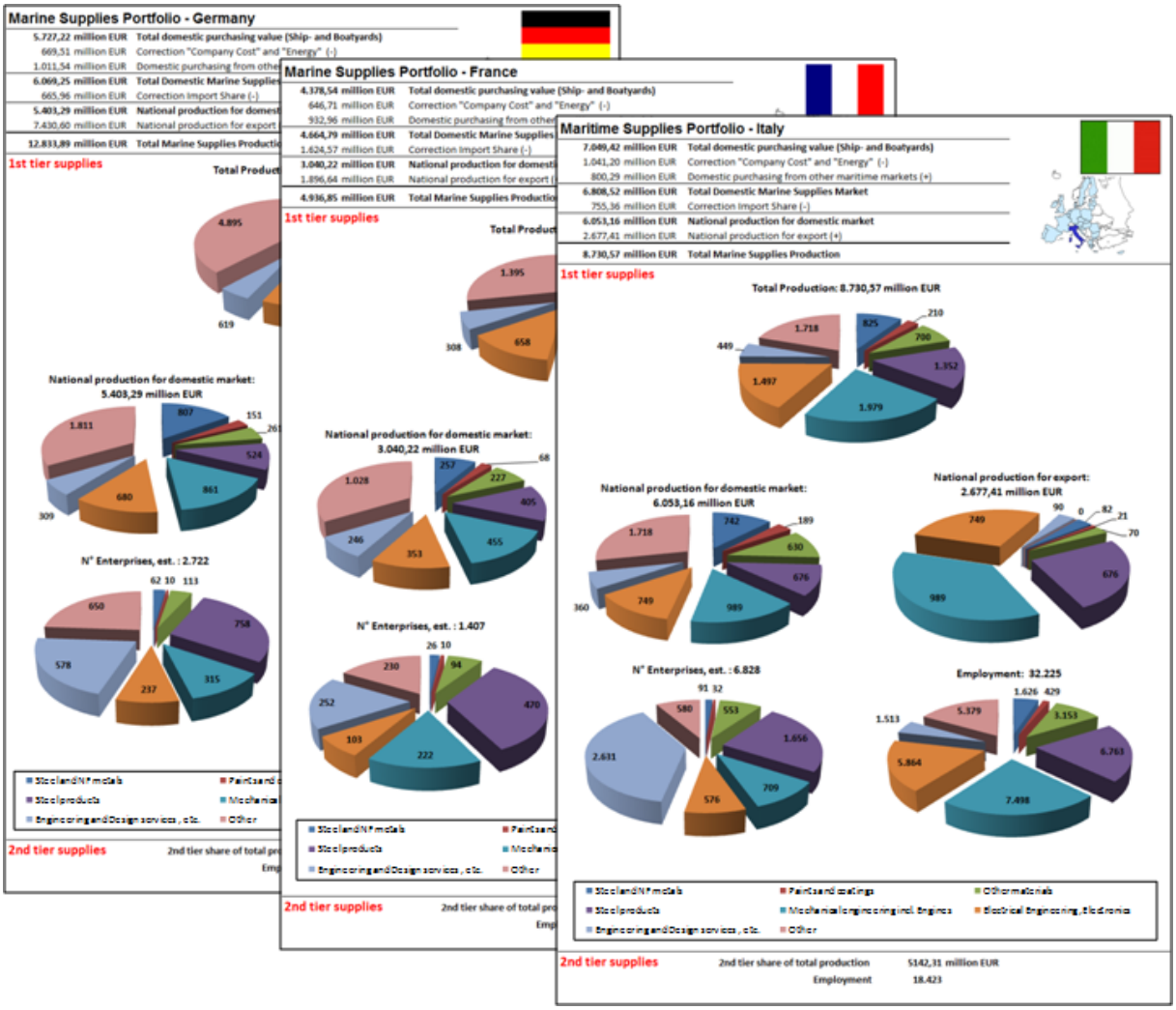


Figure 10: National portfolios (see Annex 2) [BALance TC, 2013]

3.4 Aggregation of European marine supplies industry

The results of the national statistical analysis have been aggregated to an overall European (EU-28) Portfolio *(Figure 11, see also Annex 2)* averaging data for the period 2006-2010. According to this the overall size of the marine supplies industry EU-28 is ~52,5 billion EUR (61,8 billion EUR including Norway and Turkey) per annum. The major shares are taken by the production value for mechanical engineering including engines (18,1%), closely followed by electrical engineering/electronics (13,9%) and steel products (11,3%). The total export value is 24,2 billion EUR of which 17,6 billion EUR are exported to extra EU-28 countries which represents ~33,6% of the total production value.

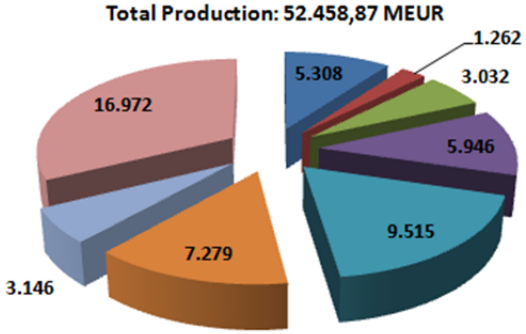
A portfolio representing EU-28 plus Norway and Turkey has been created and can be found in Annex 2.

Marine Supplies Portfolio - EU-28

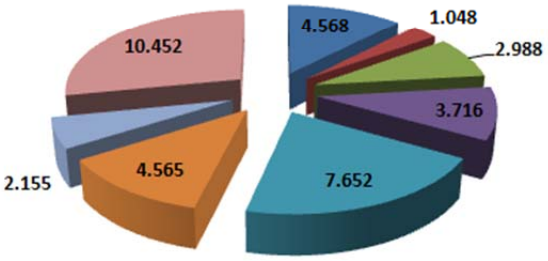
34.699,35	MEUR	**Summary total domestic purchasing value (Ship- and Boatyards)**
5.035,01	MEUR	Correction "Company Cost" and "Energy" (-)
7.479,64	MEUR	Summary domestic purchasing from other maritime markets (+)
37.143,98	**MEUR**	**Total Domestic Marine Supplies Market**
8.857,55	MEUR	Summary of import shares
		(Thereof share of intra-EU imports: 6.583,50 MEUR) (-)
28.286,43	**MEUR**	**Summary of national production for domestic market**
24.172,43	MEUR	Summary of national production for export
		(thereof share of intra-EU exports: 6.583,50 MEUR) (+)
52.458,87	MEUR	**Total Marine Supplies Production**

1st tier supplies

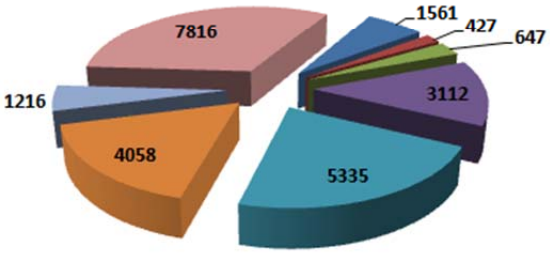
Total Production: 52.458,87 MEUR



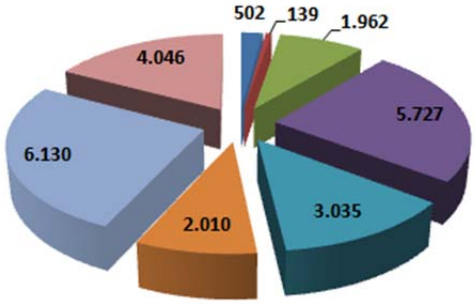
Summary of national production for domestic markets: 28.286,43 MEUR



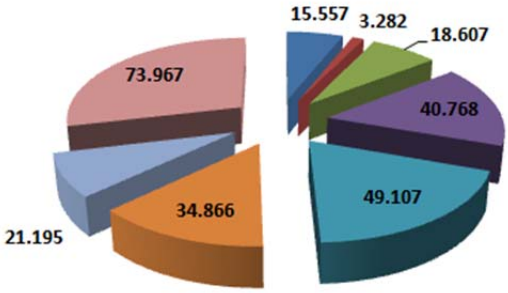
Summary of national production for export: 24.172,43 MEUR Including intra-EU export: 6.583,50 MEUR)



N° Enterprises: 23.552



Employment: 257.348



- Steel and NF metals
- Paints and coatings
- Other materials
- Steel products
- Mechanical engineering incl. Engines
- Electrical Engineering, Electronics
- Engineering and Design services, etc.
- Other

2nd tier supplies

2nd tier share of total production	30898,27	MEURO
Employment	132.499	

Figure 11: Aggregated member states portfolios EU-28, [Source: (1) and BALance TC calculations 2013]

The following figures give an overview of the main results from the statistical analysis.

Production value:

The total production value for EU-28 plus Norway and Turkey (1st tier supplies) adds up to 61,8 billion EUR. Germany with about 12,8 billion EUR is the biggest producer representing 21% of the EU-28 plus Norway and Turkey industry. Italy and Norway are following closely with 8,7 billion EUR and 8,0 billion EUR representing 14,5% and 13,3% of the total. These three are followed by UK, Netherlands, France and Spain, who represent the midfield of marine supplies industry in Europe. Since the total production volumes are initially based on the combined purchasing volumes of shipbuilding, boatbuilding and repair in both sectors, it need to be said that Italy is home of the biggest boatbuilding industry in Europe with a share of about 28% of their production value, whereas Netherlands and France are in the range of 24%-27% and Germany has a share of 18,7% in that sector.

Another note has to be made on those European countries which do not have any market in shipbuilding, boatbuilding and repair or have seen a major decline in the last 15 years. These countries are probably not or not adequately considered in this evaluation. This is a consequence of the approach chosen. Wherever other data, e.g. from associations have been available, appropriate corrections have been made in order to level the data of those countries to a comparable level. For some countries, especially landlocked countries like Czech Republic, no appropriate data could be found for the time being. Therefore, these countries might be undervalued.

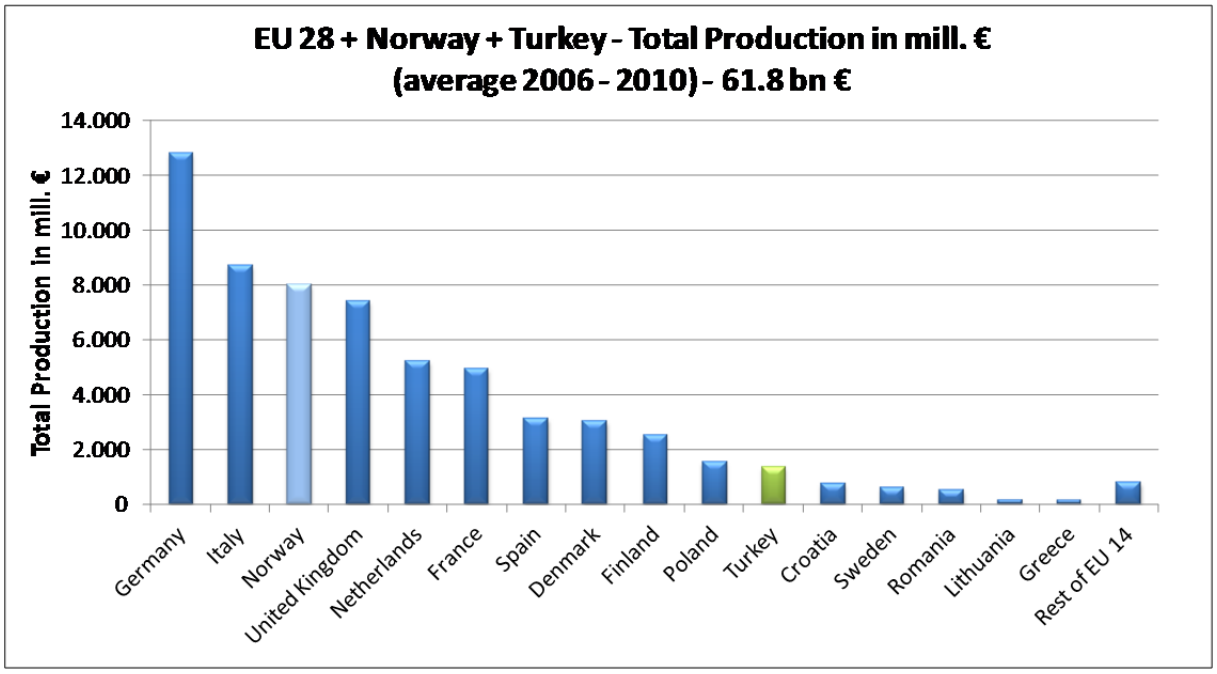


Figure 12: EU-28 - Production value in million EUR (average 2006-2010) [Source: (1), BALance TC calculations, 2013]

Export value:

The total marine supplies production for export (27,43 billion EUR) represents about 44,4% of the total EU-28 incl. Norway and Turkey production. Basically the same ranking appears for export values as a share of the production value. Germany again is the leader of the EU-28 countries with a high export share. UK, Norway, Italy, Netherlands, Denmark and France as followers show already significantly lower absolute values for export. These export values include also the export data into the EU-28 plus Norway and Turkey countries, i.e. the intra-European trade. Based on average statistical figures it has been calculated that this intra-European trade is in the range of more than 8 billion EUR, about 1/3 of the total export volume of 27,43 billion EUR for EU-28 plus Norway and Turkey, This on the other hand

means that about 19 billion EUR goes into international export (ex EU-28, Norway and Turkey) representing in average about 33% of European marine supplies production. However, the statistical basis for this is vague.

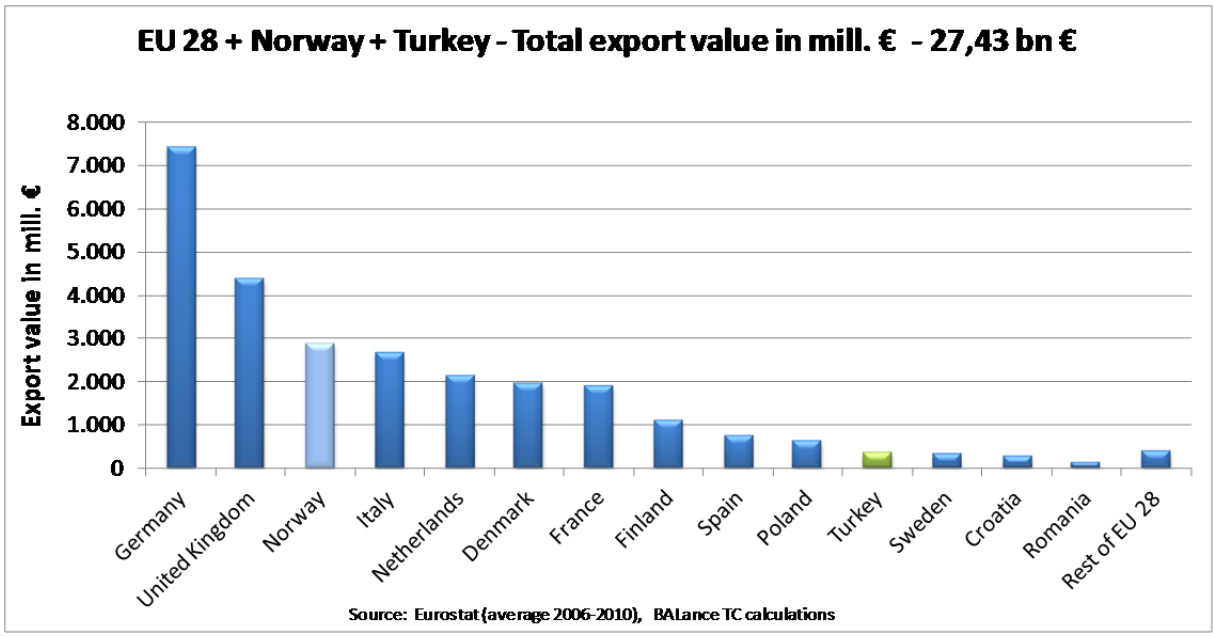


Figure 13: EU-28 - Export value in million EUR (average 2006-2010) [Source: (1), BALance TC calculations, 2013]

Employment:

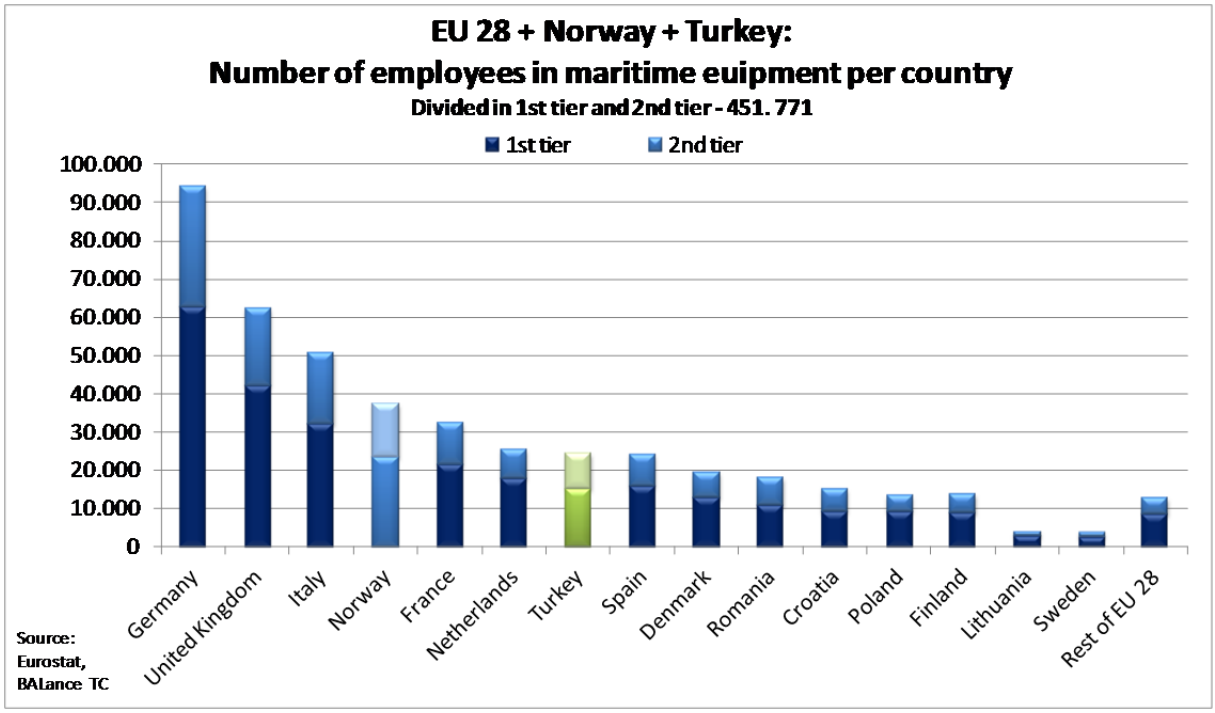


Figure 14: Number of employees in marine supplies per country (1st and 2nd tier) [BALance TC calculations, 2013]

European employment has been calculated on two levels. First of all the employment of 1st tier suppliers, which are directly dealing with the final producers, i.e. shipyards, boatyards etc. and secondly 2nd tier suppliers, which are acting as sub-suppliers. Employment for 1st tier suppliers only is summing up to 296.082 persons (full time equivalents). We can add to this number another 155.689 employees for the 2nd tier supplier which leads to a total employment of the marine supplies industry in EU-28 plus Norway and Turkey of 451.771

persons (full time equivalents) as average figure for the period 2006-2010 (Figure 13). For EU-28 alone, we calculate a total employment for that period of 257.348 persons (full time equivalents 1st tier) and 389.847 persons (1st and 2nd tier). These figures include employment from different sizes of companies which also have different coverage of marine products and services in their portfolio.

Number of enterprises:

The number of companies for the marine supplies industry has been calculated on the basis of the production values and by employing statistical figures on average employment per company, country and trade. This leads to a total number of 29.078 enterprises as 1st tier suppliers involved in the marine industry supply chain in EU-28 plus Norway and Turkey. The analysis on a country basis came to the unexpected result that Italy is far leading the European ranking on number of companies. With little less than 7.000 companies, Italy has double the number than the following countries Norway, United Kingdom and Germany with about 3.000 companies each (Figure 14). The high figure for Italy can be explained by the high share of boatbuilding in the Italian production portfolio. Many very small firms are involved in this industry sector. In addition it is a general feature of the Italian industry structure that the average number of employees per enterprise is very low compared to other EU-28 countries, which also contributes to the calculation of these very high figures.

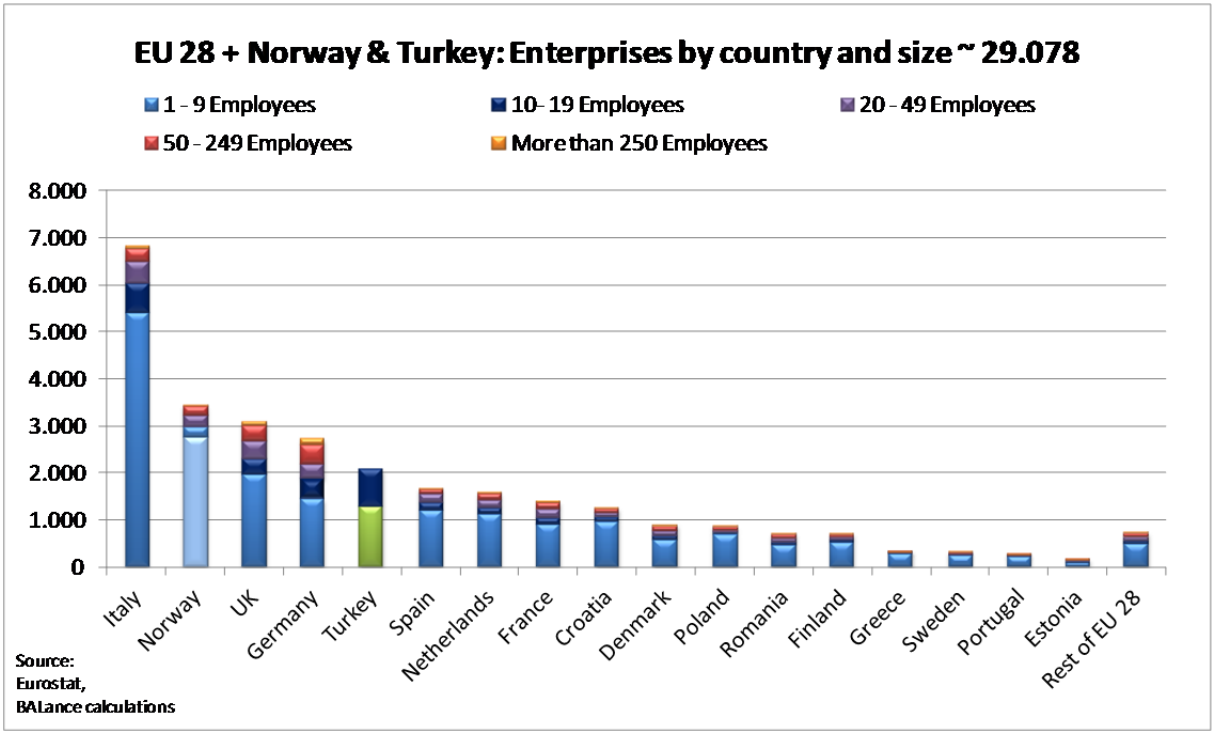


Figure 15: EU-28 number of enterprises per country and size, tier 1 [Source: (1), BALance TC calculations, 2013]

A calculation of the number of companies for the 2nd tier suppliers in the supply chain has been performed, but is in the opinion of the authors not meaningful. This is due to the fact that 1st tier suppliers very often also act as 2nd tier suppliers and vice versa. Therefore these figures have not been taken into account. The figure of 29.078 enterprises is therefore regarded as the overall total number of marine supplies companies which includes companies of very different sizes. In particular those with 1-9 employees contribute to the high total as presented. It has been therefore proposed to deduct the number companies with 1-9 employees in order to get an idea on the number of companies in the marine supplies industry in the narrower sense (Figure 15).

As a result of this analysis, we get a total of about 8.380 companies in EU-28 including Norway and Turkey, which seems to be a reasonable estimate of companies being truly involved in marine supply chains. With a view to another analysis in the following chapter,

which counts the number of European companies in marine supplies businesses to 6.553 enterprises on the basis of approvals with classification societies, the figure above is basically confirmed.

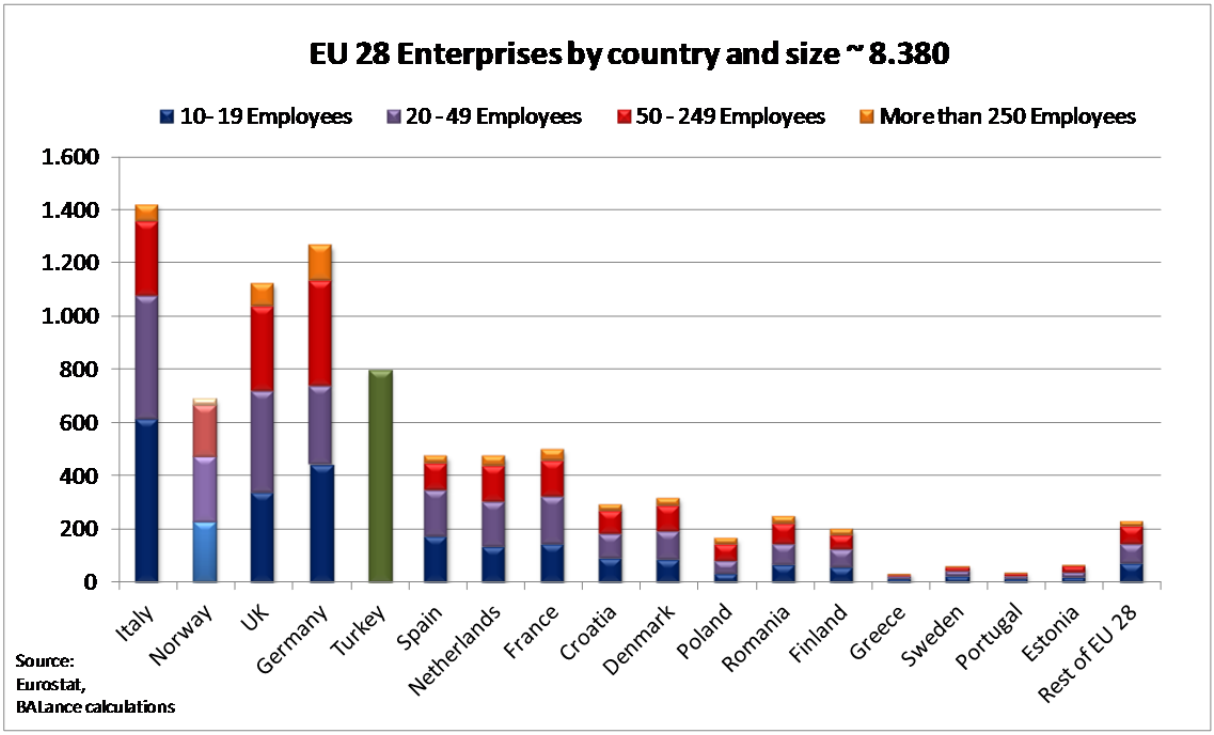


Figure 16: EU-28 Number of enterprises per country and size, tier 1 without companies with 1-9 employees [Source: (1), BALance TC calculations, 2013]

3.5 World company count based on class approvals

To learn more about the industry and as a benchmark for these statistically derived figures for the number of companies involved in marine supplies, the project team has performed an analysis of approvals for products received by companies from all major classification societies and approval bodies. The result of the analysis is built on more than 130.000 datasets on approvals from ABS, BV, ClassNK, DNV, GL, KR, LR, RINA, BSH, BG, USCG and more than 20 other smaller approval bodies.

On this basis, we identified about 11.495 different companies from 73 countries, which possess one or more type approval with one or more approval body. Europe as a whole is represented by almost 57% of these companies (EU-28 – 51%). Asia is represented by 31% of the companies and the Americas and the rest of the world by 12% *(Figure 17)*.

On a country basis it appears that the top ten countries represent about 75% of the total number of marine supplies companies worldwide (owning a product approval). Under the top ten countries we find 6 from Europe, namely Germany, Italy, United Kingdom, France, Norway and the Netherlands. Following this approach, the total number of companies from EU-28 is 5.905. Following the statistical analysis as outlined above, we calculate for EU-28 about 23.000 companies of which about 7.000 are companies with less than 10 employees. This in the view of the authors show that the 5905 companies identified by the “approval analysis” represent the system and equipment suppliers in the narrower sense, whereas the other companies represent a wide range of in majority very small companies which provide all kinds of supply services and products, which do not require any approval. As we have also already discussed for the statistical data, a large number of the very small companies are from Italy and a large number of companies without type approvals are coming from Romania. These two examples show in the view of the authors that most companies in these

countries are working in more labour intensive subcontracts and services which also do not require any approval.

On the international level it shows the strong position of China, Korea, Japan and also the United States in the number of companies with approved products. For Japan and the US this is actually the situation since a long time due to a strong market position in shipbuilding and in the offshore industry respectively. For China and Korea to be number 1 and number 3 in this list, the position has developed in the last 5 to 10 years only. As we will see below, while discussing the importance of type approvals in more detail, these two countries show three digit growth rates in the number of certificates. Although this is not automatically generating a similar market share, it shows the strategic attempt in these countries to gain a higher market share and more local content.

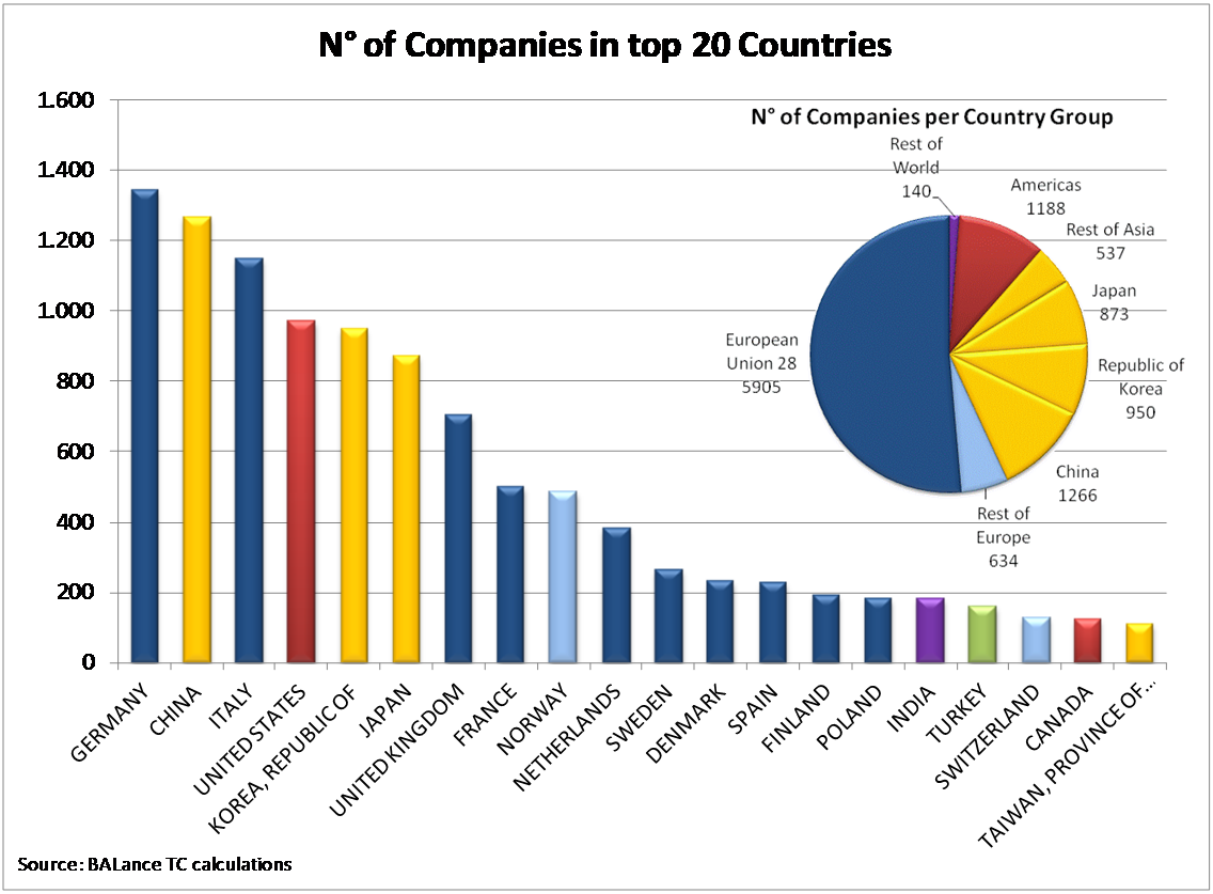


Figure 17: Number of companies in top 20 countries, [BALance TC calculations, 2013]

Another aspect, which proves this thesis, can be shown in the following diagram *(Figure 18)*, which indicates the number of companies which have one or more approvals with only one approval body and the number of companies which have one or more approvals with several approval bodies. This is an indicator for companies who are active in more than one market and provides an idea on the number of companies which are potentially also more active in export. This is especially true for China, Republic of Korea, Germany and Japan in the first place and US, Italy, UK, Norway and the Netherlands as followers. The question is whether or not this indicator is really of value for the future, because there is a trend towards more mutual recognition agreements, which makes it less necessary to apply for multiple certificates with different approval bodies. The trend can in particular be seen in Europe where the Marine Equipment Directive provides a framework for mutual recognition of more than 180 product items for application on all European flagged vessels. An additional Mutual Recognition Agreement (MRA) with the US and further political pressure towards more mutual recognition of class approved equipment will change this situation further.

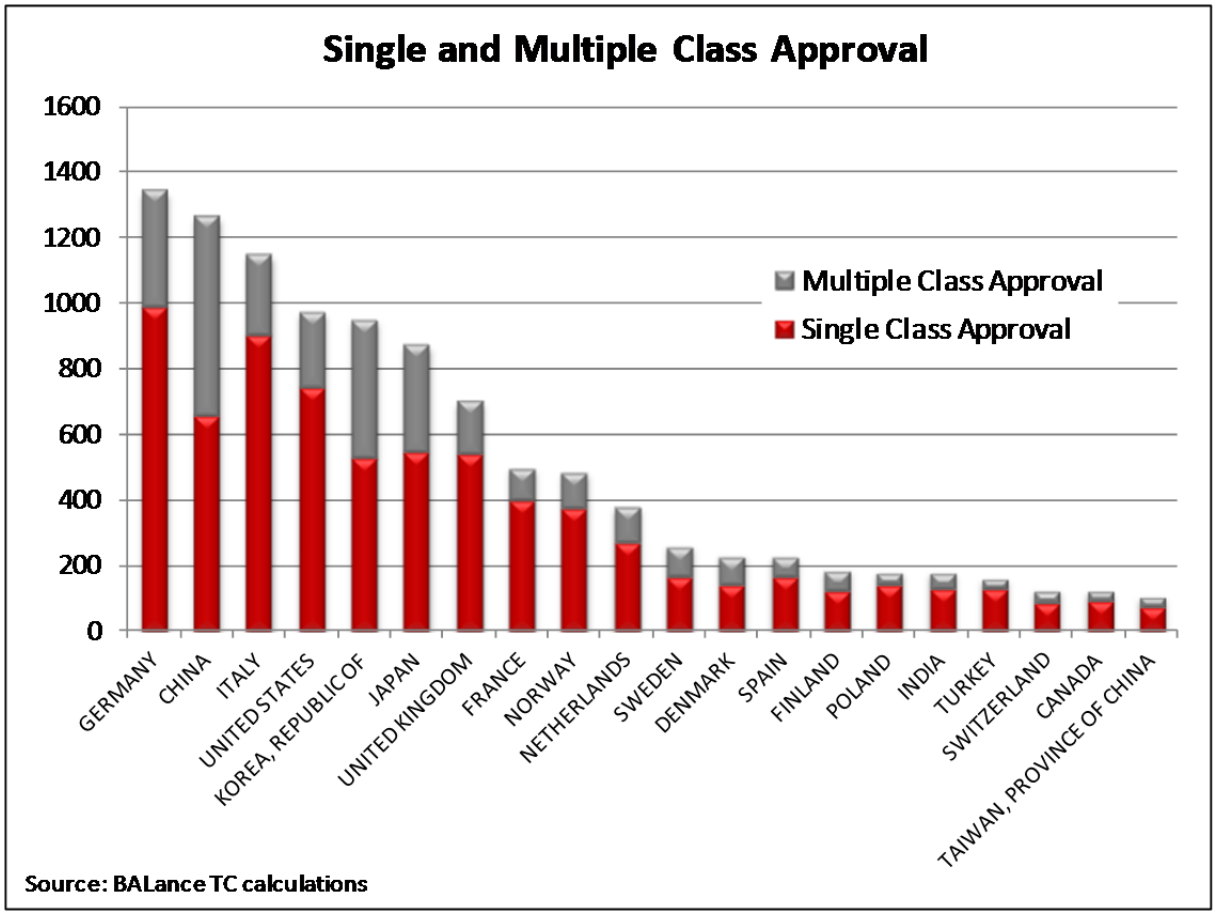


Figure 18: Companies with single and multiple class approvals by Country - Top 20 Countries, [BALance TC calculations, 2013]

4 Marine supplies industry – Current situation and recent developments

The development in the years after the financial crisis has seen a constant decline in production values of the ship-and boatbuilding industries and with this a directly related decline in purchase values and employment. Against the statistical peak figures for 2008, the purchasing volume of the industry in total (shipbuilding, boatbuilding, repair) has declined in 2011 by 27% and employment went down by about 18% in ship/boatbuilding and repair and about 24% in the marine supplies industry. See the figures below.

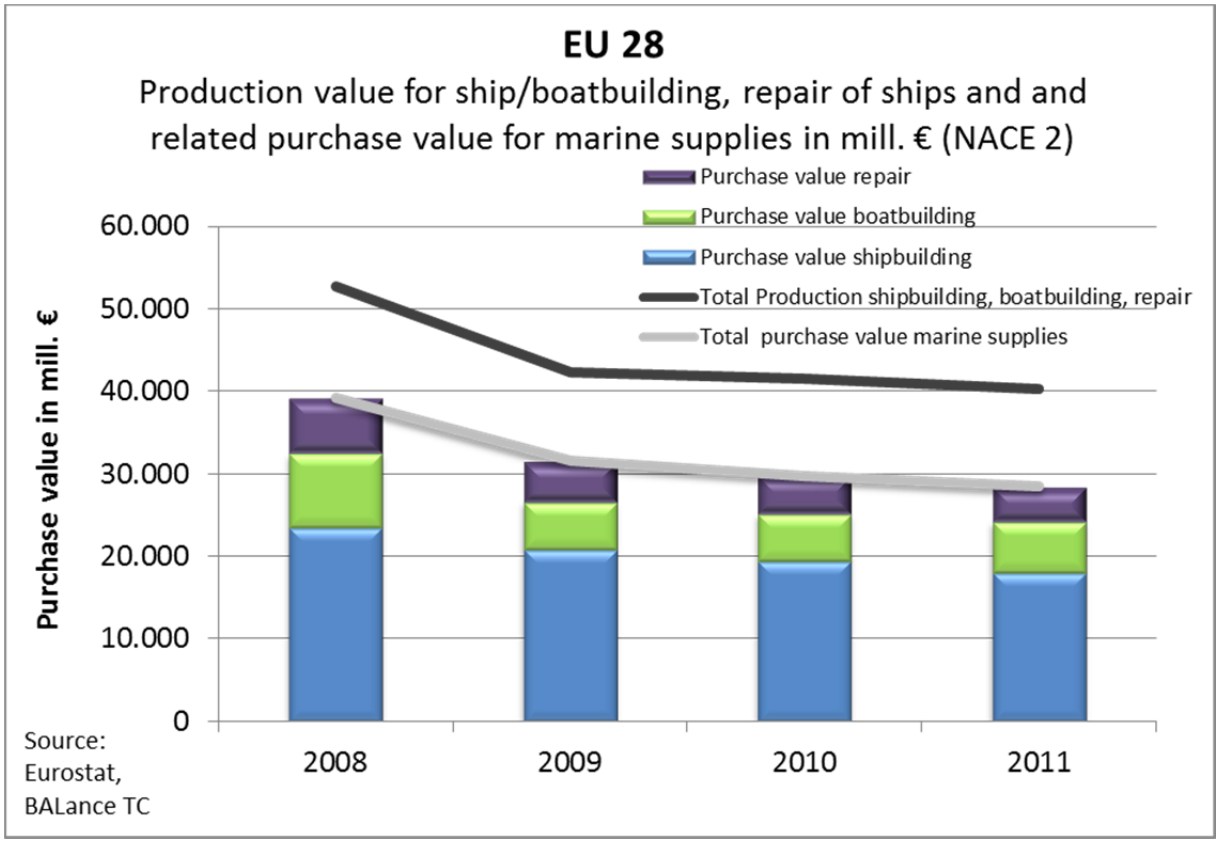


Figure 19: Production value for ship/boatbuilding, repair of ships and related purchase value for marine supplies in mill. € (NACE 2), [Source: (1) , BALance TC calculations, 2013]

The different maritime sectors did not contribute to this development in the same way. Purchasing volumes in shipbuilding declined by ~23%%, in boatbuilding by 31% and in ship and boat repair by 36%. The relatively smaller decline in shipbuilding can be probably explained by increased insourcing of activities by shipyards to the account of supplies.

Employment in ship/boatbuilding and repair in EU-28 has declined relatively less by ~18% to about 270.000, but normally is following declines in production values at a slower pace. Total reduction of employment in the marine supplies sector based on the reduced European purchasing values and dynamic export values has been calculated to ~24% and consequently to a total of 342.000 employees for EU-28 in 2011. Again, we have the impression here that the sector has not been affected equally, but subcontractors and suppliers serving regional demand are hit much harder than global playing suppliers. The latter ones may have compensated the negative trend by serving other marine markets (e.g. offshore) or by increasing export shares.

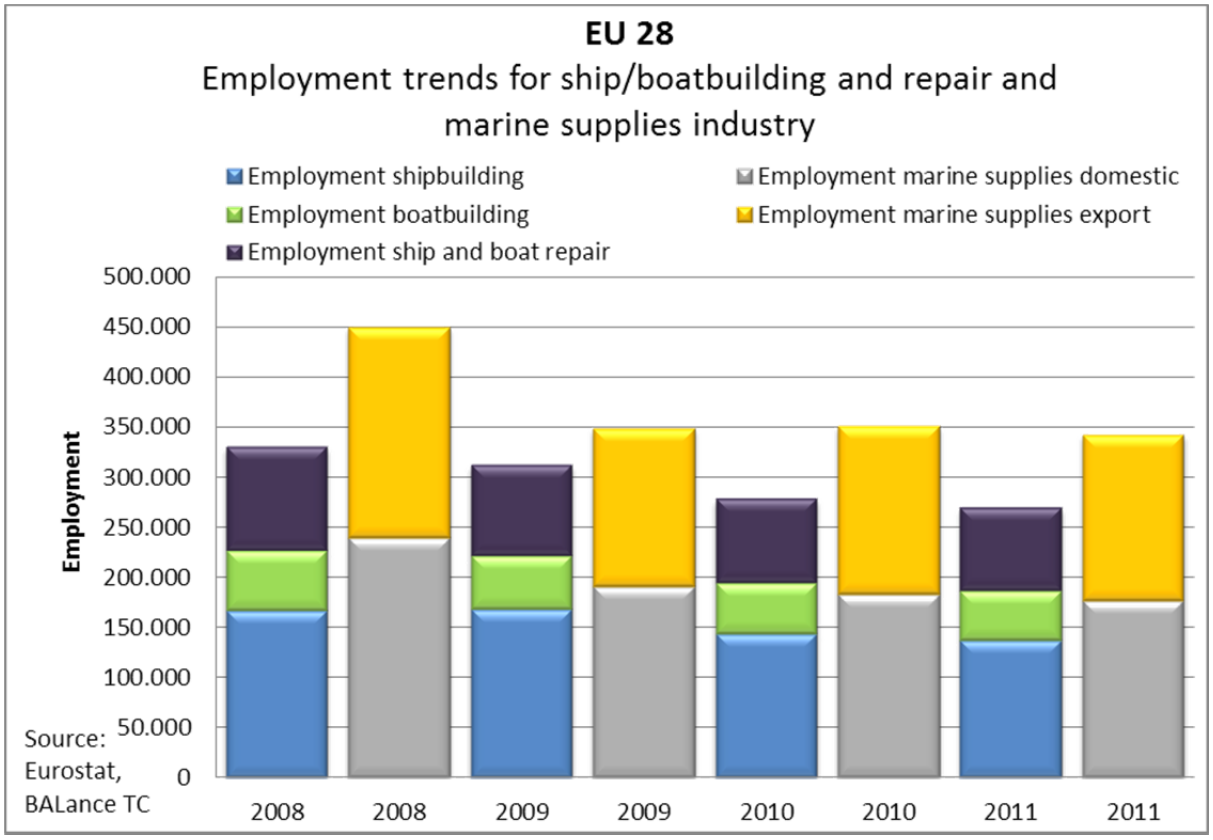


Figure 20: Employment trends for ship/boatbuilding/ repair and marine supplies industry (including export production), [Source: (1), BALance TC calculations, 2013]

Also, the economic development did not affect maritime businesses in the European countries in the same way. As can be seen in the following figures for eight selected countries, some have been hit harder by the crisis than others. Some even managed to maintain their level of 2008 production or even marginally increased production and related purchasing volumes.

According to the given figures Finland has been hit hardest by the crisis seeing an average decline of the production by an average of 25% annually according to a trend analysis over the period of the 4 years 2008-2011. This is followed by Spain, Italy Norway, Germany with an average declines of 9-15%, but on a higher absolute level of production. These economies are most affected by the crisis in merchant shipbuilding, where standard shiptype almost completely disappeared from the orderbook. Following this development the situation in Finland and Spain has become critical, because the production volume of the maritime industry as a whole has reached a very low level.

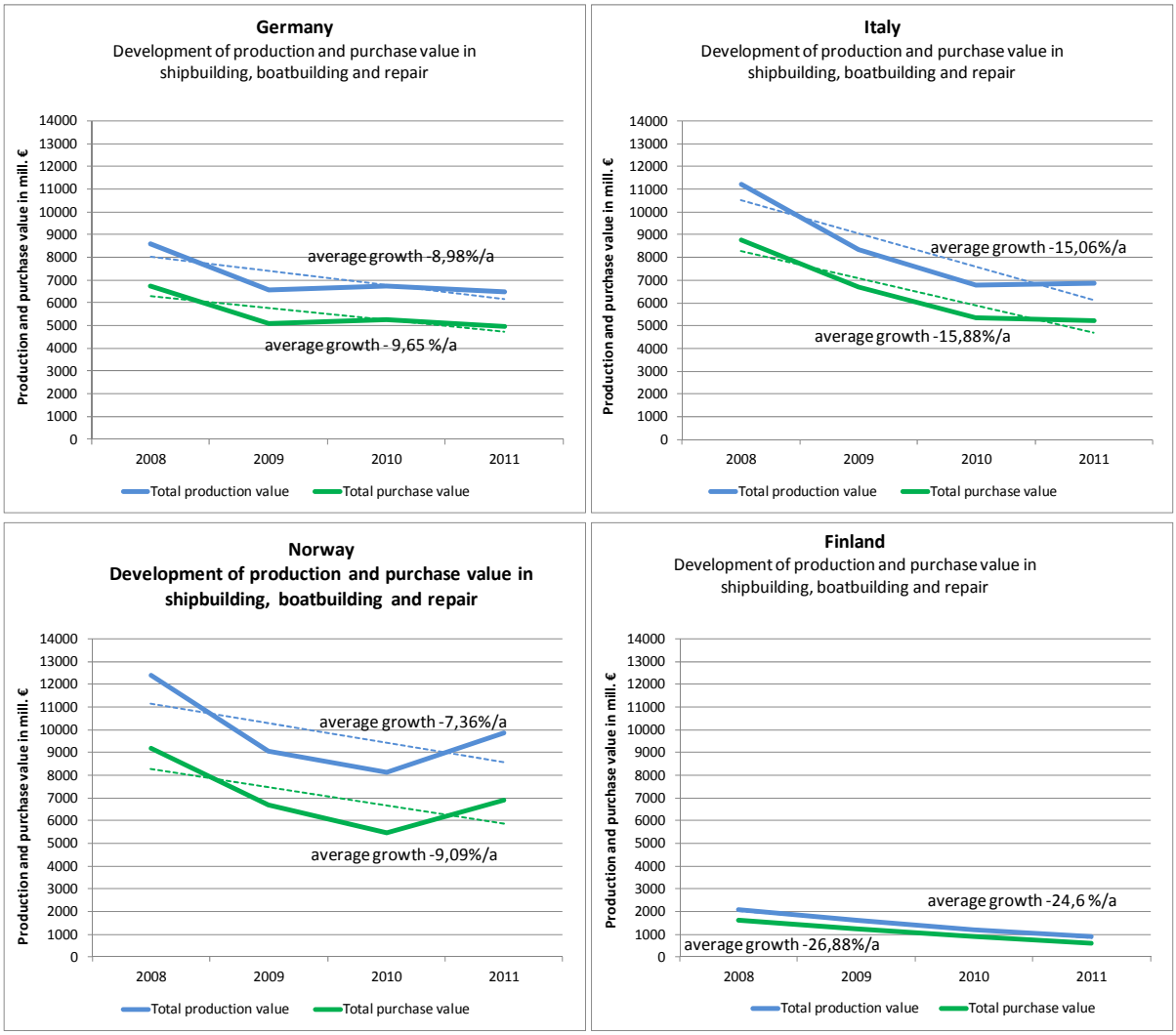


Figure 21: Development of production and purchase value in shipbuilding, boatbuilding and repair Germany, Italy, Norway, Finland [Source: (1), BALance TC calculations, 2013]

On the other hand, France and The Netherlands show relative moderate shrinkage of production over the period, whereas United Kingdom even realised positive growth. In the view of the authors this can be seen in the fact that UK figures likely are not affected by any decline in merchant shipbuilding, but industry concentrates on naval shipbuilding, offshore structures and repair. For Netherlands we can assume that the concentration on small ships (including yachts) and on specialised vessels (e.g. dredgers, offshore) has positive effects against the trend. However, the statistical figures in general also show for the end of the period that negative growth has been stopped for some countries or even developed some positive trends.

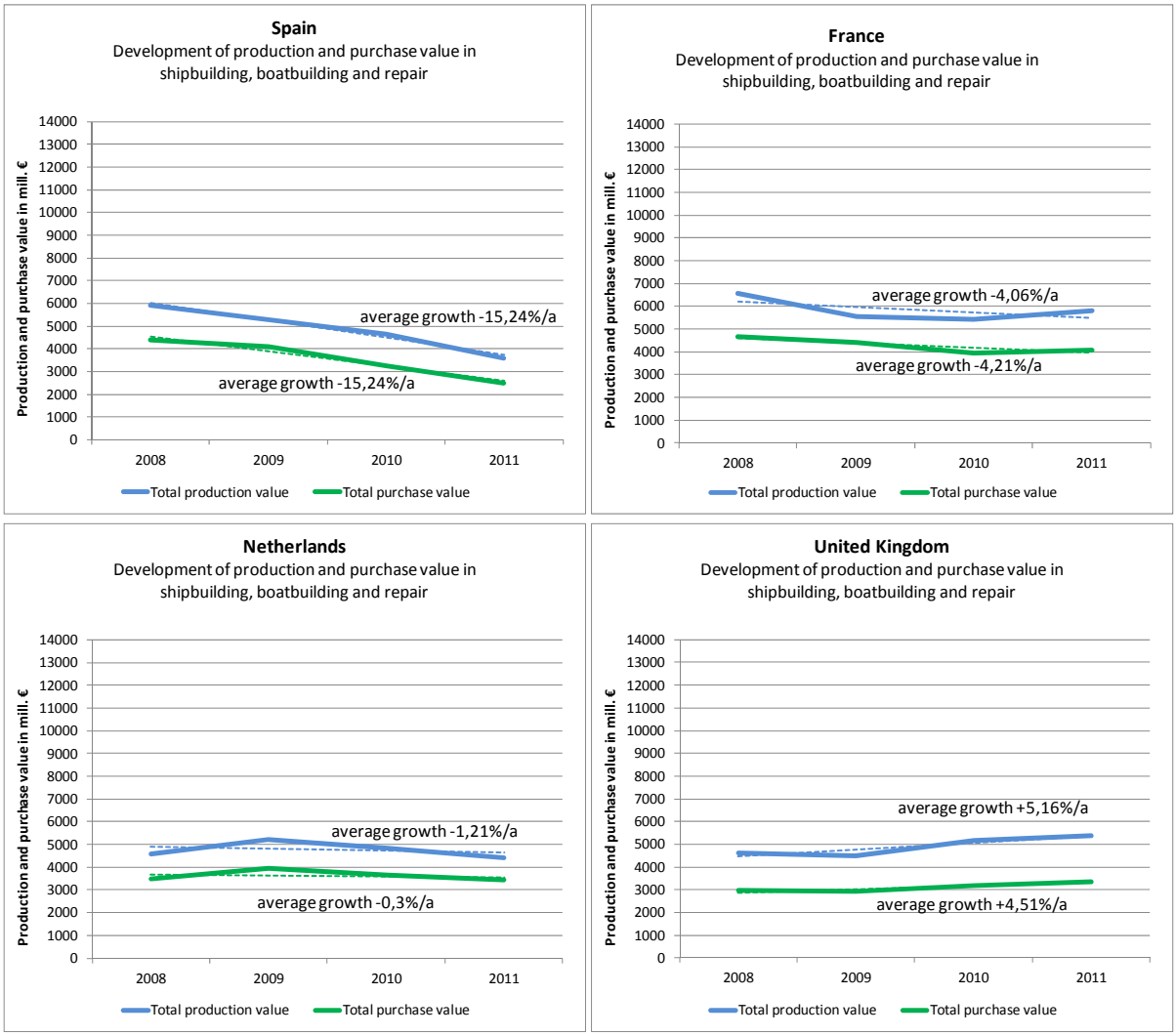


Figure 22: Development of production and purchase value in shipbuilding, boatbuilding and repair Spain; France, Netherlands, United Kingdom, [Source: (1), BALance TC calculations, 2013]

4.1 Recent general trends in marine markets

The decline of the European marine supplies industry in the last 5 years is caused by developments in the different maritime markets. Not all of these are negative, but new chances have come up, which need careful consideration. First it is of course the ship newbuilding market which has seen a dramatic decline in terms of large standard vessels. The portfolio of the orderbook has entirely changed from steel intensive standard ships to smaller, outfitting intensive complex vessels (see the shipbuilding forecast in the next chapter). The major share of the orderbook (33%) is made by offshore ships, where again the majority of ships is built in Asia. Ship repair business has suffered from the slow growth in maritime transport and financial difficulties of the shipping companies. Further, many new ships are coming on the market with a low level of repair demand and presently we see a lot of breaking of ships, which also affects younger ships, due to the increasing overcapacity for some shiptypes. Retrofitting has been identified as a promising market with high potential. This is following new regulations on energy efficiency of ships and emission reduction regulations, but the markets are emerging very slowly and perhaps not early enough to make a substantial contribution to the revitalisation of the industry in the near future. In times of financial crisis also the navy business has suffered and projects have been postponed or sustained. Since the problems also arrived in the private sector, the consumer oriented boatbuilding industry has been hit very hard and has seen declines of about 50%. Hope

again was created by the offshore industries, where in oil & gas the development of new fields in more demanding environments has picked up. In fact this industry is presently driving the market development. This is also true for the offshore wind industry, where in some European countries (UK, Germany, Denmark, Netherlands) the development pace seems to be high. However, all this is very vulnerable and depends on the further development of the world economy (especially emerging economies), the level of the oil price and willingness of countries to work on an energy change and towards more environmental friendly technologies.

How does this situation affect the suppliers as such? After the general decline of new orders, from the year 2009 onwards the industry posted a slight growth in sales in 2011 and an upturn in incoming orders. But the situation in the marine supplies industry is mixed: While some companies reported growth in 2011 and 2012, other suppliers still suffered sales declines. Particularly suppliers with great dependence on ship newbuilding business and certain ship types were affected by the sales declines. On the other hand, more broadly based supplier companies and especially offshore suppliers could benefit from the growth of these markets.

The sector expects to see a slow but steady recovery in the overall order situation, but for merchant shipbuilding the next few years will remain difficult. At the same time global competition is intensifying, also from ship suppliers in other regions in the world. Another important market in the future will remain the offshore equipment supplies in the oil and gas market with further expected considerable growths rates. In addition the middle to long-term development of the global offshore wind market will create further potential sales especially regarding the European suppliers.

Emerging shipbuilding states are forging ahead in the wake of the top three Asian shipbuilding countries China, South Korea and Japan. They include Brazil and Russia, where growth is based on demand from the oil and gas segment. A further focus of European marine suppliers is the energy- and cost-saving and at the same time environment-friendly operation of ships and also offshore plants.

The marine supplies industry comprises all products, systems and services supplied for the building, service and maintenance of ships, and offshore structures. Following the company count in the previous chapter, the shipbuilding and offshore (oil & gas, offshore wind, other offshore renewables) supplier industry in Europe includes about 7.000 companies, the vast majority of which are small and medium-sized enterprises. Whereas the export rate of individual EU countries vary from 20 – 70%, the export share of all EU-28 countries combined to countries outside EU-28 is calculated to about 33% of the total production value.

The following table gives an overview on 125 selected European companies, country of headquarters and the sectors of maritime supplies in which they are active. These major European maritime supply companies together represent an estimated average maritime sales volume of 41-43 billion EUR per year, corresponding to a market share of about 40% of the global supplies market. Many of these companies consolidate their annual production volume including international subsidiaries of which many are located outside of the EU. This is following ongoing globalisation trends of companies which are at the production side of strategic interest for cost reduction or to serve local content requirements (see also following chapters).

Annex 3, in addition, provides supplementary information on more than 30 leading maritime supply companies including main marine fields of activities, revenues, employees, joint ventures, shareholders, M&A activities, aspects of globalisation and internationalisation of production. This information has been extracted from official company information (e.g. company websites, annual reports), maritime branch magazines and commercial databases.

Company	Country	Engineering, Design, Classification	Steel	Paintings/ Coatings	Ship Operation	Cargo Handling Equipment	Special Cargo Plants and Offshore Systems	Accommodation	Propulsion and Power Generation	Auxiliary Systems, Apparatus & Accessories	Electric/Electronics/Nautical Equipment/, Communication
ABB Marine	Finland, Norway						X		X	X	X
Air Liquide Welding Group	France		X				X				
AkzoNobel Corp.	NL			X							
Aker Solutions	Norway						X			X	
Alewijnse Marine BV	NL										X
Alfa Laval	Sweden				X		X			X	
API Marine	Denmark				X					X	
ArcelorMittal France	France		X								
AREVA TA	France									X	X
ATISA Climate Solutions	Italy				X						
Aveva Group	UK										X
Autronica Fire & Security	Norway				X					X	
Bakker Sliedrecht Electro Industrie	NL										X
Becker Marine	Germany								X		
Bornemann	Germany						X				
Bosch Rexroth	Germany				X	X	X		X	X	
Brunvoll	Norway								X		
BT Marine Propellers	UK								X		
Bureau Veritas	France	X									
Cargotec	Finland				X	X					
Caterpillar Marine Power Systems	Germany								X	X	
Cegielski	Poland								X	X	
Central Industry Group	NL		X		X	X					
CLS	France										X
Cobham Satcom	UK										X
Consilium	Sweden										X
Danelec Marine	Denmark				X						X
Demont	Italy				X			X			
DESMI Pumping Technology	Denmark									X	
DNV GL	Norway, Germany	X									
DSB	Germany				X						
EADS/Astrium	France										X
ECA	France										X
EMS PreCab	Germany							X			
Enerpac	Netherlands									X	
Frydenbo Industrie	Norway								X		

Company	Country	Engineering, Design, Classification	Steel	Paintings/ Coatings	Ship Operation	Cargo Handling Equipment	Special Cargo Plants and Offshore Systems	Accommodation	Propulsion and Power Generation	Auxiliary Systems, Apparatus & Accessories	Electric/Electronics/Nautical Equipment/, Communication
GEA Westfalia Separator	Germany									X	
GE Power Conversion – Marine	France								X	X	X
GE Power Conversion – Oil & Gas	France						X		X		
Glamox Global Marine & Offshore Lighting	Norway				X						
Grundfos	Denmark									X	
GTT (Gaztransport & Technigaz)	France						X				
Hamann	Germany									X	
Hamworthy (Wärtsilä)	UK				X		X			X	
Heinzmann	Germany								X		
Hempel	Denmark			X							
Huisman	NL					X	X				
Hutchinson	France									X	
Ilva	Italy		X								
Imtech Marine	NL				X	X	X		X	X	X
Industeel	France		X								
Inmarsat	UK										X
J. D. Neuhaus	Germany				X	X					
Interschalt-Group	Germany										X
iXBlue	France										X
Jahnel-Kestermann	Germany								X		
Jeppesen Marine	Denmark										X
Jotron	Norway										X
Jotun Group	Norway			X							
Kaefer	Germany						X	X			
Karmoy Winch	Norway				X	X					
Kelvin Hughes	UK										X
KSB	Germany									X	
Kongsberg Maritime	Norway				X		X			X	X
Leistritz Pumpen	Germany						X			X	
Liebherr	Germany					X	X				
Lloyd's Register	UK	X									
Mahle Behr Industry	Germany									X	
MAN Diesel & Turbo	Germany								X	X	
Marine Software	UK				X						
Maritime Communications Partner (Telenor)	Norway										X
Martek Marine	UK									X	X
Mecklenburger Metallguss	Germany								X		

Company		Country	Engineering, Design, Classification	Steel	Paintings/ Coatings	Ship Operation	Cargo Handling Equipment	Special Cargo Plants and Offshore Systems	Accommodation	Propulsion and Power Generation	Auxiliary Systems, Apparatus & Accessories	Electric/Electronics/Nautical Equipment/, Communication
Merlin Diesel Systems		UK								X		
Mekanord		Denmark								X		
Merima		Finland							X			
Minimax		Germany				X					X	
Moteurs Baudoin		France								X		
Muehlhan		Germany			X							
Neuenhauser Kompressoren		Germany									X	
Nexans		France						X				X
Nidec ASi (Ansaldo Sistemi Industriali)		Italy								X		X
Nordischer Maschinenbau Rud. Baader		Germany						X			X	
Noris Marine		Germany								X	X	
Norsafe		Norway				X						
Noske-Kaeser		Germany				X						
R&M		Germany							X			
Palfinger		Austria				X	X					
Raytheon Anschütz		Germany										X
Renk		Germany								X		
Reintjes		Germany								X		
RINA		Italy	X									
Riva Group		Italy		X								
Rolls-Royce Marine		UK	X			X	X			X	X	
Saacke		Germany				X		X			X	
Saipem		Italy						X				
SAM Electronics		Germany				X				X	X	X
Sauer & Sohn		Germany									X	
Scana Industrier		Norway		X			X	X		X		
Schaller Automation		Germany								X		
Schneider Electric		France								X	X	X
SETTIMA		Italy									X	
Siemens	Marine Solutions	Germany								X	X	X
	Oil & Gas	Germany					X	X				
Schottel		Germany								X		
Sondex		Denmark									X	
Sperre Compressors		Norway									X	
STX Cabins	Finland	Finland							x			
	France	France							x			
Sultan		Italy							X			

Company	Country	Engineering, Design, Classification	Steel	Paintings/ Coatings	Ship Operation	Cargo Handling Equipment	Special Cargo Plants and Offshore Systems	Accommodation	Propulsion and Power Generation	Auxiliary Systems, Apparatus & Accessories	Electric/Electronics/Nautical Equipment/, Communication
Survitec Group	UK	X			X						
Tamrotor Marine Compressors	Norway									X	
Technip	France	X					X				
Tino Sana	Italy							X			
Transas	Russia/UK										X
TTS Group	Norway				X	X	X				
Tyco Marine	UK						X			X	X
UMOE Schat-Harding	Norway				X						
Veth Propulsion	NL								X		
Viking Life-Saving Equipment	Denmark				X						
Voith Schneider Propulsion	Germany								X		
Wärtsilä	Finland	X			X		X		X	X	
Wiska	Germany				X						X
ZF Marine	Germany								X		

Table 2: Selection of European top companies

Following earlier definitions above, the shipbuilding and offshore supplies industry with respect to their maritime turnover shares can be divided into the following categories, respectively different company types can be distinguished:

- Maritime specialist companies that serve essentially only the maritime and offshore market in Europe as well as worldwide. These companies operate either only one or several maritime sub-markets. Examples for this category are the following highly-specialised companies:
    - Life-saving equipment (Umoe Schat-Harding, Norway; Viking Life-Saving Equipment, Denmark: Survitec Group, UK)
    - Propulsion systems (e.g. Schottel, Germany; Mecklenburger Metallguss, Germany; Voith Schneider Propulsion, Germany; Becker Marine, Germany; Reintjes, Germany)
    - Electric/Electronics/Nautical Equipment (e.g. SAM Electronics, Germany; Consilium, Sweden; Raytheon Anschütz, Germany; Kelvin Hughes, UK; Transas, Russia/UK; Interschalt, Germany)
- Global market leaders for one or more sub-sectors that cover also mainly the maritime and offshore market. Examples are for instance Technip, France; Saipem, Italy and leading Norwegian companies Kongsberg Maritime and Aker Solutions.
- Global specialist companies with significant maritime revenue shares, but also supplies to other industrial sectors. Examples for this category are:

  - Steel (e.g. Central Industry Group, Netherlands; Scana Industrier, Norway)
  - Paintings and coatings (e.g. Hempel, Denmark; Jotun, Norway; Muehlhan, Germany)
  - Ship operation (e.g. Glamox Global Marine & Offshore Lighting, Norway)
  - Cargo handling equipment (e.g. Cargotec, Finland; TTS Group, Norway)
  - Special cargo plants (e.g. Saacke, Germany; Baader, Germany)
  - Propulsion/Power generation (e.g. Wärtsilä, Finland; MAN, Germany with the subsidiary Renk, Germany; Rolls Royce, UK; GE Power Conversion, France; Caterpillar Marine Power Systems, Germany; ZF Marine, Germany; Volvo Penta, Sweden)
  - Auxiliary systems (e.g. Hamworthy, UK; Autronica Fire & Security, Norway)
  - Satellite communication (e.g. Inmarsat, UK; EADS/Astrium, France; Telenor Satellite Broadcasting, Norway; Cobham SATCOM, UK)

- Industrial generalists with lower maritime revenue shares but still significant global maritime turnover figures as e.g. ABB and Liebherr from Switzerland, Bosch, Siemens, GEA Westfalia Separator from Germany, Alfa Laval from Sweden, Schneider Electric from France and AkzoNobel from the Netherlands.

Driven by the economic crisis but also positive market trends for the future, a number of general developments can be observed in the structure of the European marine supplies industry. This concerns activities towards market consolidation by ongoing mergers and acquisitions, the development of component manufacturers to companies offering complex systems and trends towards globalisation of manufacturing in order to reduce cost and to follow the markets to the physical places of manufacturing.

4.2 M&A, market consolidation

During the last years since 2008 in particular the suppliers exclusively focused on the shipbuilding industry were concerned heavily by the global drop. The end of the long-standing upturn in shipbuilding has uncovered the strategic and operational action deficits of many supplying companies whose consequences had been be concealed by the unusually long business cycle. Above all, the European suppliers with a strong and export-oriented turnover (global players) have reacted prompt but differently.

The necessity to counter the threat from sales reductions and strong pressure to improve profitability forced many enterprises to enter into strategic mergers and acquisitions.

The main acquisition objectives are:

- the improvement of the system competence (especially for the suppliers of components),
- overcoming technology deficits,
- lowering of the production and selling costs (> outsourcing, production location transfer),
- complementing of the product and service portfolio by different business segments with improved sales opportunities
- optimization of the regional structure of the own production facilities or distribution channels (> securing of the market access to growth markets, in particular in Asia, or fulfilment of growing demands for local content).

The reactions of the European manufacturers to these challenges which are mainly relevant for global acting companies have determined the trends of the market consolidation and can be demonstrated by the following examples of M&A-activities:

- **Cargotec, Finland** is a cargo handling solutions provider and acts as global player. With its brands MacGregor, Kalmar and Hiab Cargotec offers cargo handling equipment, solutions and products. MacGregor offers integrated cargo flow solutions for maritime transportation and offshore industries, Kalmar a wide range of cargo handling solutions and services to ports, terminals, distribution centres and to heavy industry and Hiab on-road load handling solutions.
    - In 2007 Cargotec acquired Plimsoll and Hydramarine. Plimsoll is based in Singapore and is a leading company in deck machinery for the offshore oil and gas, and marine industry in the Asia-Pacific region. Hydramarine is based in Norway and is the leading company in high-end area of offshore and subsea load handling systems for the offshore vessel industry
    - In 2008 Cargotec bought Platform Crane Services International Inc (PCS), which specialises in the service, repair and maintenance of marine and offshore cranes with an emphasis on installations in the Gulf of Mexico.
    - In 2011 Cargotec bought Platform Crane Services International Inc (PCS), which specialises in the service, repair and maintenance of marine and offshore cranes with an emphasis on installations in the Gulf of Mexico.
    - In 2013: Cargotec acquired Hatlapa, a leading German marine equipment manufacturer of air and water cooled compressors, steering gears and a wide range of deck machinery.
    - Also in 2013 Cargotec has bought the Aker mooring and loading systems business.

- **Wärtsilä, Finland** is a global leader in complete power solutions for the marine and energy markets. It is world's second largest supplier of ship engines and world market leader for 4-stroke engines (medium-speed).
    - In the last few years Wärtsilä bought a number of international ship design companies, among others the German company group SCHIFFKO (2006) and the global ship design company Vik-Sandvik
    - In 2011 Wärtsilä acquired the Swedish Cedervall, one of the leading manufacturers of shaft seal and bearing systems for the marine industry. This company also has subsidiaries in Spain, China and Singapore and/or manufacturing facilities in Sweden, China and Spain.
    - In 2012 Wärtsilä did the largest acquisition of its history. The company bought Hamworthy, another global player, headquartered in Poole, UK. Hamworthy employs around 1.150 people worldwide and operates design, manufacture and sale of equipment facilities in the UK, Norway, Denmark, Germany, Singapore, and a modern assembly plant in China.
- **Rolls-Royce Marine, UK** has a leading range of capabilities in the marine market, encompassing the design, supply and support of power and propulsion systems. Rolls-Royce has strong positions in the offshore, naval and merchant and naval sectors.
    - In 2009 the global marine headquarters of Rolls-Royce moved to Singapore.
    - In 2011 Rolls Royce together with Daimler/Germany acquired the German engine manufacturer Tognum AG. The strategic objective is to integrate the Rolls Royce Bergen Diesel engines (medium-speed diesel and gas engines) with the Tognum engines (high-speed diesel engines).

- **Alfa Laval Group, Sweden** runs 32 major production units and 102 service centres worldwide. The group realizes yearly revenue of about 24,7 billion SEK (2010) with a very diverse product portfolio and a relatively small maritime share.
    - In the last few years (2008-2012) Alfa Laval acquired 23 different companies with combined sales volume of 7.565 million SEK. In order to strengthen the maritime portfolio and market position in shipbuilding and offshore Alfa Laval bought the Danish Aalborg Industries in 2011.
    - Alfa Laval Aalborg (former: Aalborg Industries) is a leading equipment and service supplier in the marine sector and a supplier of industrial products to selected key markets. It is the world's leading marine boiler engineering company. The revenue before the takeover amounted to 3,1 billion SEK.
      Aalborg Industries is the biggest acquisition for Alfa Laval so far.

4.3 System suppliers (from component suppliers to system suppliers)

The table given chapter 4.1 provides an overview of major global European market players in the main shipbuilding and offshore sub-sectors. It is evident that many of these companies now cover not only one subsector, but develop to system providers covering three or more subsectors.

The trend for the development of components to system suppliers is continuing. This development is accompanied by the formation of larger company structures in Europe which are also stronger integrated in international networks. The following examples should describe some important global system suppliers for the global shipbuilding and offshore market:

Total propulsion systems and flow, gas & environmental solutions

The Finnish-based Wärtsilä is the most important company in this connection. Already up to 2011 Wärtsilä was one of the most important global suppliers of complete propulsion systems. With the acquisition of Hamworthy, a UK-based global player and provider of fluid handling equipment and services for marine, oil & gas and industrial sectors, in 2011 Wärtsilä became a global system supplier for total propulsion systems and flow gas & environmental solutions. Wärtsilä Hamworthy is now a global system supplier with total offering for automation, power drives, power distribution, communication and control, engines, seal & bearings, propulsion, flow & gas solutions, environmental solutions, ship design and service agreements.

Complete electric/ electronics/ navigation Solutions

The most important European global system suppliers in this sector are:

- Siemens, Germany (including overall company's industry market coverage)
- ABB, Finland, Norway and Switzerland (including overall company's industry market coverage)
  Together with the Italian shipyard Fincantieri ABB operates a joint venture in Italy (Seastema SpA), involved in the design, development and achievement of integrated automation systems for the naval, cruise, ferry and mega yacht business.
- Kongsberg Maritime, Norway (including a strong offshore business)
- SAM Electronics, Germany
- Imtech Marine, Netherlands (including strong offshore business)

The most important European global system suppliers for complete propulsion systems are:

- MAN, Germany (and other European countries)
- Rolls-Royce, UK (and other European countries) especially in connection with the recent acquisition of Tognum in Germany)
- Wärtsilä, Finland
- Caterpillar Marine Power Systems, Germany
  Caterpillar Marine Power Systems was established and headquartered in Hamburg/ Germany by the US based Caterpillar Inc as part of a strategic realignment of Caterpillar's marine activities. This organization carries the responsibility for all sales and service operations involving the Cat and MaK brand marine products of Caterpillar.

Paintings and coatings with the following most important European companies:

- AkzoNobel, Netherlands
- Hempel, Denmark
- Jotun, Norway.

Cargo handling equipment

The most important European suppliers in this sector are:

- Cargotec, Finland
- Liebherr, Switzerland

Satellite communication with the following most important European companies:

- Inmarsat, UK
- EADS/Astrium, France
- Telenor Satellite Broadcasting, Norway
- Cobham SATCOM, UK.

With respect to the further growing the offshore oil & gas market complete **offshore drilling solutions** became more and more important also for the shipbuilding supplier branch. The most important European system suppliers in this sector are Technip from France and Saipem from Italy as leading international offshore enginering companies and the Norwegian-based Aker Solutions Group.

4.4 European shipbuilding suppliers following markets - Examples for globalisation, internationalisation of production

A steadily increasing share of the global shipbuilding production has moved to Asian countries. As a result, innumerable European ship suppliers run their own facilities in Asia, mainly in China, but also in other Asian countries. Here are some few examples:

Steel

- The Central Industry Group from the Netherlands operates in China the Shanghai SEC (Ship Equipment Centre) for machinery & equipment.

Paintings/ coatings

- Hempel, Denmark has acquired in 2009 100% shares of Hempel-Hai Hong and the company name was changed to Hempel (China) Ltd. With its headquarters in Hong Kong, there are three production facilities, ten sales offices located in Beijing, Dalian,

Qingdao, Shanghai, Chengdu, Guangzhou, Shenzhen, Wuhan, Chongqing and Tianjin, and eleven stock points strategically located in China. The former company of Hempel (China) Ltd was Hempel-Hai Hong (China) Ltd which was founded in 1992 as a joint venture of the Hempel Group and China Merchants Holdings (International) Co Ltd.

- Jotun Paints, Norway
    - 1993: Jotun Ocean Paint Co Ltd in China was formed as a joint venture through the acquisition of a 51% stake in a factory run by the Chinese state shipping company Cosco
    - 1996: Opening of P T Jotun in Indonesia (First manufacturer of liquid and powder coatings
    - 1999: A new paint and powder coatings factory opened in Thailand (Jotun's single largest investment before 2010)
    - 2008: Jotun's first manufacturing facility in India was opened
    - 2009: New factory for marine paints in Korea
- Two other leading manufacturers of paintings and coating Muehlhan, Germany and AkzoNobel, Netherlands produce marine paints and coatings in China.

Ship operation

- TTS Group, Norway runs selected joint ventures and production facilities in Asia and has a long history of successful business in China with respect to joint ventures with two leading Chinese state owned corporations China State Shipbuilding Corporation (CSSC) and China`s Dalian New Shipbuilding Heavy Industry Co. (DNS). Together, TTS and CSSC/DNS own three companies that operate within the markets of cargo access, deck equipment and offshore handling equipment. TTS is the Norwegian company with largest operations in China
    - TTS Hua Hai Ships Equipment in Shanghai (1998)
    - Jiangnan TTS Marine Equipment Co. In Nantong (2007)
    - TTS Bohai Machinery Co. in Dalian (2011)

Cargo handling equipment

- Cargotec from Finland has established the joint venture Rainbow-Cargotec Industries Co Ltd (RCI) with Jiangsu Rainbow Heavy Industries Co., Ltd. to strengthen presence in China in 2011. RCI will build a new facility to Taicang that will increase Cargotec's delivery capacity.
- Liebherr from Switzerland operates different joint ventures as e.g.:
    - Liebherr Machine Tools India Private Limited (Bangalore, India): The joint venture company produces gear cutting machines in Bangalore that are intended for sale on the Asian market in particular.
    - Xuzhou Liebherr Concrete Machinery Co., Ltd. (Xuzhou, China): The joint venture company produces concrete batching plant and recycling plant for the Chinese market
    - Zhejiang Liebherr Zhongche Transportation Systems Co., Ltd. (Zhuji, China)

Cargo handling/ special cargo plants (offshore oil & gas)

- Huisman from the Netherlands expanded its operations to Fujian Province (Xiamen area) in China, to facilitate customers in this region and to increase the overall production

capacity. The facility has been fully operational since April 2007 and delivers a significant contribution to the overall Huisman engineering and production capacity (Fujian Huisman Steel Manufacturing Co., Ltd.)

Propulsion/ power generation

- Wärtsilä from Finland has established a joint venture with Hyundai Heavy Industries for the production of Wärtsilä Dual Fuel Engines (DF) in Korea (WHEC) in 2007, a joint venture with Jiangsu CuiXing Marine Offshore Engineering Co. Ltd. for the production of Wärtsilä 26 and 32 medium-speed engines in Nantong/China for the Chinese market in 2011 (production start planned for early 2013) and agreed on another joint venture with Yuchai Marine Power Co. Ltd. (YCMP) for the production of medium-speed marine engines to serve the increasingly dominant Chinese shipbuilding industry. Production is planned to start in 2014.
- Rolls-Royce from UK moved in 2009 its global Marine headquarters from London to Singapore. In 2001 Rolls-Royce started a joint development project for a medium-speed engine with Hyundai Heavy Industries in Korea. Since 2006 the subsidiary Rolls-Royce Marine Manufacturing (Shanghai) Limited manufactures and supplies marine equipment and runs marine aftermarket support services.
- MAN Diesel & Turbo from Germany runs the following maritime joint ventures and production facilities in Asia:
    - MAN Turbocharger China is the leading supplier of turbochargers for marine diesel-engine manufacturers in China. A facility was already established in Shanghai in 2002. Initially acting as an assembly workshop for axial turbochargers, MAN subsequently localized component production over the years. In time, the Shanghai factory became too small and, in 2011, the turbocharger workshop was moved to the current plant in Changzhou.
    - MAN runs a production facility and an engineering center for four-stroke engines In Aurangabad/India.
- Caterpillar
    - Plant for the production of MaK engines in Guangdong, China.
    - Joint venture with Chinese Anqing CSSC Diesel Engine Company, Ltd., to manufacture MaK brand medium-speed marine engines for China and the Asia Pacific region.
- Schottel, Germany, a global player in the area of propeller and pod propulsion production, manufactures propulsion components in Suzhou, China

Auxiliary systems (e.g. ballast water, fire fighting)

- Alfa Laval Aalborg from Denmark operates engineering major factories are located in China, Brazil and Vietnam. Selected joint ventures are:
    - Aalborg Industries Ltd., Qingdao, China (Manufacturing of marine boilers, heat exchangers, and inert gas systems since 1974)
    - Alfa Laval Hai Phong Co. Ltd., Hai Phong, Vietnam (Manufacturing of marine boilers since 2006) Aalborg Industries Vietnam Co. Ltd. was established in 2004 as a joint venture between VINASHIN (Vietnam Shipbuilding Industry Corp.) and Aalborg Industries A/S. In 2009, after mutual agreement the Aalborg Industries Group became the sole owner of Aalborg Industries Co. Ltd., Vietnam
- The UK-based Hamworthy, a Wärtsilä company, runs selected joint ventures and production facilities in Asia:

- Wärtsilä Suzhou Ltd., China
- Wärtsilä Hamworthy Korea Ltd
- Wärtsilä Hamworthy India
- Wärtsilä Pumps Pte. Ltd., Singapore

Electric/ electronics/ nautical equipment

- Kongsberg Maritime from Norway has a manufacturing location in Zhenjiang/China which is focused on the delivery of electrical control & distribution units to the marine industry.
- Consilium from Sweden operates a production facility for navigational products in China since 2004.

The **Brazilian maritime and offshore market** is very attractive but also very challenging. There are two specific challenges also the ship European maritime and offshore suppliers are faced with

- High and sophisticated requirements for “local contents products” from Brazil for state-owned projects, intensified by the current “Local Content Initiative”
- Suppliers qualification and registration procedure (for example requested by the leading oil company Petrobras)

Brazil’s NOC Petrobras owns the mineral rights to some of the largest deepwater hydro-carbon deposits in the world. However, exploiting these remote, ultra-deepwater reserves is a capital intensive task. In March 2013, Petrobras announced its 2013-17 investment plan that covers total investments von 236,5 billion USD.

For example, more than 100 new subsidiaries of German companies have been registered since January 2010. The mentioned challenges motivate also an increasing number of maritime and offshore suppliers to cooperate with Brazilian manufacturers or install own production facilities in the country. The German based suppliers MAN, Siemens, Voith and Bosch run own companies in Brazil. One of the main important production facilities of the Danish Alfa Laval Aalborg is situated in this country. Also, Grundfos from Denmark is producing in Brazil.

Further examples for Brazilian activities of European suppliers are:

Cargo handling/ special cargo plants (offshore oil & gas)

- The Norwegian Aker Solutions opened a new plant in Paraná that will double the company's subsea production capacity in Brazil. Wärtsilä from Finland is to set up a new fully owned manufacturing facility in Brazil to meet the increasing market demand, particularly in the offshore market. Wärtsilä's investment in the new facilities is approximately 20 million €. The manufacturing premises will be based on a multi-product factory concept for the assembly and testing of Wärtsilä generating sets and propulsion products.
- Huisman from the Netherland has an engineering, sales and service office in Rio de Janeiro, Brazil. In addition, Huisman is currently building a new production facility in Navegantes, Santa Catarina. The new production facility should be operational in 2014.

Propulsion/ power generation

- Wärtsilä from Finland is to set up a new fully-owned manufacturing facility in Brazil to meet the increasing market demand, particularly in the offshore market. Wärtsilä's investment in the new facilities is approximately 20 million €. The manufacturing premises will be based on a multi-product factory concept for the assembly and testing of Wärtsilä generating sets and propulsion products. In the initial phase, activities will focus on

medium sized, medium speed generating sets and steerable thrusters, with the possibility to flexibly expand the product range to respond to market needs. The new manufacturing plant will be located some 300km north of Rio de Janeiro. It will commence in April 2013 and it is scheduled to be fully operational by mid-2014. The new delivery centre is expected to employ close to 100 people.

- Caterpillar has enlarged the facility in Piracicaba, Brazil to package 3500C series engines, generator sets and diesel electric propulsion systems for marine and offshore applications.

Auxiliary systems

- Alfa Laval Aalborg from Denmark operates in Brazil a factory for marine and industrial boilers since 2000.

4.5 Certification and type approval as major benchmark for international application of products and services

The Type Approval Process as required by IMO regulations, flag states and also classification societies themselves is structured into three steps. The supplier has to submit the application information (e.g. copies of applicable drawings and datasheets; test results; sufficient data to verify compliance with stated standards; additional specified information related to the application). The Classification Society then executes the design evaluation, prototype testing, management assessment (performed by local surveyors using standardised checklists) and production assessment (performed by local surveyors using standardised check-sheets for guidance). All these class tasks include step 2 of the Type Approval Process. The production surveillance is typically being conducted on an annual basis. New products or changes to existing products may necessitate additional design reviews. As final step the certificate is issued to the supplier. In general it is valid for five years. The Class Society puts the product on the list for type approved products (Remark: Some Classification Societies make this list public on their website) and the manufacturer can market the product as type approved by the classification society.

4.5.1 The role and impact of the European Marine Equipment Directive

Type approvals provide the suppliers with a major pre-condition for the marketing of their products in the marine fields. It is however also a high cost factor to be taken into account. Mutual recognition of type approvals by different classification societies and flag states provides a competitive advantage with regard to the cost of certification but also with regard to the harmonised application of available regulations and standards. The European Marine Equipment Directive (MED) in this respect provides the basis for mutual recognition of products in seven item categories for equipment to be installed on European flagged vessels.

For products certified under the directive the European Commission is running a database (MarED database) which allows some evaluation of market shares and timely development of number of certificates. This gives an idea on market shares and market development for the item categories covered by the directive, i.e. Life Saving Appliances, MARPOL Equipment, Fire Safety Equipment, Navigation Equipment and Radio Communication Equipment, SOLAS Chapter II Equipment and COLREG Equipment.

Analysis for data from 2012 shows that companies from 4 countries (Germany, China, Korea, UK) represent more than 50% of the database entries. If we add entries from companies coming from Norway, Japan and Italy, than they represent altogether a share of 75% of all certificates. See the following figure.

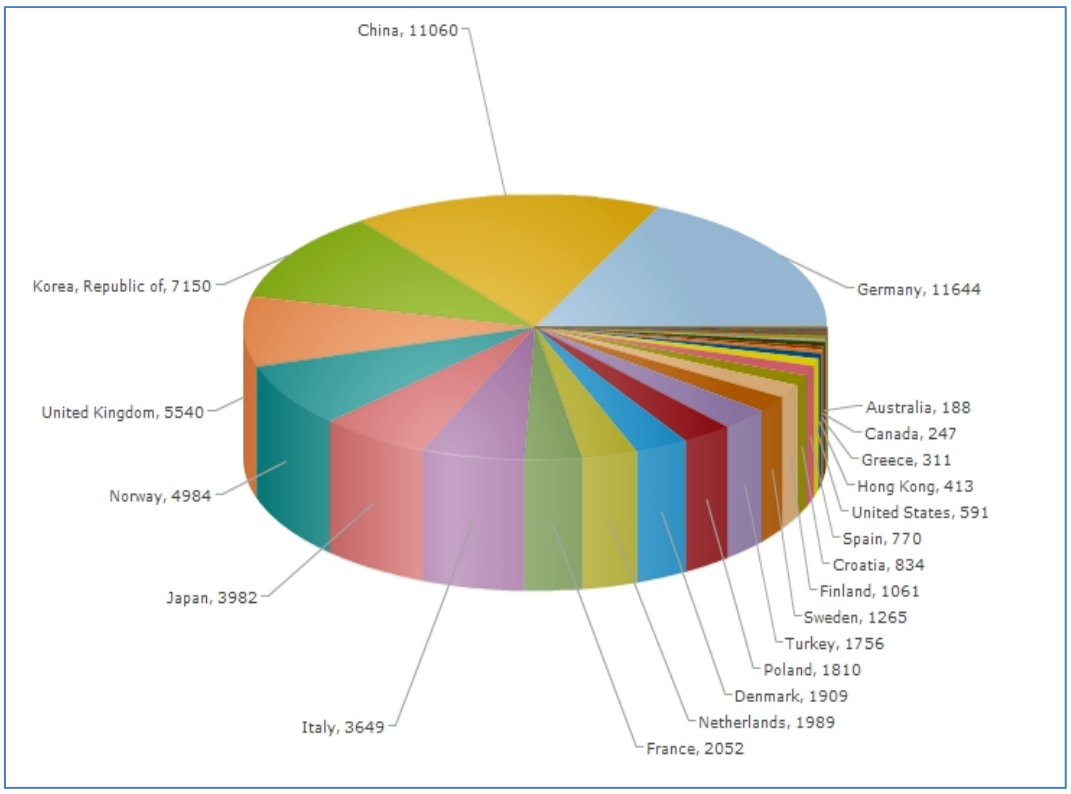


Figure 23: Number of companies with MarED database entries per country, [Source: (3)]

However, if we analyse the share of database entries for the different product categories, the situation changes:

- For Life Saving Appliances, we see China in the lead (35%) representing together with Norway 50% of the entries. If we add database entries from Korea, Turkey and Japan this adds up to more than 75%.
- For MARPOL Equipment we see Japan in the lead (35%) representing together with China and Korea 60% of the database entries. If we add database entries from Germany, Sweden and UK this adds up to about 80%.
- For Fire Equipment we see Italy in the lead (30%) representing together with Korea, the UK China and Korea more than 50% of the database entries. If we add database entries from Japan, Germany, Poland and France this adds up to about 75%.
- For Fire Equipment we see Germany in a strong lead with a abut 60% of all database entries alone. If we add database entries from UK, Japan and Italy this adds up to about 80%.
- For Radio Communication Equipment we see Japan in a strong lead with more than 40% of all database entries alone. If we add database entries from Denmark, UK and Germany this adds up to about 85%.

As can be seen from the following figure, European owners of certificates are producing not only in their own countries, but also in numerous countries worldwide. According to this analysis top 5 favourite places of manufacturing for EU-28 certificate owners are Japan, China, US, Viet Nam and Korea.

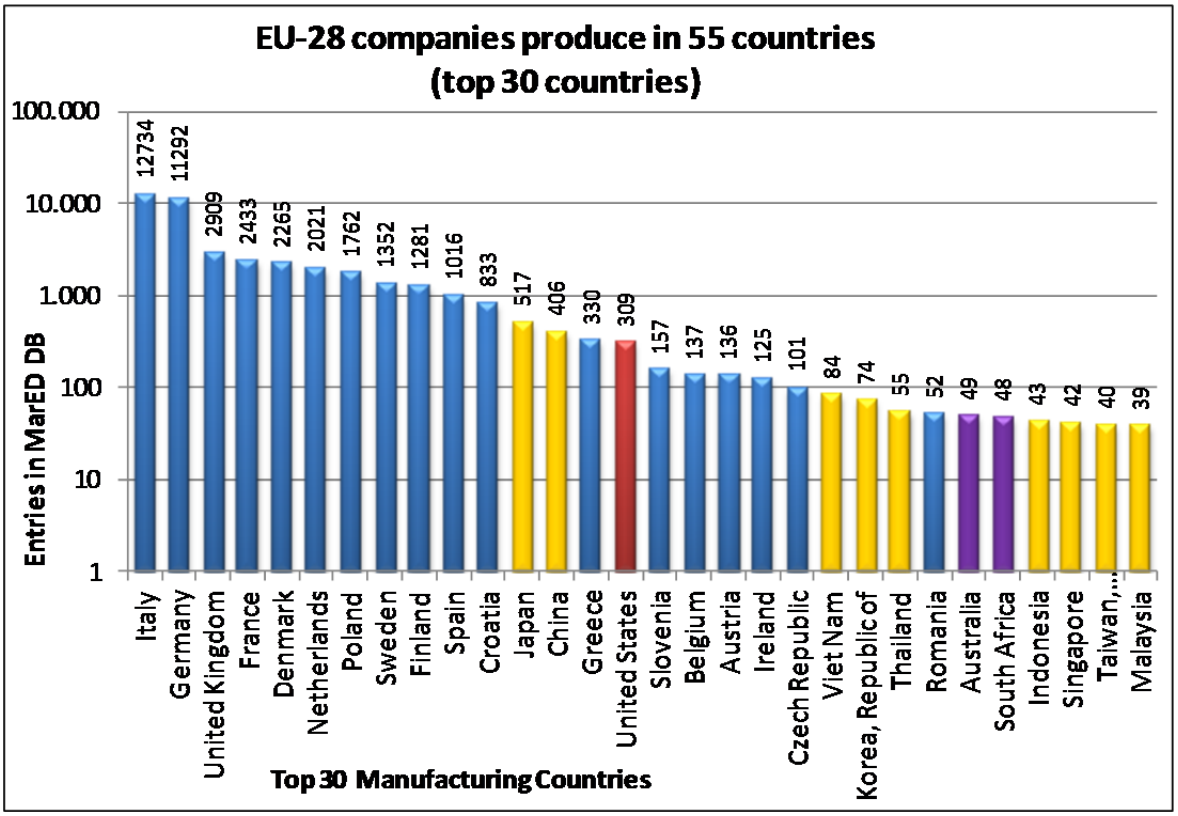


Figure 24: EU-28 companies produce in these countries (2013), [Source: (4), BALance TC calculations, 2013]]

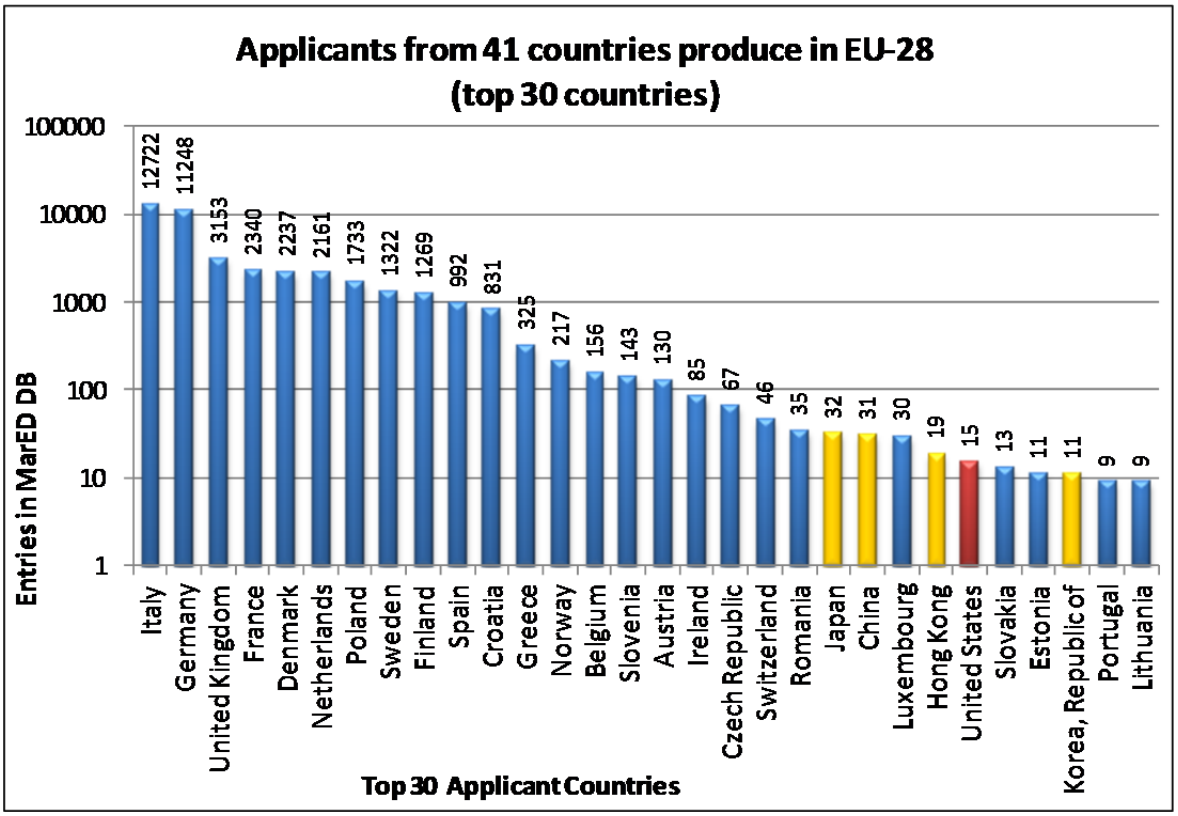


Figure 25: Countries those applicants produce in EU-28 (2013), [Source: (3), BALance TC calculations, 2013]

For individual EU countries the situation looks different. The following two examples based on data from 2013 show that the companies in the UK are already more globalised than for example Germany. Whereas UK companies produce in 40 countries including UK, Germany only produces in 24 countries (incl. Germany) and on top on a much smaller scale. It has to

be said that sometimes it is difficult to interpret the statistical data for countries, because due to globalisation strategies by building joint ventures or to operate even own companies in other countries, it might be still the technology coming from Europe which is for example produced at different places in the world. However, the employment effect in the end will be negative for Europe.

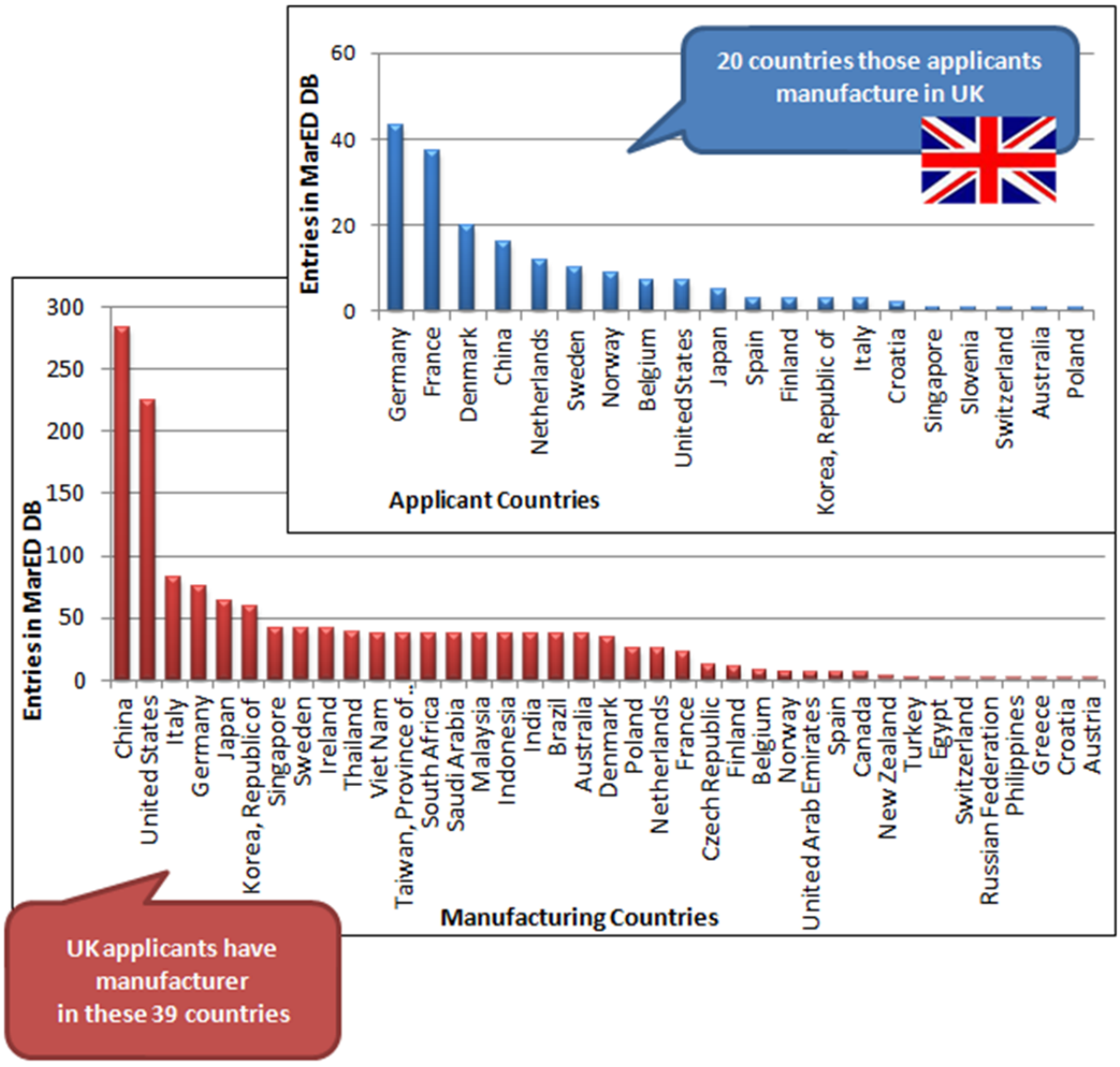


Figure 26: Manufacturing places UK (2013) [Source: (4), BALance TC calculations, 2013]

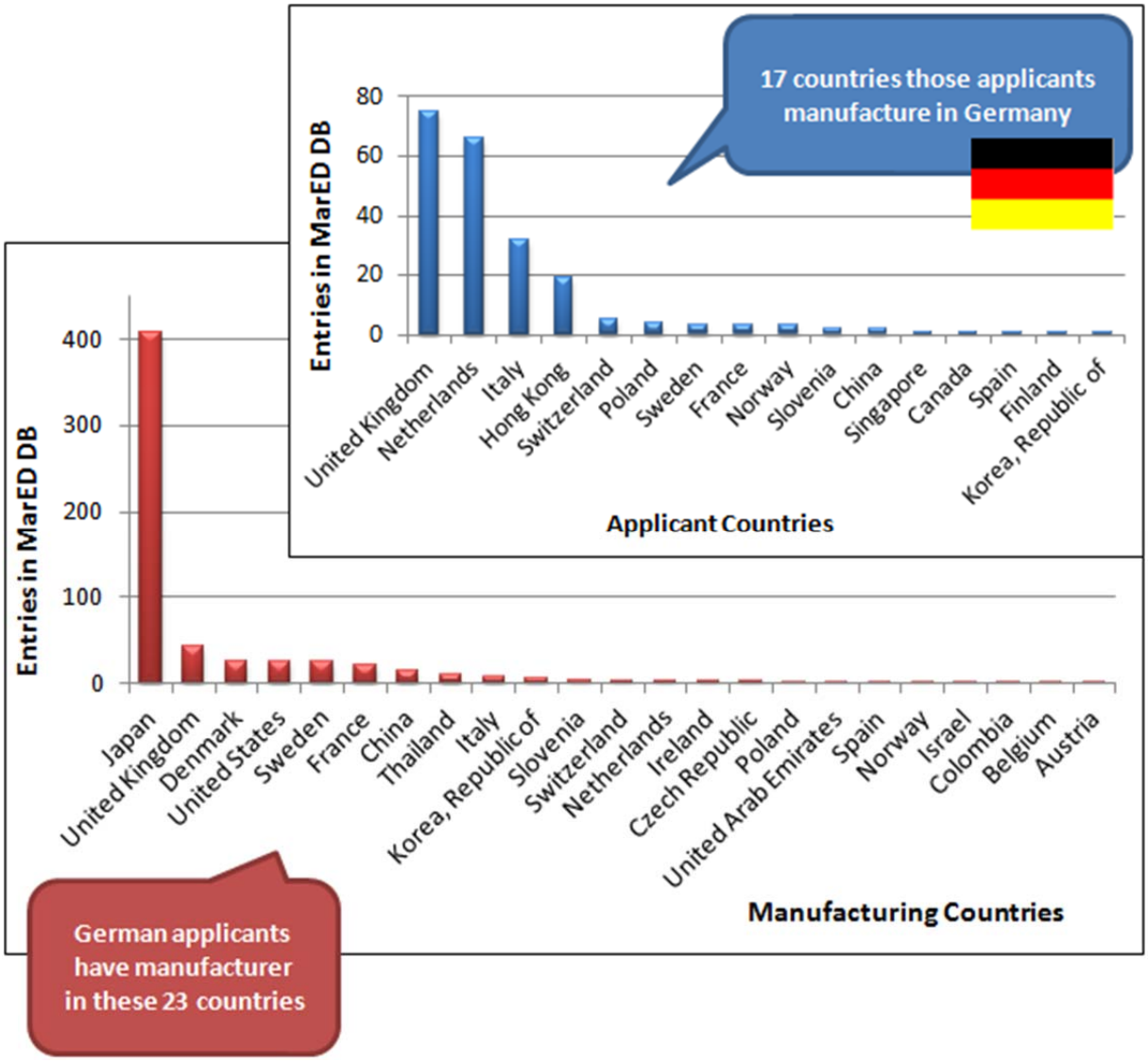


Figure 27: Manufacturing places Germany (2013), [Source: (4), BALance TC calculations, 2013]

The dramatic geographical move of the marine supplies business to Asia can be seen when we have a look at the development of the number of certificates in the years 2007 to 2010 as shown in the following figure. Whereas German manufacturers held a high number of certificates in the beginning of this period, the number of certificates in hand of Chinese and Korean manufacturers was fairly low. However, for Germany growth on certificates was about 25% over the period of four years, i.e. consolidation on a high level. In comparison, the number of certificates for China and Korea almost exploded through growth in the period by 250% and 170% respectively. This year China has taken the lead for the first time in number of certificates held under the MED by national manufacturers. Although the possession of certificates is no guarantee to gain respective market shares, it is a clear indicator where the business is heading. As outlined above, the company count by type approvals from all classification societies, and therefore going far beyond the MED, shows basically the same trend. It needs to be noted that certificates assigned to China and Korea are not necessarily owned by companies with pure national shareholders. In many cases these are also Chinese or Korean certificates of companies owned by European companies or being joint ventures producing in those countries. This is a consequence of continuous globalisation trends due to cost reasons or to serve local content requirements. However, we see this as a clear indicator for geographical move of the branch and implicitly a danger for European employment in the marine supplies industry, at least for jobs in manufacturing. On the other hand, it has to be considered that outsourcing of manufacturing may save or even create

jobs in R&D, engineering, branding, design, marketing, administration, sales and after sales services. This may need to be discussed and elaborated further in a future study.

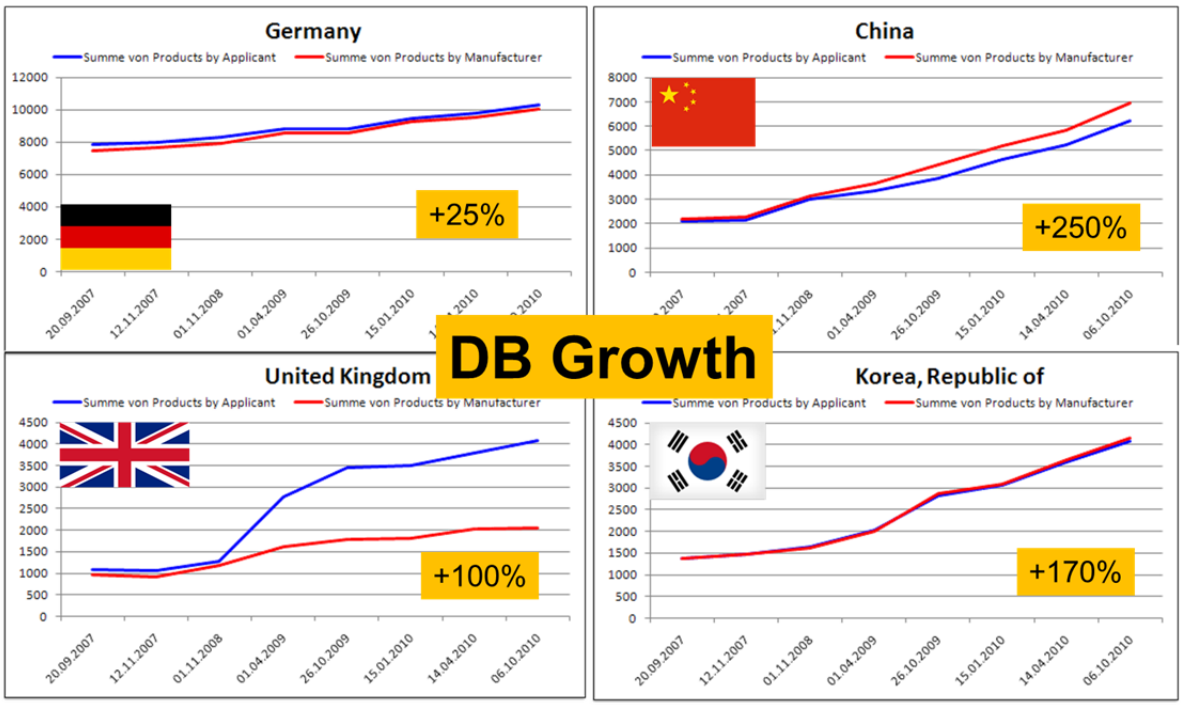


Figure 28: Database growth [Source: (5), BALance TC calculations, 2013]

5 Marine supplies - Economic drivers and market outlook

5.1 Objectives and approach

It is the objective of this chapter to discuss the seven different primary markets as identified in chapter 2.1 creating demand for marine supplies. These are

- Newbuilding of Merchant Ships and Offshore Ships (shipyards, boatyards and shipping companies)
- Ship repair and conversion of merchant ships (shipyards, boatyards and shipping companies)
- Retrofitting - a special conversion market for ships following new regulations (shipyards, boatyards and shipping companies)
- Offshore Platforms, Jack-ups etc. for oil and gas (offshore- and shipyards, oil and gas companies/operators)
- Offshore Facilities, plants for offshore wind applications (offshore- and shipyards, offshore wind operators and wind farm developers)
- Naval shipbuilding, maintenance, repair and overhaul (shipyards and governments)
- Boatbuilding (boatyards, shipyards)

All chapters will discuss the major economic drivers of the specific markets including a longer term outlook, estimate the primary market size for the period 2013-2017 and marine supply values derived from that. Finally, each chapter will discuss chances and risks out of the specific markets for European marine supply companies.

The core and most accurate part of this analysis is the shipbuilding and related marine supplies forecast 2013-1017 in subchapter 5.2, the analysis of the primary shipbuilding market has been carried out as part of the study.

All other market estimates and trend as outlined in the following chapters 5.3 to 5.8 have been made by using different public sources complemented by own data, interpretations and estimates.

The overall summary of the market forecast figures is given in chapter 6 as the baseline for the discussion on position and future potential of the European Marine Supplies Industry.

5.2 Marine supplies for merchant ship newbuilding

5.2.1 Economic drivers GDP and seaborne transport

The primary driver for creating demand for ships and marine supplies remains the global development of GDP in the developed countries and also, if not more important nowadays, the GDP development in emerging economies and non-OECD countries, as China, India, Brazil etc. The development of world seaborne trade has to be seen in direct relation to the development of GDP, but is also influenced by some geographical relocation of major sea routes.

After years of strong global growth until 2007, averaging approx. 5% growth rates, the financial crisis in 2008 caused a major drawback of economic developments in 2008 and 2009 with a decline of the average global growth rates to 0%, with the advanced economies (USA, Euro-Zone and Japan) on average even dropping into a recession. However, in 2010 world GDP growth showed a surprisingly strong revitalization to about 5%, in our view also to compensate for some of the draw-backs from 2008 and 2009 *(figure below)*.

For the future, there is a scenario for growth to continue at a level of about 3,5% in the coming years, very much driven by the sustained upturn of the emerging economies, driven by general development dynamics, long term population growth and positive consumer climate. The relative GDP growth for the advanced economies remains on a stable low level, but contributes to the positive trend in absolute figures. See the two figures below on GDP growth, one offering a timely forecast until 2017, the other a geographical view on the GDP growth expectations.

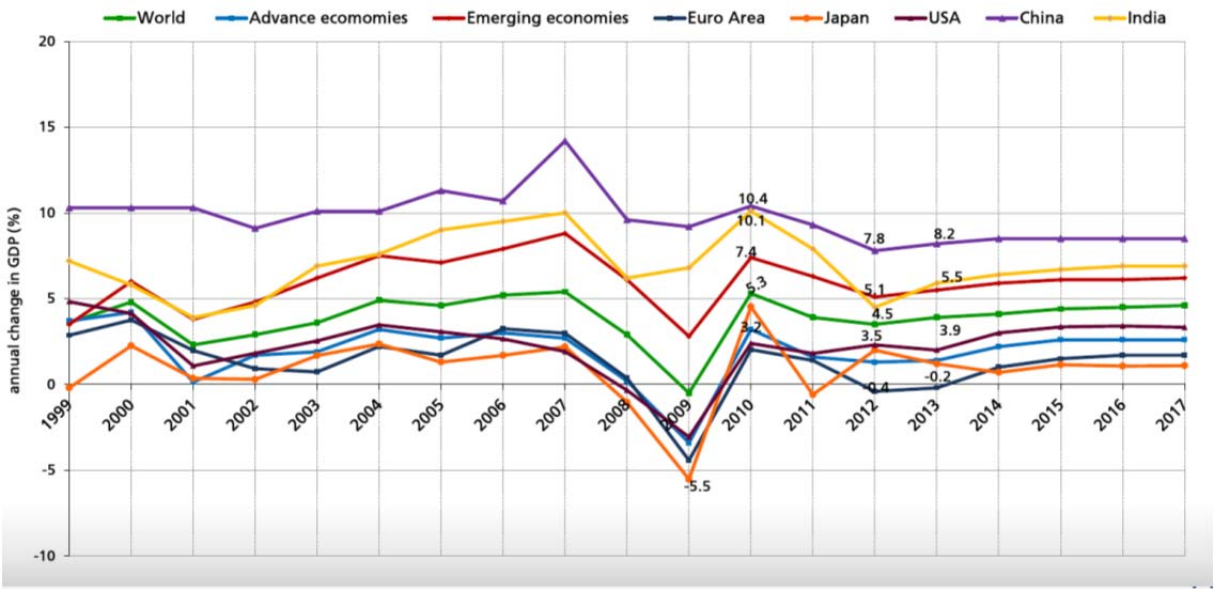


Figure 29: GDP outlook [Source: (6)]

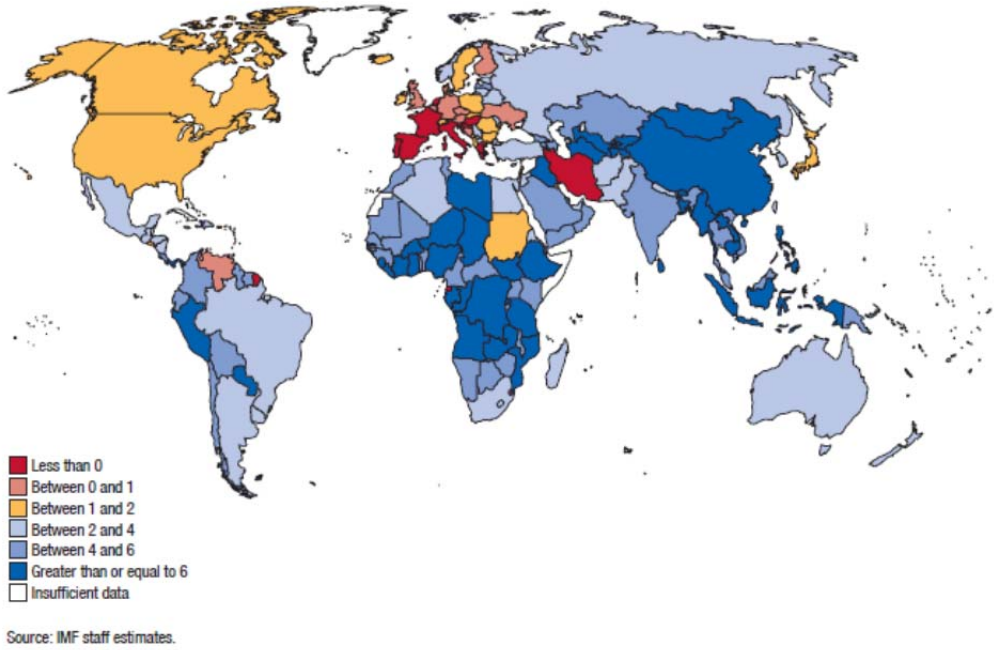
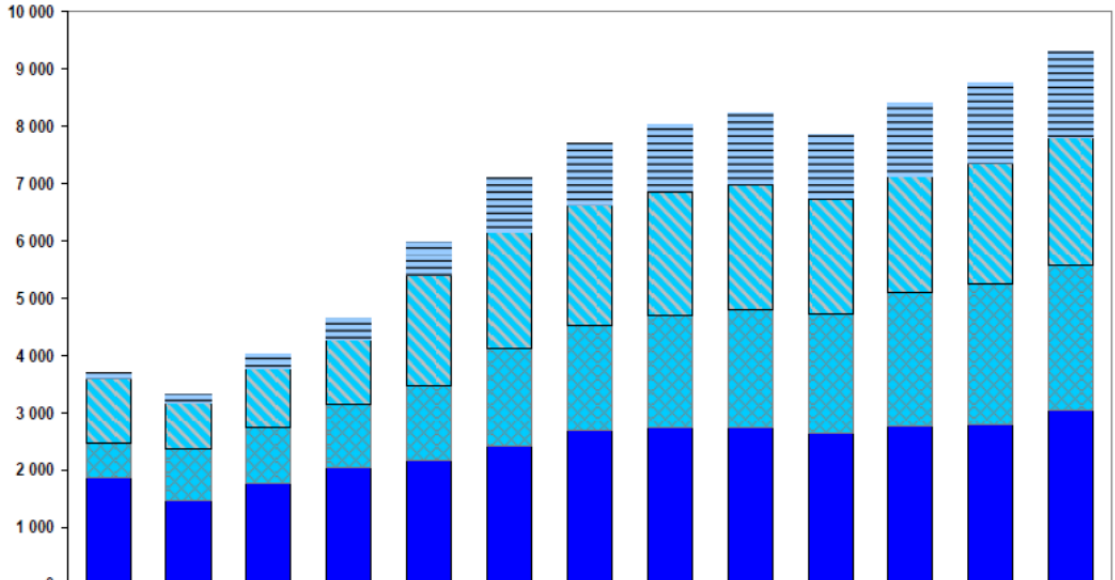


Figure 30: GDP growth forecast 2013 [Source: (7)]

In line with the developments of GDP, world seaborne trade showed a decline in 2009 by about 4,5% (10% for container shipping only), but picking-up again in 2010 showing continuous growth in 2011 and 2012 (figure below).



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Container	102	152	234	371	598	969	1 076	1 193	1 249	1 127	1 275	1 385	1 498
Other dry cargo	1 123	819	1 031	1 125	1 928	2 009	2 112	2 141	2 173	2 004	2 027	2 108	2 219
Five major bulks	608	900	988	1 105	1 295	1 709	1 814	1 953	2 065	2 085	2 335	2 459	2 547
Oil and gas	1 871	1 459	1 755	2 050	2 163	2 422	2 698	2 747	2 742	2 642	2 772	2 796	3 033

Figure 31: World seaborne trade [Source: (8)]

In line with this is the long term forecast for economic growth and world seaborne trade. The related development and forecast for the world fleet growth by “LR Global Maritime Outlook 2030” suggests annual CAGR factors of 3,5% as average figures, which is in line with other long term forecasts. The study says “World fleet grew on average 7,4% per year during 2004-2011, compared with world seaborne trade growth of 3,9% over the same period.

Although world fleet growth is expected to slow down to approximately 3,5% per year up to 2020, world seaborne trade will still grow at a similar rate of 3,7%." However, the effect of the economic crisis is that in the transition from 2008 to 2009 the capacity demand from seaborne trade dropped below the capacity increase of the world fleet. This effect of tonnage overcapacity will further increase due to the delivery of the huge shipbuilding orderbook existing at the end of 2007 for deliveries until 2012. This overcapacity in offered tonnage will continue to create pressure on the shipping market and will/did slow down the ordering activity for ship new buildings. This is proven by the very slow ordering activity for ships in 2009 to 2012, but is not necessarily true for all ship types. The shipbuilding forecast in the following chapter builds on forecasts for the demand of specific shiptypes in order to provide a more detailed picture on the demand situation. The individual growth factors are given for the single fleets in the shiptypes portfolios in Annex 4. However, it is basically anticipated that the overall ratio of world fleet capacity to tonnage demand ratio will for the foreseeable future be over 100%. This means that ordering activities for ship new building, especially for standard vessels like bulkers, tankers, containers etc. will remain moderate to slow, maintaining shipbuilding as a buyer's market for the foreseeable future as long as shipyard overcapacities in the market exist. For some shiptypes like LNG, passenger ships and RoRo, but especially for the offshore market, ordering prospects seems to be more promising.

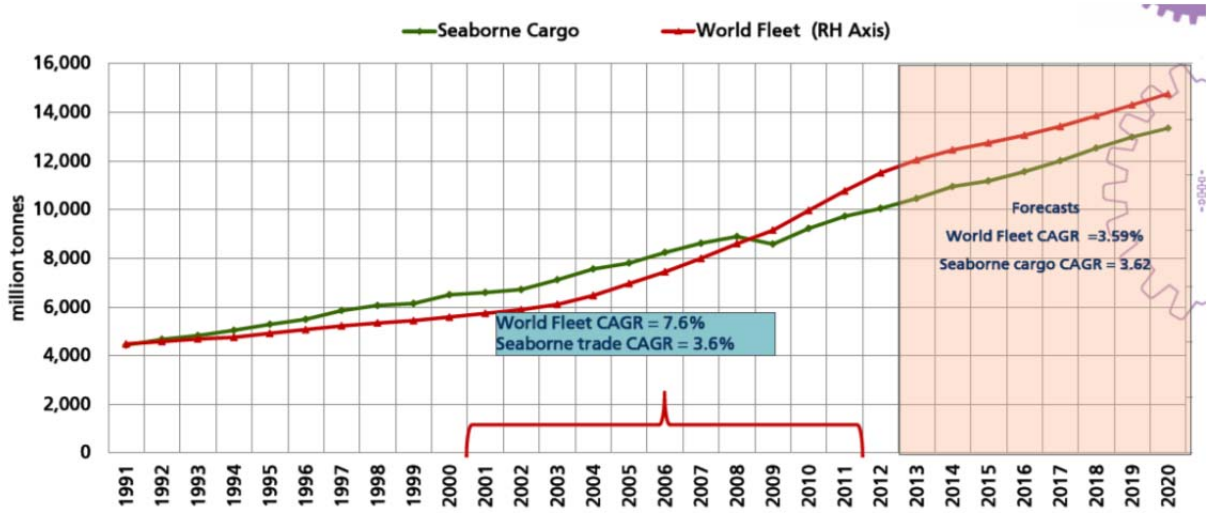


Figure 32: World seaborne trade [Source: (9)]

Just to add some other aspects to the discussion and having a view on the longer term development again, it is likely that some emerging economies are overtaking established economies in their economic power. In the 2013 study from Lloyds Register on „Global Marine Trends 2030" they apply a scenario based approach and as a result from the base case calculation (the called „status quo scenario") China, Brazil, India, Russia and Indonesia catch up and outperform established economies not only in GDP growth, but absolute size of economies.

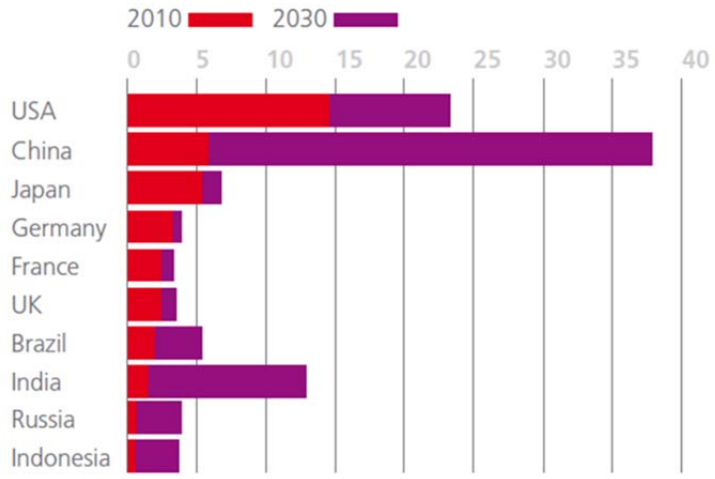


Figure 33: GDP Projection 2030 base case [Source: (10) (7)]

As a consequence of this GDP growth and absolute economic power, we will see a change from the Atlantic centred economic world with a major trade route across the Atlantic today to a Sino-Pacific centred world. See below the artist impression with oversized country representation in proportion to their GDP. This scenario is not new, but it has to be considered that the expected relocation of major trade routes due to the geographical changes of the global economic centres of gravity will have a major impact on the maritime markets.

Figure 34: The world changed towards a Sino-Pacific centred global economy [Source: (10)]

This global development will also have major impacts on the geography of global trade. We will see a drastic increase of traffic between the bigger Asian economies, a drastic increase in Arabic Gulf to Asia traffic, major increase of traffic on the classical Europe to Asia routes, and also major increase of Pacific trade to the US West coast, but also to South America, basically to Brazil through the Suez Canal. A recent political agreement from China with Nicaragua to build a second “Panama Canal” under control of China supports very much this kind of a long scenario. The following figure illustrates this scenario for the container trade. Similar mappings with even more dramatic changes for oil, gas, coal, grain etc. are available in the LR report.

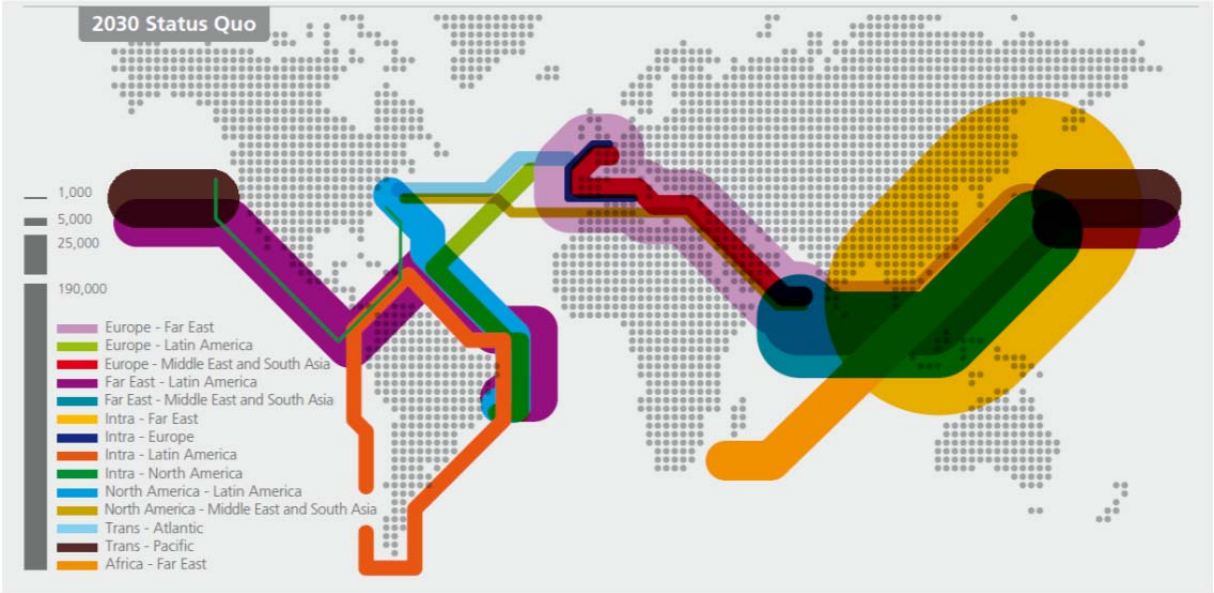


Figure 35: The world changed towards a Sino-Pacific centred global economy [Source: (10) (7)]

5.2.2 Economic driver shipbuilding - Market forecast 2013-2017

This report provides a shipbuilding forecast for the 5 years period 2013 to 2017. It has been built on data, estimates and own calculation from the study team and from external sources, basically from Shipyard Economics and using data from Drewry.

The markets have been discussed and calculated on the basis of different ship categories and within this different size bands or even further discussion of specific shiptypes as shown in the following chapters. For the forecast the existing orderbook has been discussed against forecast requirements based on fleet growth demand and scrapping scenarios. In case the existing orderbook exceeds the forecast requirements, the orderbook has been taken as the basis for the summary (Figures in red have been taken for the forecast summary). However, for these ship categories a risk of cancellations exists since the demand forecast is lower than the existing orderbook.

On this basis, the aggregated figures show an annual average delivery of 31 ships, representing 58,6 mDWT, 43,7 mGT and 27,6 mcGT. By using price trends from the last ten years, the overall annual average market value has been calculated to 82,0 billion USD. However, it cannot be expected that the timely market distribution is equal over the coming five years, because the existing orderbook for bulk carriers, oil tankers and general cargo, which is exceeding the forecast data, will be delivered in the coming two years. There is also a danger that for those ship types cancellations will be seen, which will reduce the overall market volume respectively.

The overall market has also been divided in four submarkets, representing (1) bulker and container ships, (2) all types of tankers, (3) special cargo ship categories and minor fleets (reefer, RoRo, general cargo, car carrier, special cargo) and (4) non cargo carrying vessels (NCCV), passenger vessels and offshore vessels. This clearly shows that although by far the biggest market in size (91% in DWT and 83% in GT) categories (1) + (2) represent only 45% of the market value in USD. In comparison to this category (4) represents about 46% of the market value in USD, but only about 8% of the forecast in GT.

Shiptype	No	DWT	GT	CGT	Total USD
Bulk Carrier	1.702	127.656.219	70.505.458	30.644.695	49.711.055.740
Container	932	59.356.543	54.777.462	28.507.239	50.361.698.179
Subtotal	2.634	187.012.762	125.282.920	59.151.934	100.072.753.919
Average per year	527	37.402.552	25.056.584	11.830.387	20.014.550.784

Shiptype	No	DWT	GT	CGT	Total USD
Oil Tankers (Crude + Products)	757	50.247.513	27.194.747	11.219.780	26.364.766.725
Chemical Tankers	787	11.249.207	7.067.171	8.653.058	16.380.957.576
LNG	171	14.040.970	17.544.369	13.865.603	33.496.402.742
LPG	189	3.593.909	2.879.620	2.479.830	5.879.035.482
Special Tanker	40	490.413	370.324	453.474	972.248.225
Subtotal	1.945	79.622.012	55.056.230	36.671.745	83.093.410.750
Average per year	389	15.924.402	11.011.246	7.334.349	16.618.682.150

Shiptype	No	DWT	GT	CGT	Total USD
General Cargo incl. MP	530	6.670.951	4.678.233	4.342.685	8.244.445.125
Car Carriers (PCC & PCTC)	231	3.661.427	10.277.885	6.046.421	11.681.685.046
Reefer	8	38.010	43.221	73.963	206.101.456
RoRo	156	1.159.685	1.711.628	1.516.103	4.256.309.563
Special Cargo	219	3.746.333	3.154.844	2.586.830	12.359.873.636
Subtotal	1.144	15.276.407	19.865.810	14.566.002	36.748.414.825
Average per year	229	3.055.281	3.973.162	2.913.200	7.349.682.965

Shiptype	No	DWT	GT	CGT	Total USD
Passenger Cruise	34	255.570	3.217.203	3.349.078	16.243.028.499
Passenger Ferry	174	176.277	1.179.982	1.626.595	8.442.027.534
Passenger Yacht	191	44.851	296.753	1.184.336	7.229.189.097
Passenger Other	19	15.001	65.831	187.694	516.540.201
NCCV Dredger	109	504.676	415.231	734.922	3.304.209.582
NCCV Fishery	428	243.535	445.277	1.373.058	7.120.678.841
NCCV Tug	226	101.763	215.435	703.966	4.675.744.918
NCCV Other	79	229.546	341.378	584.893	4.587.838.007
Offshore AHTS	1.068	2.263.711	2.921.721	6.367.032	35.464.365.642
Offshore OSV	715	2.601.301	2.706.414	5.203.968	33.909.052.645
Offshore Production	81	4.055.609	4.832.649	3.274.245	48.963.061.382
Offshore Construction	35	410.205	801.969	748.550	6.337.975.885
Offshore Research	47	120.988	315.724	427.191	6.304.479.718
<500 GT	1.227	190.511	349.348	1.753.299	7.013.196.206
Subtotal	4.433	11.213.543	18.104.916	27.518.826	190.111.388.157
Average per year	887	2.242.709	3.620.983	5.503.765	38.022.277.631

Total overall	10.157	293.124.724	218.309.876	137.908.508	410.025.967.651
Average per year	2.031	58.624.945	43.661.975	27.581.702	82.005.193.530

Table 3: Ship newbuilding forecast [Shipyard Economics and BALance TC calculations]

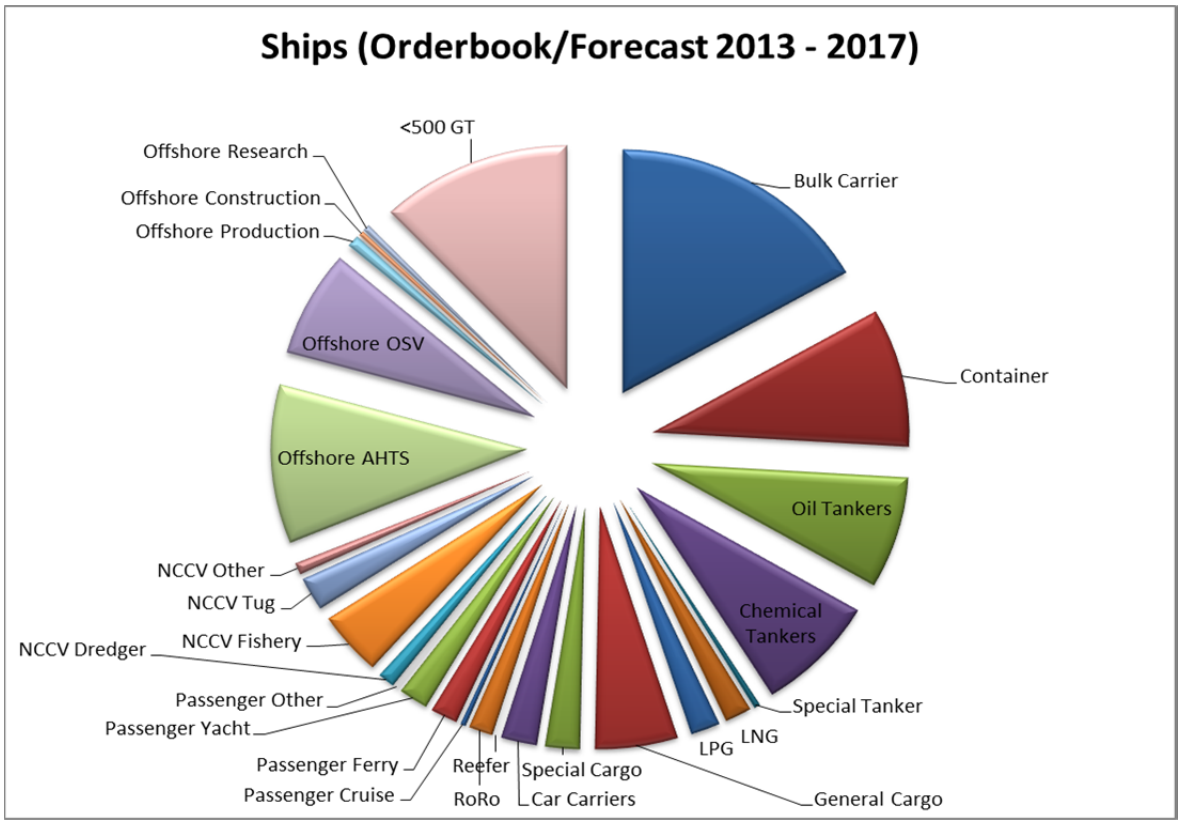


Figure 36: Ships (orderbook / forecast 2013-2017), [Shipyard Economics and BALance TC calculations]

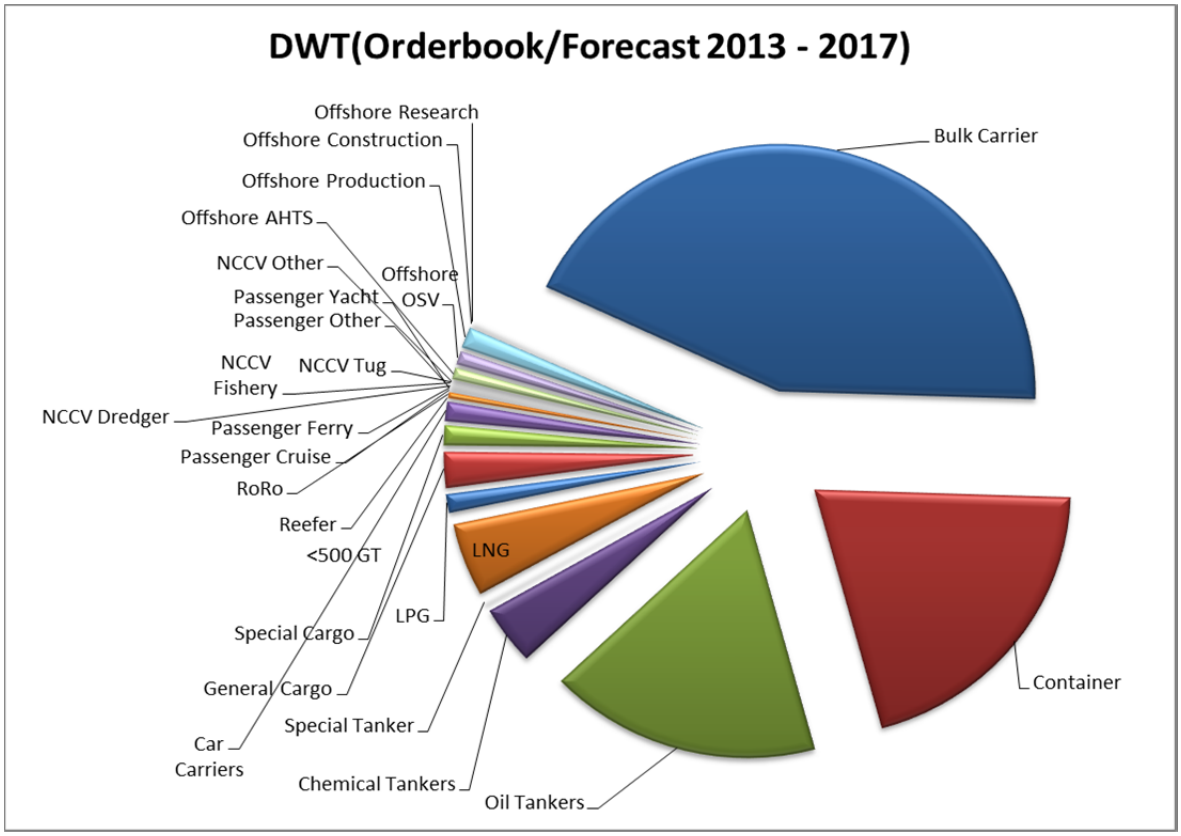


Figure 37: DWT (orderbook / forecast 2013-2017), [Shipyard Economics and BALance TC calculations]

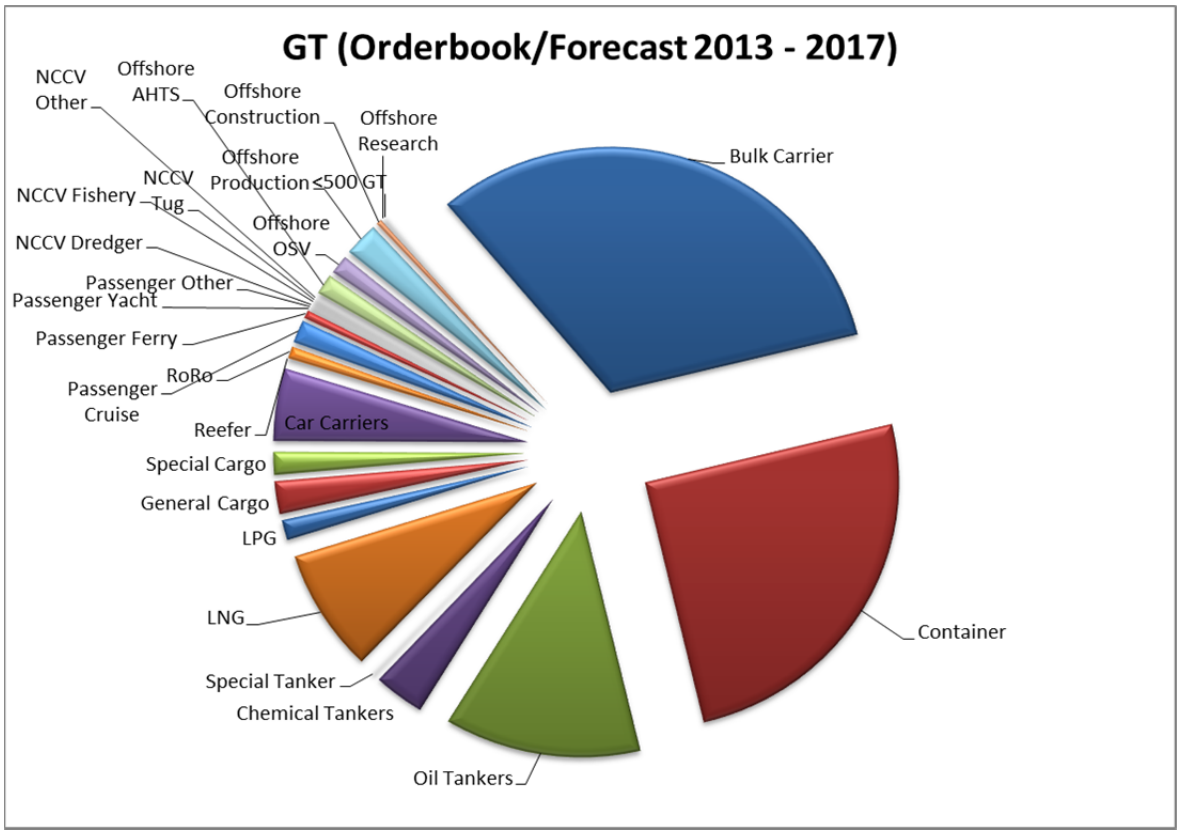


Figure 38: GT (orderbook / forecast 2013-2017), [Shipyard Economics and BALance TC calculations]

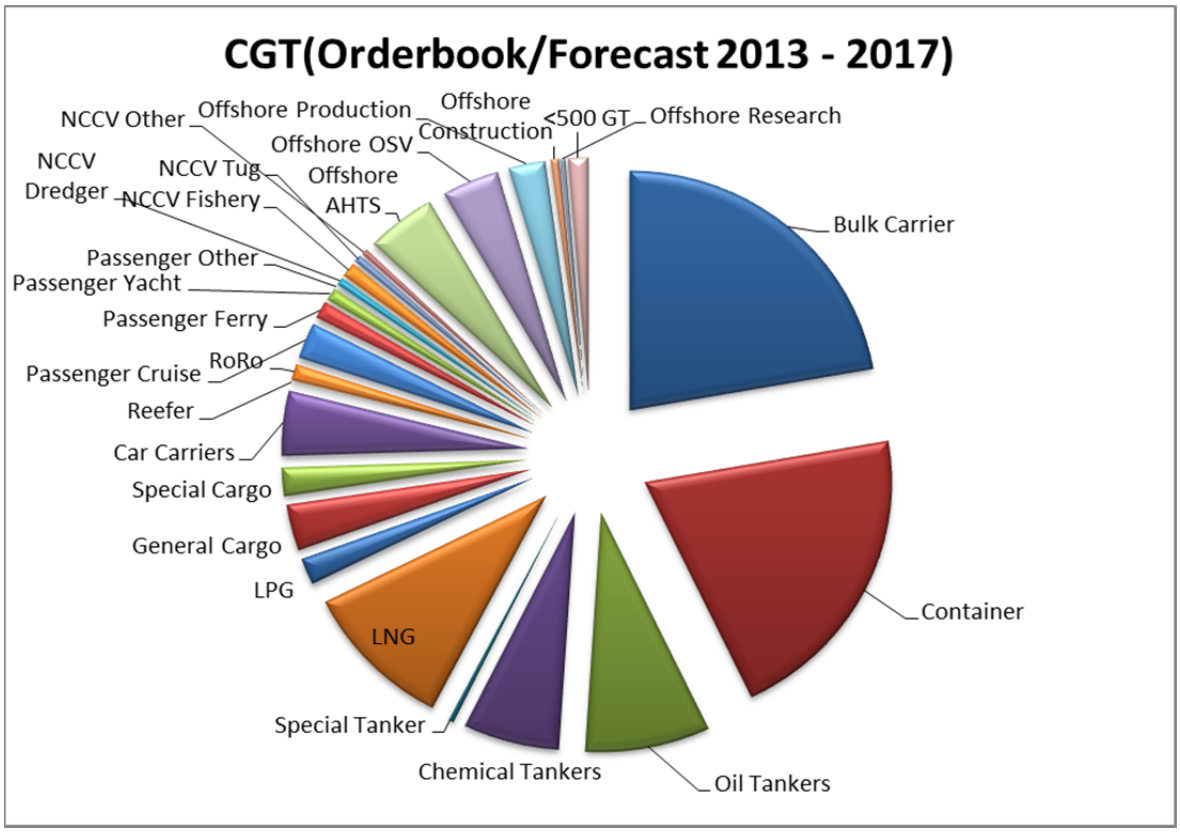


Figure 39: CGT (orderbook / forecast 2013-2017), [Shipyard Economics and BALance TC calculations]

In comparison to an earlier analysis by the authors based on the record high orderbook 03/2008 (5 years delivery schedule, 3,5 years 100% yard capacity utilisation, annual delivery in average 45-50 mcGT) the actual orderbook/forecast 2013-2017 (5years delivery schedule, yard capacity utilisation <70%, annual delivery in average <30 mcGT) shows significant

differences. Although both market evaluations represent a monetary volume of slightly over 400 billion USD, the other parameters are quite different as shown in the following table. It demonstrates that the comparable shipbuilding volume risks to be 30-40% lower in the period 2013-2017 than it was estimated for 2008-2012.

	3/2008 Orderbook	2013-2017 Orderbook/Forecast	Comparison
No. of Ships	9422	10157	108%
DWT	517 mDWT	293 mDWT	57%
GT	336 MGT	218 mGT	65%
cGT	181 mcGT	138 mcGT	76%

Table 4: Comparison orderbook 03/2008 and forecast 2013-2017

This comparison shows that the orderbook has significantly changed, away from major steel intensive shiptypes (tankers, bulkers, container) towards more sophisticated and outfitting intensive shiptypes (passenger, offshore, NCCV). This is to certain degree good news for many shipyards and marine suppliers. Although the orderbook has been declining in terms of ship sizes, the monetary market value per ship has increased due to different shiptype portfolio. However, it seems that the effect is more positive for marine suppliers, since the relative value of components and systems has increased in comparison to the share of value added of the shipyards.

Having a look at the present orderbook and compare it with the forecast scenario for the next five years (2013 – 2017) clearly shows that the forecasted demand is already on order to a large extend, especially for the steel intensive ships. According to that the situation is worst for bulk carriers with an orderbook more than 5 times as high as the forecasted demand. Although the forecast does not consider the possibility of speculative orders (shipbuilding markets have tendency to that) the “overbooking” of this shiptype makes cancellations or longer postponements likely. Also for some other shiptypes, the market prosperity for new orders seems to be low. The following two diagrams show the overall situation, indicating the shiptypes with “overbooking” (orderbook >100% of forecast) in red, “orderbook meets demand (80-100%)” in light red and “prospects for new orders” in light green (50-80%) and dark green (<50%).

Looking into future beyond 2017, it is likely that the major fleets (bulker, tankers, containers in some parts of the fleet) will continue to suffer from oversupply for the foreseeable future (compare figure 32 above). This combined with a normalised ordering activity for ships and normal scrapping scenarios will keep the pressure on the shipping market high. In combination with underutilisation of yard capacities the shipbuilding market in general will remain a buyer’s market. This might be different for specialised vessels and minor fleets and also for the demand created by the offshore industry for offshore supply vessels, drillships and production units. For these vessels the demand drivers are not seaborne trade, but energy demand in combination with high energy prices, creating demand for offshore production of any kind of fossil and renewable energy.

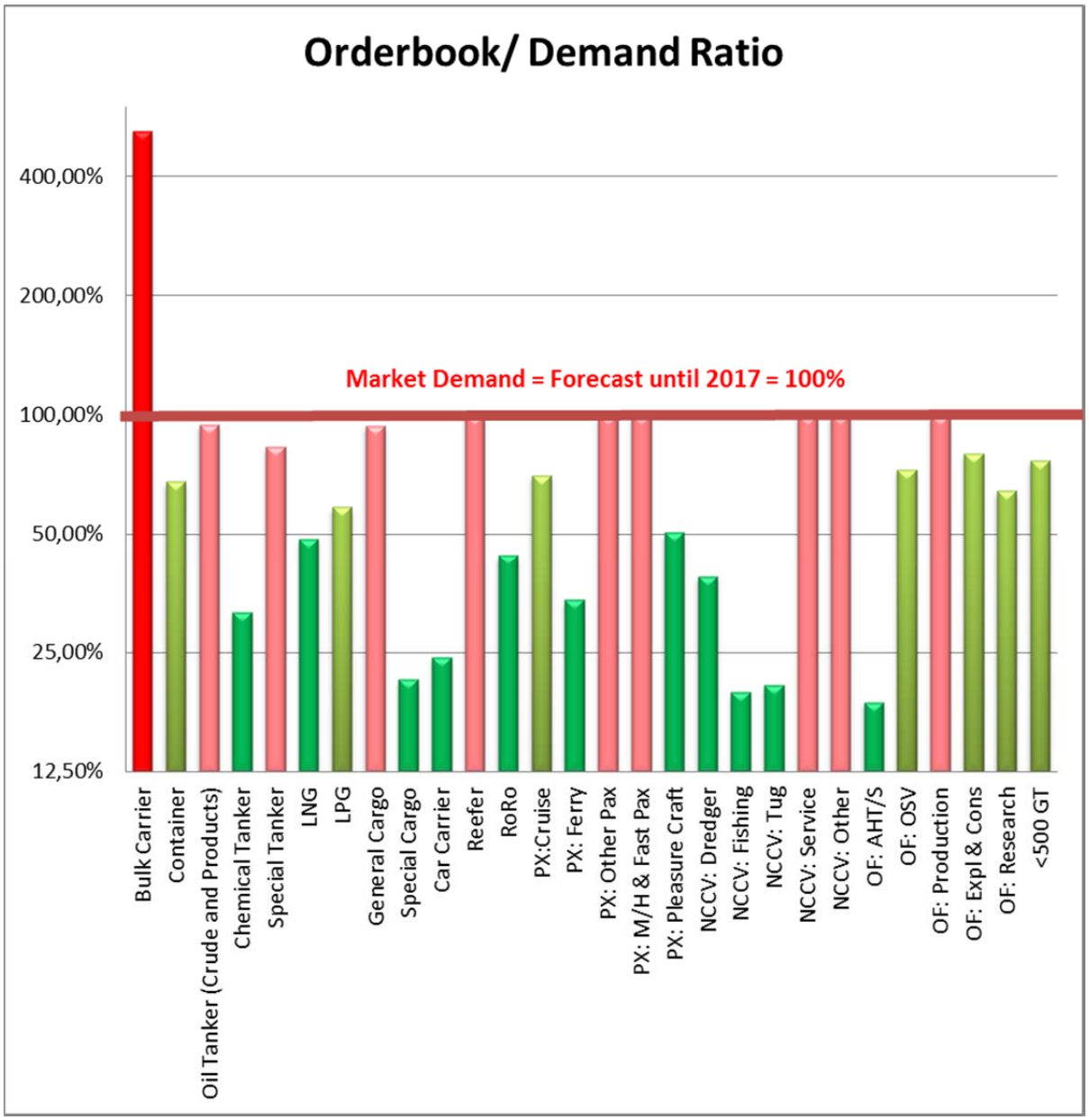


Figure 40: Orderbook/demand ratio [BALance TC calculations]

A detailed analysis on the shipbuilding market per shiptype including analysis of the existing fleet is given in Annex 4.

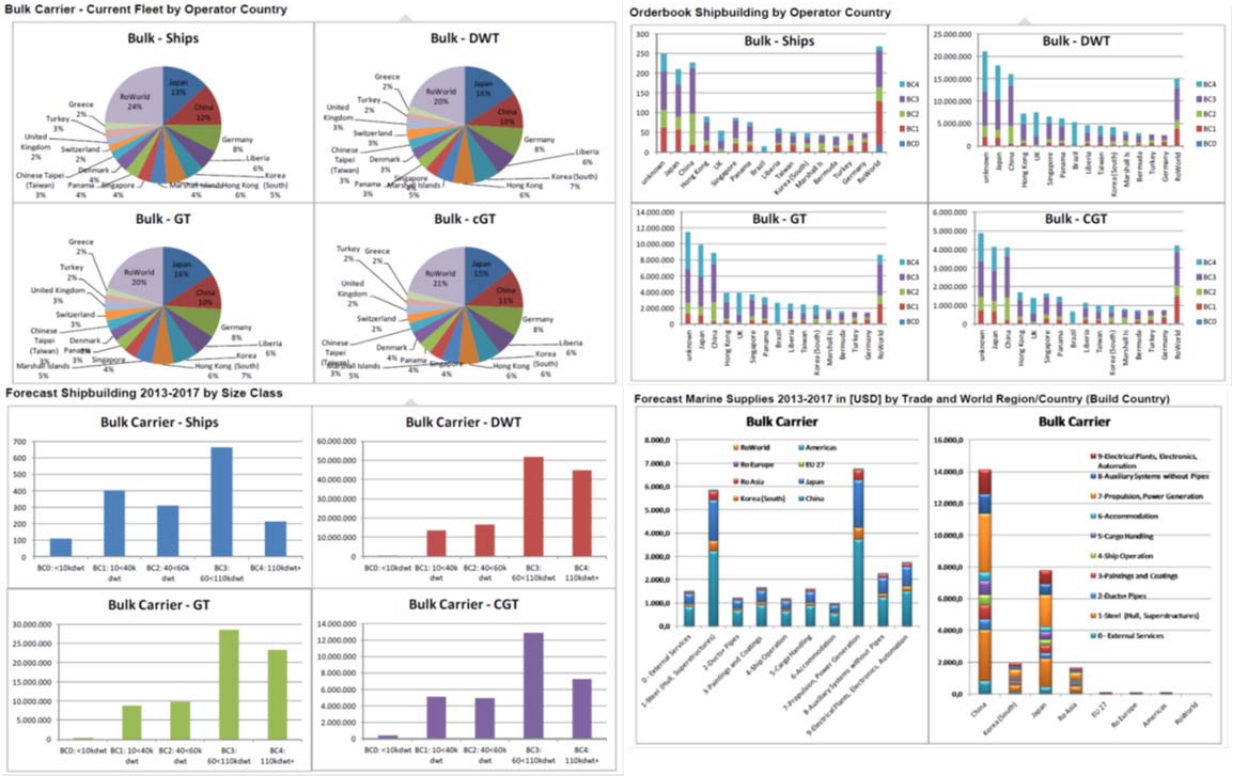


Figure 41: Portfolios per ship type, fleet structure, shipbuilding and marine equipment forecast (See Annex 4)

5.2.3 Marine supplies market 2013-2017 for new-building of ships

The authors have calculated the market for marine supplies created by ship new building in the period 2013-2017 based on the shipbuilding forecast as outlined in the previous chapter. Calculations are based on individual cost models per shiptype and shipsize, suggesting relative values of marine supply trades in relation to the overall value of the vessel. In addition the geographical distribution of the shipbuilding demand/orderbook projection gives an indication on where the demand for marine supplies is created. The following description gives an overview on the forecasted demand for marine supplies by supply trade, shiptype and region. A detailed analysis on the marine supplies market per shiptype is given in Annex 4 (Shiptype Portfolios).

On the basis of the shipbuilding market forecast as given above predicting an approx. 410 billion USD market for 26 different ship categories over a period of 5 years, the marine supplies forecast sums up to 253 billion USD (62% of shipbuilding market). This figure can be further subdivided into approx. 71 billion USD for materials (steel plates, profiles, pipes, ducts, paint, 17,5% of the shipbuilding market) and into approx. 185 billion USD for marine equipment (systems and components, approx. 45% of the shipbuilding market). Both figures include supplier services for pre-manufacturing and assembly on board.

The following figures show a more detailed analysis of the marine supplies forecast 2013-2017 per marine supply category and per ship type.

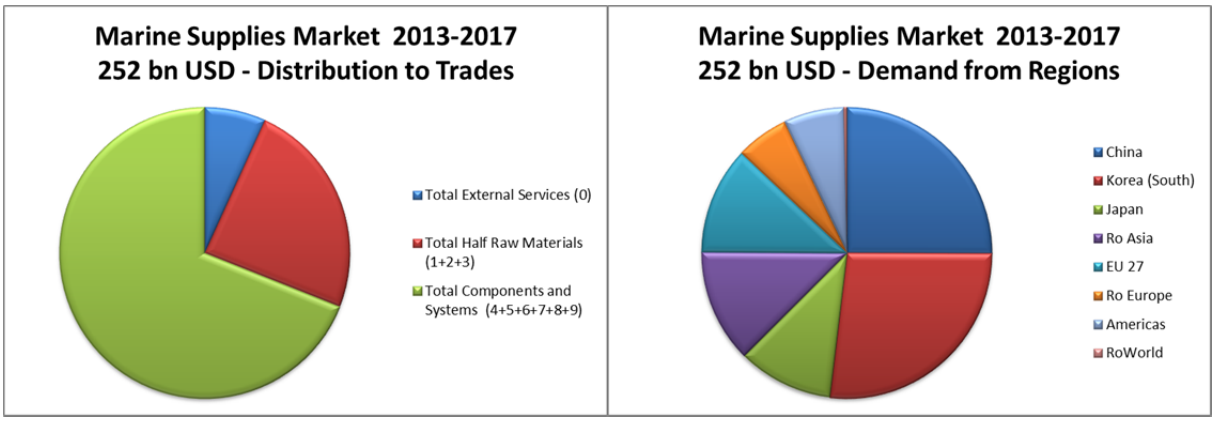


Figure 42: Marine Supplies Market 2013-2017

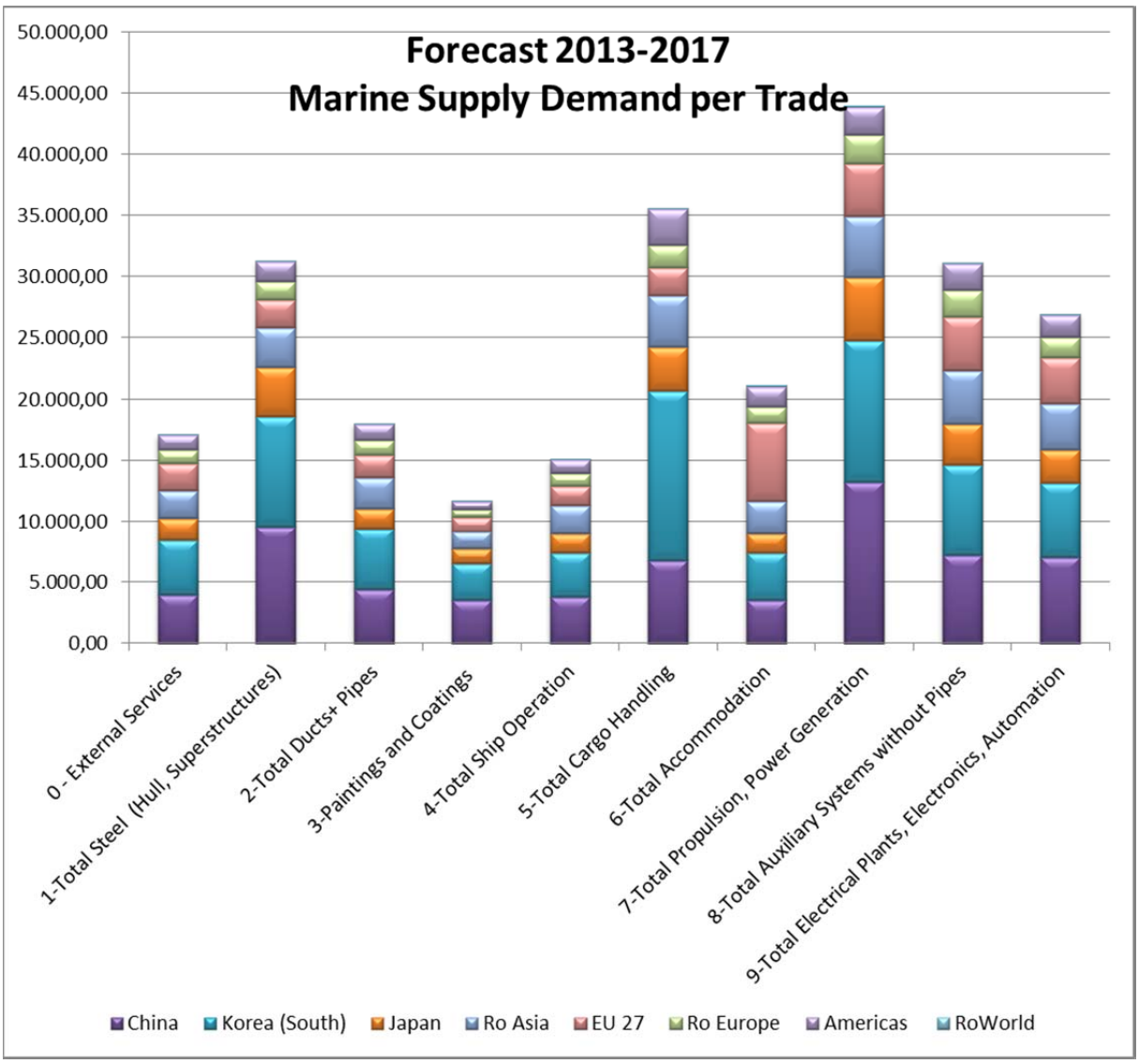


Figure 43: Forecast 2013-2017 marine supply demand per trade

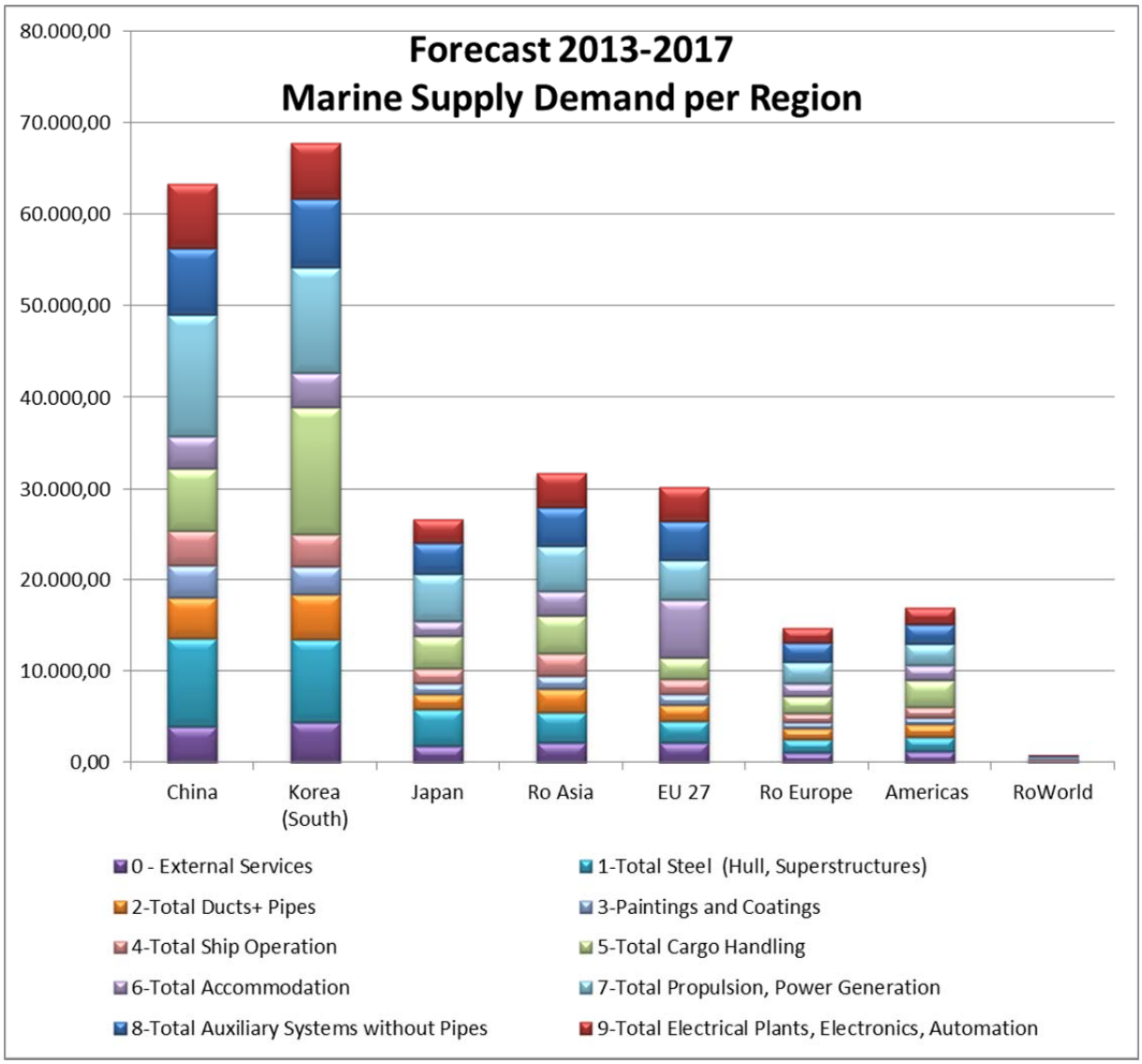


Figure 44: Forecast 2013-2017 Marine supply demand per region

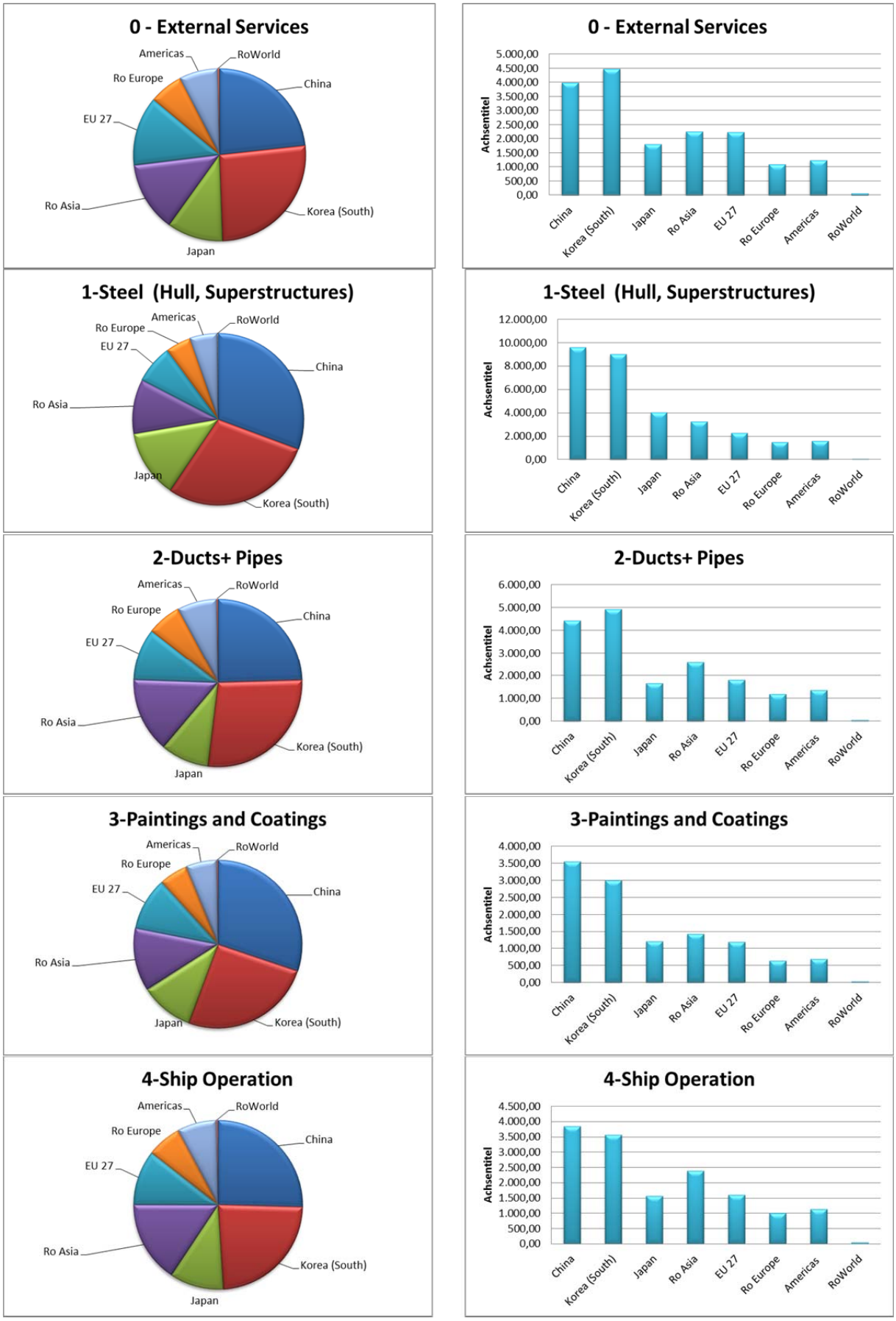
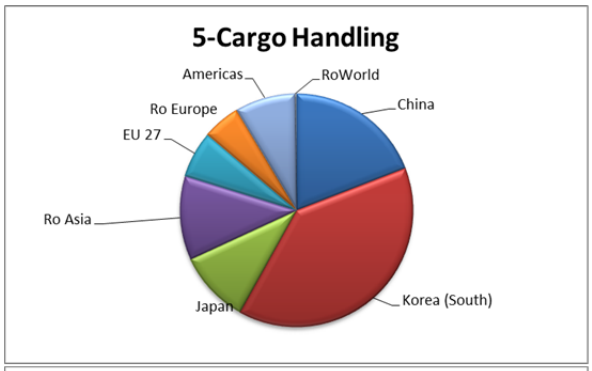
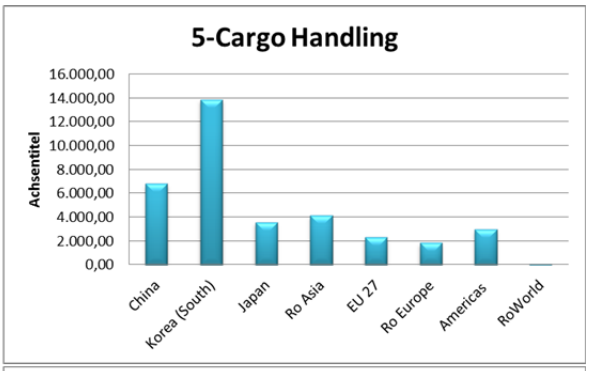
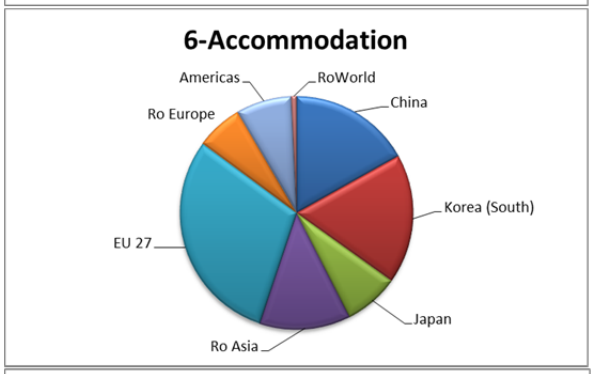
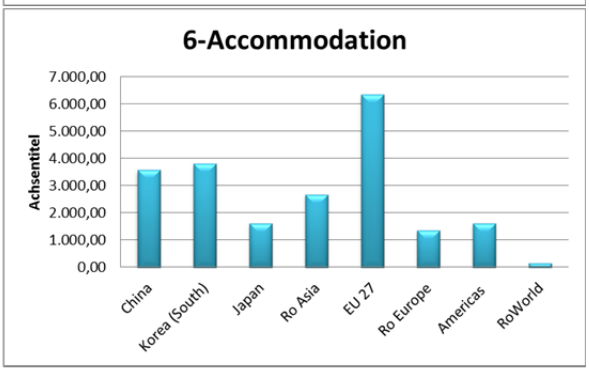


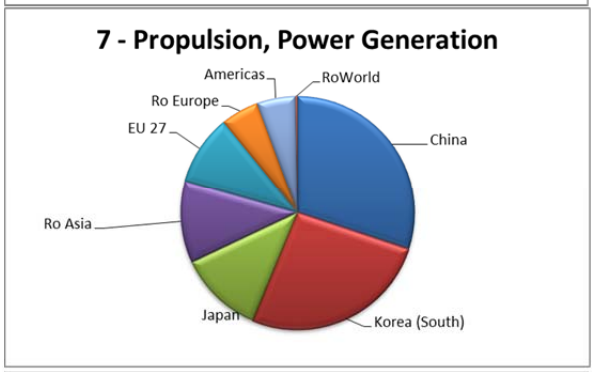
Figure 45 Forecast for different trades 1

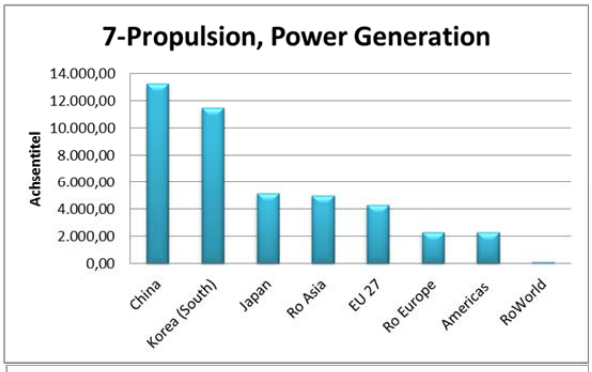


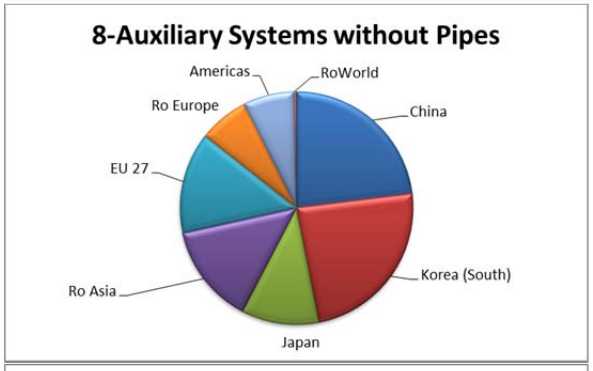


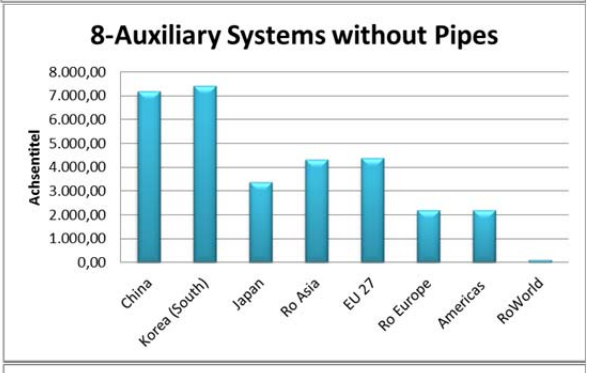


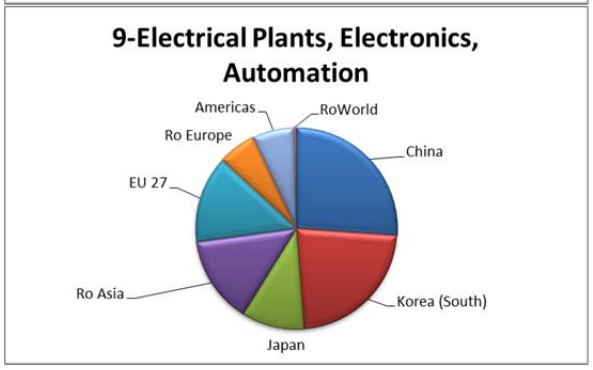












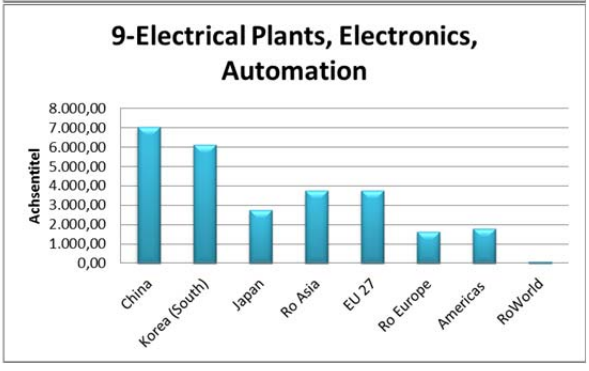


Figure 46: Forecast for different trades 2

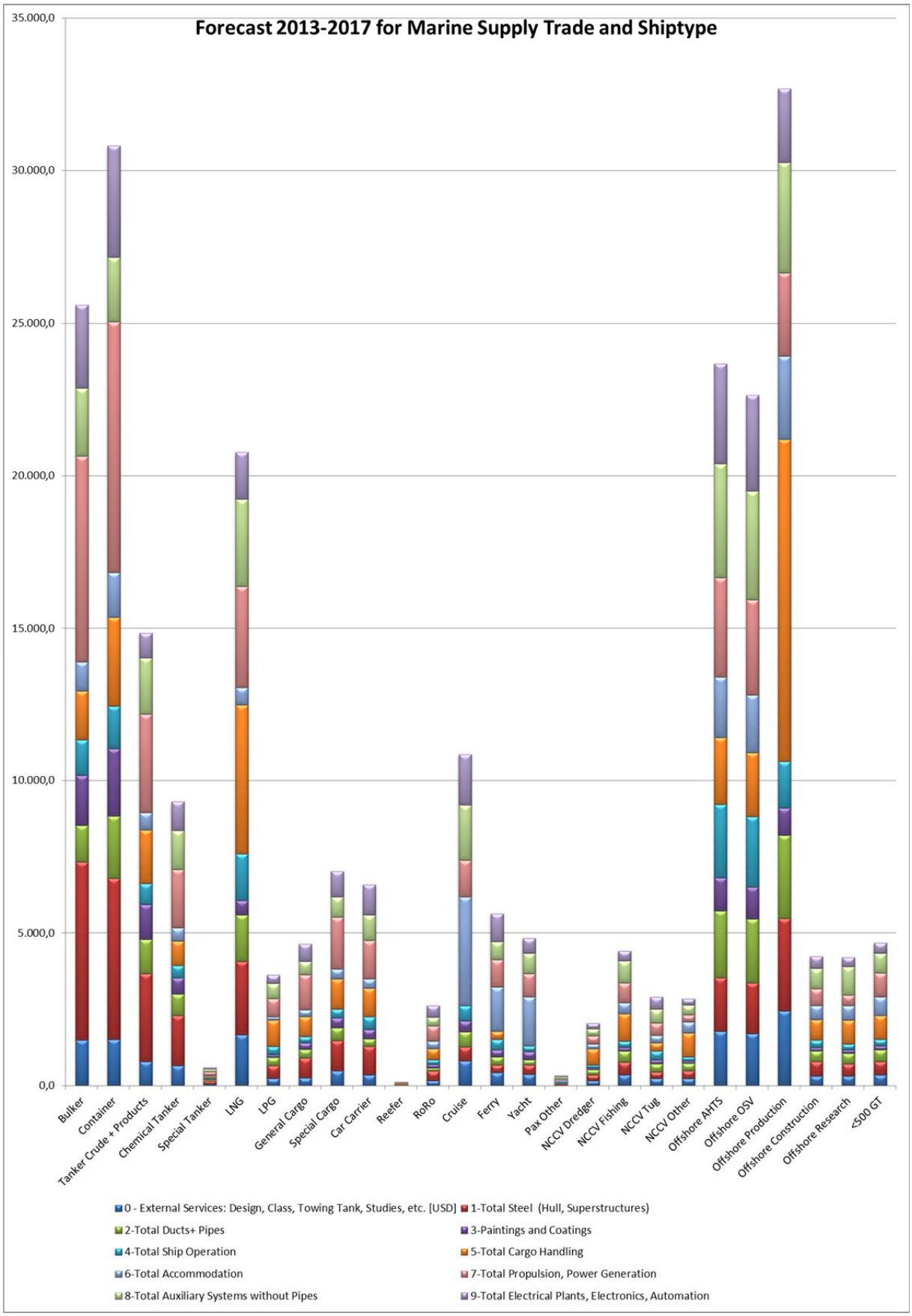


Figure 47: Forecast 2013-2017 for marine supply trade and ship type

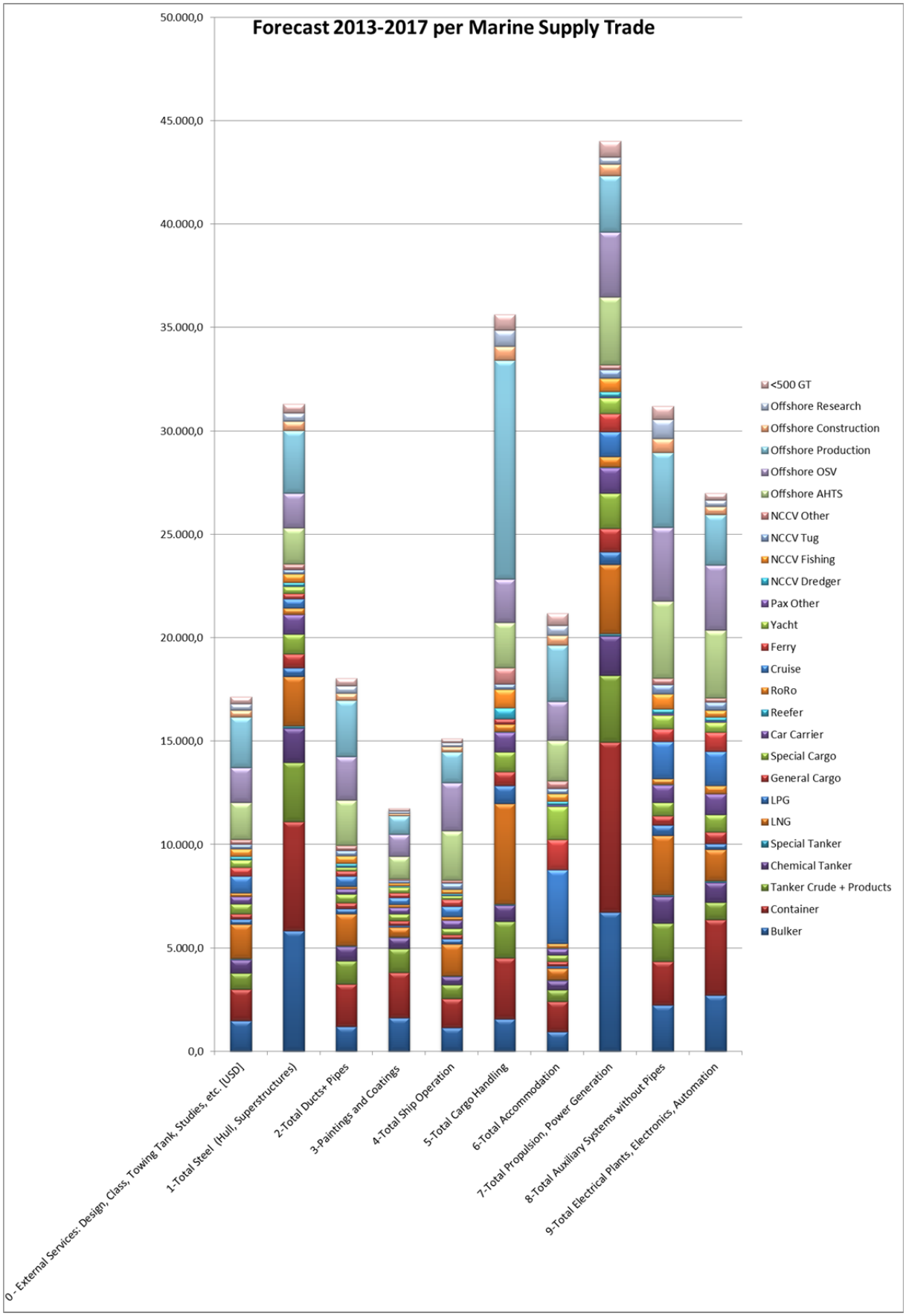


Figure 48: Forecast 2013-2017 per Marine supply trade

A detailed analysis on the marine supplies market per shiptype is given in Annex 4 (Shiptype Portfolios).

5.2.4 Chances and risks for European marine supplies industry

The European marine supplies industry is split into two different groups. On the one hand there are global players who are active in one or more marine markets and one or more supply trades. This group is to a large represented by the top 100 companies as described in chapter 4, i.e. large or medium sized companies. On the other hand the vast majority of companies is dependent on regional maritime markets or even dependent on single maritime customers. This group of companies is basically consisting of a large number of small and medium sized enterprises, often also located in the close proximity of shipyards or in areas (also cross border) with intensive maritime activities. These two groups face different risks and challenges, but also have different opportunities in accessing market and in the co-operation with their customers.

With regard to the marine market it can be said that this is getting a truly global market. It is difficult or impossible to say with any degree of confidence that any part of the market can be considered as an 'EU share'. EU suppliers same as the shipyards will have to compete in all sectors on the world market, there are no longer safe havens either by virtue of EU ownership or build of ships. While there may be natural tendencies to source from the EU for both EU owners and EU builders, the final decision is technical ("Does the equipment meet the technical specification?") and maybe more important, commercial ("Is the product at the right price?").

Global players:

As shown in Chapter 4 and Annex 3, Europe's strong position in the global marine supplies market relies on a relatively limited number of companies with leading market positions in one or more segments. These companies are dependent on the market development on a global scale and serving the whole shipbuilding market including those ship types with systems, equipment and services, which do not play any role anymore in European shipbuilding. The majority of these companies are coming from Northern Europe, building their strength also on a general strength in machine building or technical services or a traditionally strong maritime market. The same group of companies is also very active in M&A activities, extending their position as system suppliers or benefit from global distribution of manufacturing. The financial crisis leads to a strengthening of their market position. It is likely that this trend will continue in the foreseeable future. The products of these companies are at the forefront of technical performance including high level of reliability and quality. Continuous innovation and competitive cost levels are the keys for maintaining this market position, even more so as the increasing demand for energy efficient and environmentally friendly vessel opens the market for many sophisticated systems with a high performance. Not only innovation is critical for success for such new applications, a powerful and well distributed service network is a "must have" market asset in order to convince shipping companies to rely on their products, because they can offer a global service network in order to help keeping ship downtime at a low level.

As the shipbuilding market is moving more and more to Asia and also the position of European shipping companies is presently weakening in the international competition, there is a risk to loose market shares to developing Asian marine supplies competitors; even more so as some Asian countries establish strategies to improve their market position. Examples for this are South Koreans export offensives and programmes to develop systems for offshore units. The sharp increase in obtaining type approvals for marine equipment by Asian manufacturers is a clear indication of these efforts as well. Although risky with regard to IPR protection, European marine suppliers team up with Asian companies in order to counter loosing markets to Asia without own involvement. This materialises in form of co-operations, license agreements, joint ventures and production sites. At the end this might negatively affect European employment in the sector as the well known example of slow speed engines shows.

European regional suppliers

The second group of European marine suppliers represents more the SME group of companies. Here we can distinguish again service providers and equipment suppliers, which have a certain market position defined by their products. We may even find here internationally active companies, but due to the size of their businesses most of them operate regionally, nationally or just cross border European. Especially in the area of subcontracting (for manufacturing and assembly) we find either companies, which had been shipyard businesses in former times (joinery, accommodation specialists, pipe factories, thin metal shops, plate shops etc) or companies, which are specialised in assembly jobs for some specific ship systems. The latter are very often subsidiaries of larger system or component suppliers. These companies live and die with the health of the regional maritime economy. This is a major risk for this type of companies which they can normally not control. In case the related shipbuilding industry in the region is suffering or disappearing, these suppliers are directly affected. To team up with shipyards in order to improve the competitiveness of the value chain by means of smart integrated production processes and low cost is probably the only chance to influence the situation. The only alternative to address this risk is trying to broaden the business basis, i.e. open up to serve also other industries and/or trying to broaden the geographical customer basis. In addition to continuous innovation this strategy can improve the chances to stay in business.

5.3 Marine supplies - Ship maintenance, repair and conversion market

5.3.1 Economic drivers

Major drivers for the ship maintenance, repair and conversion market are the size of the world fleet, fleet utilisation (especially also old ships and the level of laid-up vessels), regular maintenance and docking cycles, irregular maintenance and docking cycles (e.g. following accidents or Port State Control failures), Further reasons triggering demand for maintenance, repair or conversion are changing of flag or classification society following an owner change or adaptation to new regulations. The current demand for retrofitting of vessels following new environmental IMO legislation is discussed separately in chapter 5.4.

A major driver is also the average age of the different fleets. Older average age is causing more repair and conversion activities than needed for younger fleets. Due to the very high ordering activity until 2007 and the related fleet growth and recent high scrapping rates some fleets are presently very young (e.g. bulker). In combination with a low level of fleet utilisation, the repair market activities might be seen as under pressure. However, conversion activities in the offshore market segment, where for example conventional vessels are converted into some kind of offshore production unit or major overhaul of existing offshore floating units may partly compensate for this.

Due to ongoing newbuilding activities and low fleet utilisation it is expected for the foreseeable future that scrapping activities will increase and consequently the average age of ships in the different fleets will go down further. This trend might be even stronger in case shipping companies decide for scrapping instead of retrofitting of their vessels following increasing environmental regulation. The situation might have to be evaluated for every single ship-type, because the average age of ships in the fleets is different and also the places of operation have to be taken into consideration. However, there seems to be no doubt that the overall fleet will increase in numbers and may grow until 2020 by some 30%. This will increase the demand for spare parts and related services and in the longer term also for shipyard related repair activities.

5.3.2 Market size 2013-2017 and long term outlook

For the reason mentioned above, market predictions are difficult and differ over time. In their Annual Report 2013 CESA gives figures on the volume of the European market in the range of 3-4 billion EUR (4-5,2 billion USD) annually for the period 2006 to 2011 and estimates the global market volume to be in the range of 10-12 billion USD annually. Values for Japan are reported to be in the range of 1,3 billion USD annually. A similar amount is reported for cruise ships alone. All these figures include the turnover of (repair) shipyards only. They do not include voyage maintenance and repair and also not the related expenses for spare parts. In other words these proposed figures do not include any turnover created by direct spare part/materials purchasing by shipping companies or repair services established by the suppliers directly.

Different ideas have been proposed in literature to come up with total figures based on docking frequencies and class cycles for the different shiptypes, but no real estimates for the repair market are available. Therefore, for this study the authors have applied an own approach to estimate the total volume of the repair and conversion market, which is based on the world fleet.

From earlier studies the authors have got figures on repair expenses from shipping companies ranging from 0% to 4% annually, depending on the age of vessels. Assuming a life cycle of 20 years per ship, it has been decided to make calculations on the basis of annually average value of 1% repair and maintenance cost based on today's replacement cost for the vessel. This approach has been applied to the entire fleet of vessels in service.

Based on this data this calculates to annually 18,5 billion USD total market for maintenance and repair of the world merchant fleet, of which 50% is estimated to be labour cost (shipyard

or shipping companies) and another 50% is estimated to be spare parts (material, equipment including subcontracts for supply companies).

5.3.3 Chances and risks for European marine supplies industry

The ship repair and conversion market is an attractive segment for the marine supplies industry. Once systems and equipment have been installed on ships during newbuilding they provide a continuous market for spare parts, maintenance and other related services. Prices realised are more attractive than for the provision of systems for newbuilding, because only a limited competition has to be faced. However, a very efficient global network and logistical system is required in order to ensure fast and reliable services to shipping companies and shipyards. In the market segment of conversions a high flexibility is required on top in order to cope with limiting conditions of the spatial situation on board and good co-operation with shipyards in the area of conversion-engineering is essential. This is even more important for the retrofitting market as described in the next chapter.

The general market situation of ship repair and conversion rises and falls with the size of the world fleet. The fleet in total is growing and will create a higher demand in the longer term. On the other hand, due to the recent oversupply of newbuildings for some fleets the average age of vessels has decreased which will create for some future a lower demand.

Another important factor is fleet utilisation. Back in 2007/2008, fleet utilisation was extremely high; all capacities including old ships have been used. Consequently it has been attractive to enable the old ships to stay in service for a longer time than originally foreseen. This situation has totally changed today with an underutilisation for some fleets, seeing many vessels being laid off and early scrapping activities for some fleets occur. This has a negative impact on the repair business since many shipping companies have cut expenditure or postponed repair work, trying to lower their costs.

In summary it can be said that the repair and conversion business for marine suppliers is a global business where the geographical location of the yards is of secondary importance. This is at least true for the suppliers of major systems and equipment, because they are serving shipping markets and shipyards worldwide. But again, as for ship new- building, there is a second group of suppliers of considerable size which work in the close proximity of shipyards and which are affected by the market situation of the European ship repair yards. Since the actual market position for European shipyards in ship repair is relatively strong (35%) the impact of a market change would be comparably high. Given the labour intensive nature of the industry, there is a risk that some of this business will be lost to low-wage countries in Far-East and Middle-East and within Europe may be shifted to countries in the south east, e.g. Romania, Ukraine and Turkey. However, apart from the price, shipping companies may decide to accept more expensive offers, due to better know how, quality and timely job execution. This is especially true for cruise ships and liner operators, because there the price aspect is of lower importance. In addition, as said above, a close co-operation of shipyards with suppliers might be an asset for complex ship conversion tasks.

Further risks for the operation of repair yards in Europe originate from increasing environmental restrictions to operate the shipyards, which in itself may be justified, but create problems in the competitiveness of bids. Financing of repair or even more of conversion contracts has become a problem for shipping companies (especially when it comes to retrofitting, see chapter 5.4), because the relative value of the ship in comparison with conversion cost may be unacceptable for the financing banks.

New chances for suppliers and shipyards can be seen in the market of offshore units since in this market the demand is presently quite high due to high fleet utilisation and full order books. Repair and conversion in this market is therefore on a high level and creates besides newbuilding also additional demands for special cargo equipment, meaning in this context the processing plants, drilling systems and special handling equipment. Risks in this segment can be seen by specific and strategic activities in South Korea to generate a better market position for their domestic suppliers, which will affect European and US suppliers in the end.

5.4 Marine supplies - Retrofitting market

5.4.1 Economic drivers - Following new regulation

Experts regard energy efficiency, environmental friendly ships and new ship types as of highest importance for innovation in ship technology. The ranking is illustrated in the following figure.

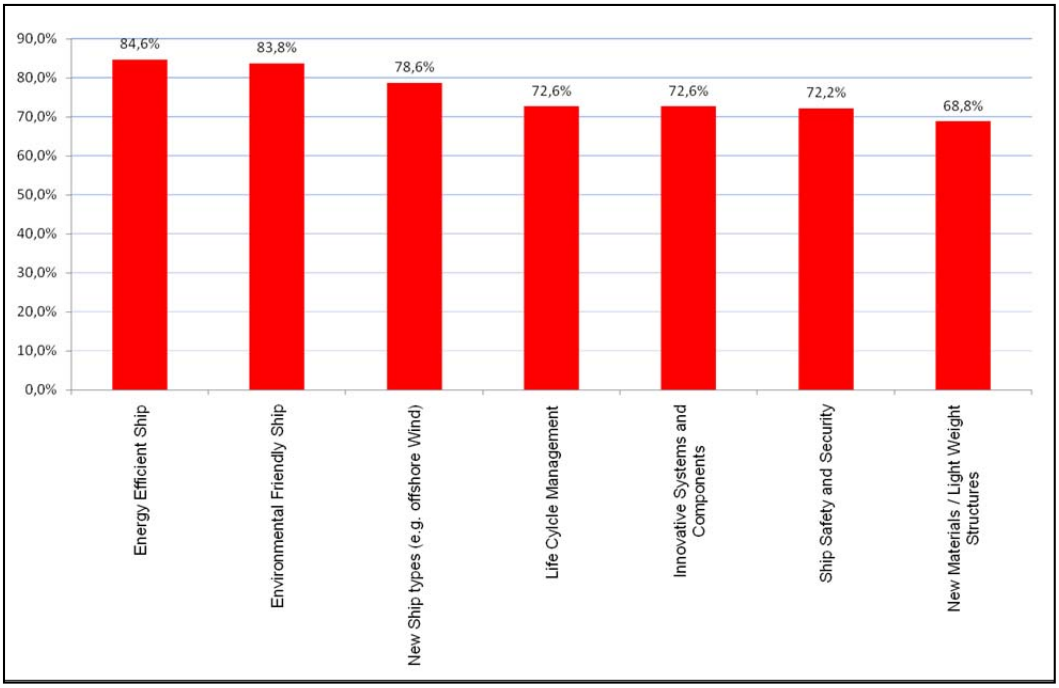


Figure 49: International peer evaluation on trends in innovation [Source (11)]

There are thousands of ships currently sailing on the oceans which are not built according to today's modern standards for energy efficiency. For these in-fleet ships to remain competitive against the backdrop of new buildings and increasing bunker costs, design upgrades, and operational improvements can bring large fuel efficiency gains. Fuel costs have become the main cost driver in shipping.

If the market requests modern and cost efficient vessels the owners are forced to invest in retrofitting or build new ships to stay in the market. The owners have to bring their ships up to today's standards to achieve essential efficiency goals. The driver for the maritime retrofit market is the strong competition because of transport overcapacities in the global fleet as well as new international and national environmental regulation.

The high competition on the waterborne transport market requires the optimisation of vessel operation costs. This is more difficult because of increasing external cost (e.g. fuel costs) which cannot always be transferred by the ship owners to their customers.

All big classification societies are nowadays creating consulting services in order to help shipping companies to make appropriate decisions on which measures are most suitable for their applications. The following figure from GL shows exemplarily additional measures for future improvements and future supply markets.

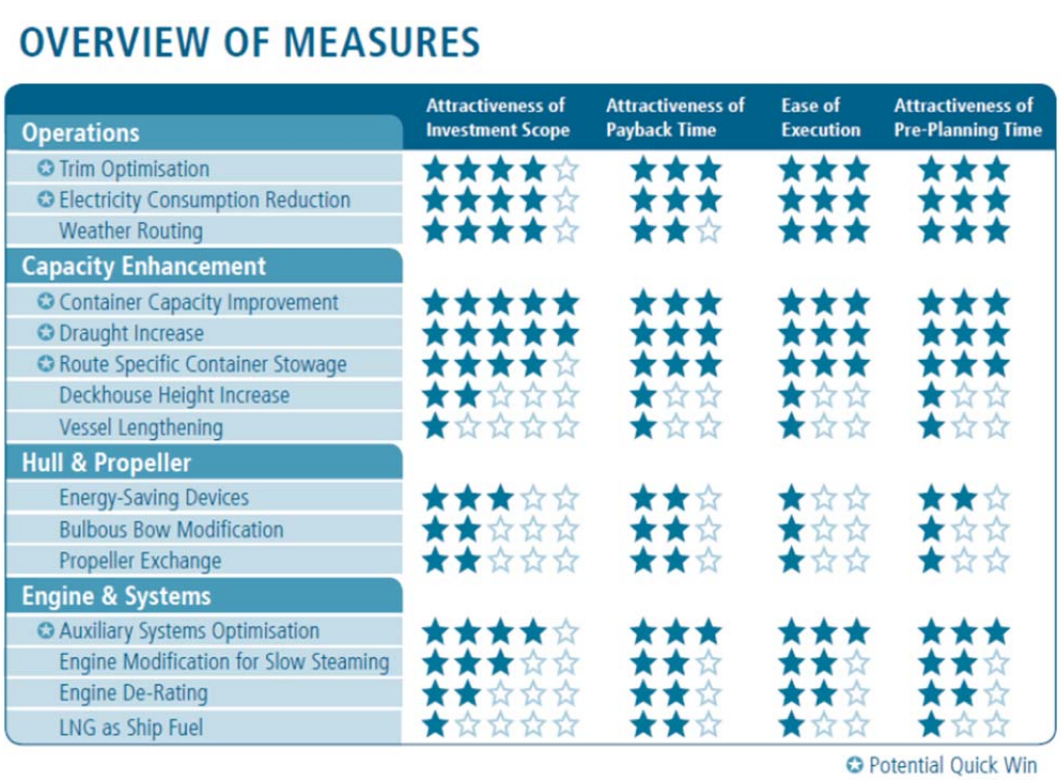


Figure 50: Enhance performance, control cost [Source: (12)*]*

Beside the optimisation activities the upcoming international environmental regulations will influence the maritime retrofit market. Important environmental regulations *[Source* (13)*]* coming into force addressing vessel emissions of

- **GreenHouse Gases (GHG) (in particular CO2)** => EEDI, SEEMP and discussion/preparation of Market Based Measures
- **Sulphur Oxides (SOx) and Particulate Matter (PM)** => MARPOL Annex VI - Reg. 14 (Sulphur Oxides and Particulate Matter (SOx))and the revised Sulphur Directive
- **Nitrous Oxides (NOx)** => MARPOL Annex VI – Reg. 13 (Nitrogen Oxides (NOx) and
- **Ballast Water Management** => IMO (MPEC.152) Ballast Water: Ballast Water Convention

Once in force the regulations will create a special market for retrofitting of existing vessels, which may substantially influence the volume of the repair and conversion sector. It may also create an extra ship new building activity in case the retrofitting cost may not pay-off for old vessels.

In addition to the existing and upcoming regulations the IMO and international authorities such as the EU are discussing the introduction of Market-Based Instruments (MBI) for emissions reduction *[Source* (14)*].* These include an emissions trading system, emissions taxation and a greenhouse gas (GHG) fund coupled with a bunker surcharge.

There are currently three designated **IMO Emission Control Areas (ECA's)** in effect globally, the Baltic Sea ECA (SOx); the North Sea and English Channel ECA (SOx;) and the North American ECA (SOx, NOx, PM). As fourth ECA the United States Caribbean Sea ECA will be in effect from 2014 and concerns emissions of Sulphur oxide (SOx), Nitrogen oxide (NOx) and Particulate Matter (PM) *(Figure 51*) Within the ECAs the sulphur limits are even stricter than defined in MARPOL Annex VI.

In future further discussions can be expected at IMO level, but also on regional or national levels about further emission controlled areas (ECA). This will probably not be limited to sulphur (SECA), but also nitrogen (NECA).

*Figure 51: World Emission Control Areas [*Source: (15)]

The chances for strengthening the rules and regulations with regard to pollution even further will very much depend on the global environmental policy and climate agreements. However, the achievable results are also very much depending on the willingness and financial capabilities of shipping companies, which already for today's rules and regulations in force or waiting to be ratified, succeeded to influence the scope and delay the implementation. In times of crisis implementation and enforcement of new regulations will be even more difficult. However, for marine supply companies increasing technical requirements always imply chances for new technological markets, which need to be early identified and served with innovative solutions.

5.4.2 Market Size 2013-2017

Different environmental regulations will enter into force in different years depending of the size of the vessel, the kind of vessel, the size of the equipment (e.g. amount of ballast water), etc. For some regulations schedules are currently under discussion and may be shifted for different reasons.

Green House Gases (GHG) (in particular CO2): The IMO made instruments for reducing marine carbon emissions mandatory for all new buildings and in-service vessels: the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP).

Initially, the **EEDI** applies to container ships, tankers, bulkers, general cargo ships and refrigerated cargo carriers above 400 gross tonnes, but applications for other ship types planned. At present ships with steam turbine, diesel-electric and hybrid propulsion are excluded. The EEDI is mandatory since January 2013 and defines that new buildings have to have an increased fuel efficiency of 30% over a period of three phases up to 2025. Load capacity, speed and design quality are the main drivers for a vessel's EEDI compliance. Within these three areas ship owners can optimize their vessels to meet regulations and, at the same time, reduce fuel costs. This regulation will have an enormous impact on the shipping industry but is also a challenge for supplier market to offer new solutions (e.g. increase propulsive efficiency & power production efficiency, reduce auxiliary consumption…).

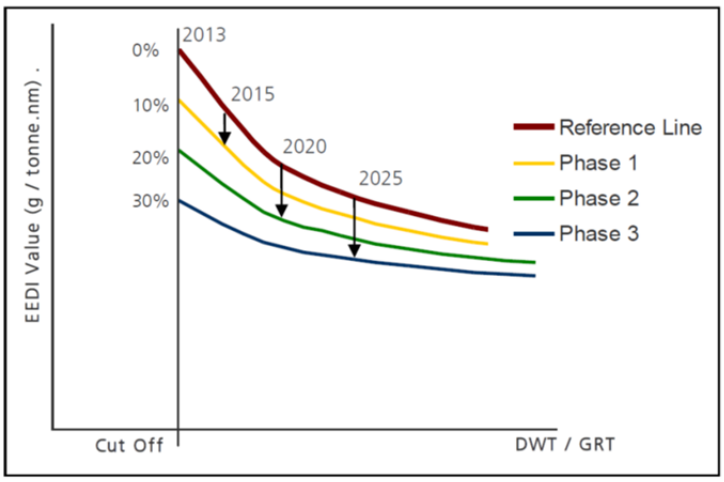


Figure 52: Regulatory concept of the EEDI [Source: (16)]

In contrast to other emission abatement technologies energy efficiency measures fulfil two goals because they reduce fuel consumption and consequently emissions, and they are (potentially) cost-effective. The expected higher energy prices and corresponding fuel prices will increase the focus on development and installation of more energy-efficient systems on vessels.

The EEDI is only applicable for new buildings and has only an indirect effect on the retrofit market. The reduction of fuel consumption and therefore the operational costs of new vessels will exercise a strong pressure to retrofit existing ships in order to stay competitive.

The **SEEMP** (see IMO Guidelines (Resolution MEPC.213(63)) is mandatory for ships over 400 GT since January 2013. It is intended to be a practical tool to support ship owners managing their environmental performance and improve the operational efficiency over time.

It forces the vessel managers and entities to consider new technologies and practices optimising the ship performance. An IMO Study *[Source:* (17)*]* indicates that a 20% reduction on a tonne-mile basis is possible mainly by operational measures and it would be cost-effective even with the current fuel prices. The intension of SEEMP is to assist the shipping industry achieving this potential.

First of all SEEMP related measures will address the organisational and less investment intensive activities. But especially when phase 2 of EDDI will be implemented from 2020 forward additional investments for retrofitting can be expected. After 2020 new ships have to operate 20% below the IMO reference lines and existing vessels have to compete with them on the market.

Sulphur Oxides (SOx) and Particulate Matter (PM): Under the revised MARPOL Annex VI, the global sulphur cap *[Source:* (18)*]* is reduced initially to 3,5% (from the current 4,5%), effective from 1 January 2012; then progressively to 0,5%, effective from 1 January 2020, subject to a feasibility review to be completed no later than 2018. Based on the result of that review it can happen that the effective date will be shifted to 2025.

The limits applicable for all vessels operating in SECAs/ECAs for SOx and particulate matter were reduced to 1,0%, beginning on 1 July 2010 (from the original 1,5%); being further reduced to 0,1%, effective from 1 January 2015 *(Figure 53)*. From 2016 NOx emissions for new buildings operating in ECAs will also be limited *[Source:* (19)*].*

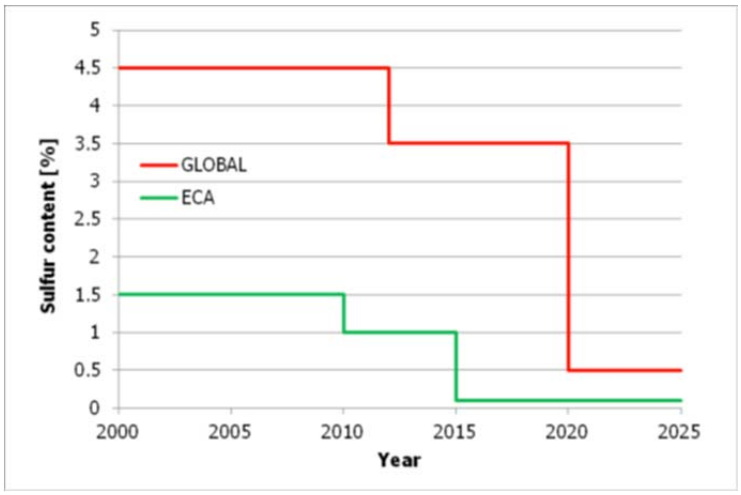


Figure 53: Sulphur content limits in Emission Control Areas (ECA)

The limits apply to all kind of vessels operating in ECAs. Nowadays a lot of vessels operate in ECAs and in the future it can be expected that additional ECAs will be defined. Three different solutions/technologies are available and tested to reach the defined limits:

- Scrubber solutions
- Low sulphur fuel (MGO – Marine Gas Oil)
- Liquefied Natural Gas (LNG) as fuel

Scrubber Solutions: It is for sure that the mentioned solutions and may be some additional technologies will be applied to the existing fleet. It is not easy to predict which owner will select which technology for his fleet or at least for a part of his fleet.

Within our calculation we have assumed that 50% of the fleet will implement a scrubber solution. Within the first phase (until 2015) a part of the existing fleet will install the scrubber solution while it is only required in some predefined areas. But with the low levels globally defined the installation of scrubber will be increased.

SOx Abatement Technology Market										
Vessel types affected by scrubber technology	Amount of vessels build before 2010	Retrofit costs for the main engine scrubber installation					Retrofit costs for the auxiliary engine installation			
		CAPEX for main engine scrubber in $k	OPEX for main engine srubber in $k (over 5 years)	Percentage share of vessels selecting scrubber technology	Total market based on the scrubber technology selection in $k	OPEX over 5 years in $k	CAPEX for Auxiliary Engine in $k	OPEX for Auxilery Engine in $k (over 5 years)	Total market based on the scrubber technology selection in $k	OPEX over 5 years in $k
Oil Tanker	4.984	$ 5.590.101	$ 557.172	50%	$ 2.795.051	$ 278.586	Scrubbers are not necessary			
Chemical Tanker	3.877	$ 5.835.582	$ 582.690	50%	$ 2.917.791	$ 291.345	Scrubbers are not necessary			
Bulk Carrier	6.589	$ 11.517.163	$ 1.154.577	50%	$ 5.758.582	$ 577.289	Scrubbers are not necessary			
General Cargo	9.716	$ 12.909.943	$ 1.290.571	50%	$ 6.454.972	$ 645.286	Scrubbers are not necessary			
RoRo Vessels	975	$ 977.246	$ 97.621	50%	$ 488.623	$ 48.811	$ 722.046	$ 73.943	$ 361.023	$ 36.972
Container	4.417	$ 10.061.108	$ 1.005.227	50%	$ 5.030.554	$ 502.614	$ 6.771.432	$ 677.669	$ 3.385.716	$ 338.835
Passenger	1.251	$ 1.441.052	$ 144.491	50%	$ 720.526	$ 72.246	$ 1.286.929	$ 125.225	$ 643.465	$ 62.613
Total	**31.809**	**$ 48.332.195**	**$4.832.349**		**$ 24.166.098**	**$ 2.416.175**	**$8.780.407**	**$ 876.837**	**$ 4.390.204**	**$438.419**
Total market main and auxiliray engine scrubber installation in $k (based on the percentage share selected scrubber technology)					**$28.556.301**					
Total market for scrubber operatinal costs in $k (50 % 0f affected vessels)						**$ 2.854.593**				

Figure 54: SOx abatement technology market

For the first phase it is expected that approx. 16% of the fleet *[Source:* (20)*]* needs the Scrubber installation which means a market volume of 4,5 billion USD until 2015 followed by most of the investments during the period until 2020 respectively until 2025 if the effective date will

be shifted for the last step. It cannot be expected that a lot of ship owners will invest in scrubbers before the starting date for the last step has been finally agreed. The investment curve will follow an exponential function (starting slow and increase especially within the final phase before the deadline).

Nitrous Oxides (NOx): Beside the limits for SOx emissions MARPOL Annex VI sets also limits for NOx emission of vessels. The emission limits are set for diesel engines depending on the engine maximum operating speed presented in *Figure 55.* Tier I and Tier II limits are global, while the Tier III standards apply only in NOx Emission Control Areas.

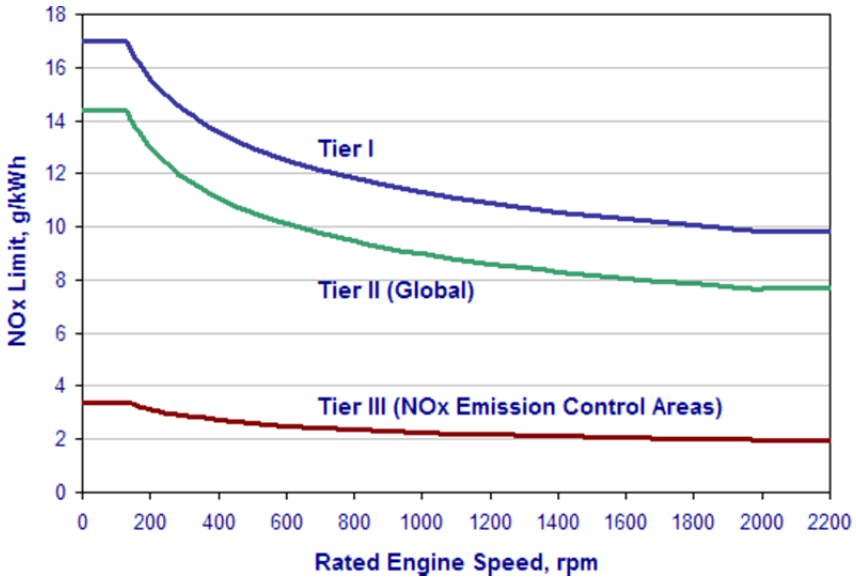


Figure 55: MARPOL Annex VI NOx emission limits

It is expected that Tier II standards can be met by combustion process optimisation. Tier III standards are expected to require dedicated NOx emission control technologies such as various forms of water induction into the combustion process, exhaust gas recirculation, or selective catalytic reduction.

Tier III applies only for vessels constructed after 1. January 2016. Therefore retrofit of Tier III technology is mainly relevant for vessels constructed after this date if they have not been delivered with the technology. Present state of the technology is not available for retrofit on pre-2016 vessels.

Ballast Water Management

The IMO Ballast Water Management Convention will enter into force 12 months after it has been ratified by 30 states representing 35% of the world's merchant shipping tonnage. The ratification is still not finalised.

The IMO MPEC has decided on their 65th session (13-17 May 2013) that ships built before the entry into force of the Convention to be existing ships and postpone the requirement for those ships to install treatment systems until their periodical surveys after 2016. Additionally it removed the requirement to retrofit a treatment system at the intermediate survey after 2014/2016, and keep only that ships must retrofit a treatment system by the renewal survey after the anniversary date of the delivery of the ship in 2016.

If a ship has just completed dry docking it would have two and a half to three years, depending on when its next dry dock is due to install a ballast water treatment system on-board. Therefore the market will develop slowly and depending on the final ratification the market volume will be lower than 50% of the calculated volume until 2017.

Market Volumen Estimation							
Price per system installtion				Installation costs per time period			
Pump capacity	Lowest Price	Highst Price	Averaged Price	until 2016		until 2020	
				Amount of systems	Market volume	Amount of systems	Market volume
200 - 250 m³/h	$175.000,00	$ 490.000,00	$ 332.500,00	11.785	$ 3.918.512.500	2.175	$ 723.187.500
2.000 m³/h	$600.000,00	$ 1.045.000,00	$ 822.500,00			41.439	$ 34.083.577.500
Total market per time period					$ 3.918.512.500		$ 34.806.765.000
Market volume until 2020							**$ 38.725.277.500**

Table 5: Market volume estimation for ballast water management

Summary

Following the above, the total retrofitting market volume for SOx and ballast water can be estimated to approx. 72 billion USD plus an incalculable market volume for retrofitting caused by SEEMP measures and potential voluntarily measures to reduce NOx. Besides assessing the volume of the market, the difficulty is more to predict the time of materialisation of the market due to the dependency on many different parameters and decisions, including ratification and final decisions at IMO level. The following assumptions have been made for the retrofitting market size 2013-2017:

- The retrofitting market for Scrubber Technology (SOx emissions reductions) until 2017 has been estimated at 20% of the overall CAPEX (33 billion USD), i.e. 6,6 billion USD for the five year period, 1,32 billion USD/a. Another 0,56 billion USD have to be added annually for operational expenditures.
- The retrofitting market for Ballast Water Treatment Systems of 38,7 billion USD can be realized by 15% until 2017 (basically covering the retrofitting demand for the smaller vessels) if the ratification process will be finalized shortly and the implementation will not be further delayed. This leads to 5,8 billion USD market for the five year period, 1,16 billion USD/a.

In total this calculates to 15,2 billion USD for the period of 2013-2017or 3 billion USD/a.

More than 35% of the approved ballast water treatment systems have been developed in Europe, but additional systems are within the IMO approval processes.

As a final remark it has to be noted that the longer the ratification and implementation process lasts, the smaller the retrofitting market will be in the end. This is due to the fact that older vessels will more likely be scrapped earlier and replaced by newbuildings. However, this will be a trigger to a higher ship newbuilding demand and in that sense a shift between the different maritime markets.

5.4.3 Market outlook

The maritime retrofitting market is mainly driven by new rules and regulations. Rules which result in more efficient vessels generate additional market pressure for all owners not directly affected by the rules. They need to invest in energy efficiency measures to increase the competiveness of a ship. This opens additional markets for the supplies industry.

The global sulphur limit in combination with the 20% EEDI reduction requirement by 2020 will have a significant impact on the implementation of LNG engines. It could lead to additional ship orders on the new building market but losing parts of the retrofit market. The

determining factors are the LNG market prices and the availability on global LNG supply. It is also a challenge to solve the problem with the release of unburned methane from engines (methane slip), especially for 4-stroke dual fuel engines.

EEDI and SEEMP will be an important driver for the optimisation of the vessels. In particular from 2020 forward when Phase 2 of the EEDI is implemented, the exiting SEEMP vessels have to compete with the efficient EEDI vessels which are 20% below IMO reference curve. This situation will open up a significant retrofit market especially for scrubbers but also for other technical solution focusing on vessel efficiency improvements.

Once the Ballast Water Convention has entered into force the market will develop slowly. This is because the installation is connected to the first renewal survey which can happen for the first vessels between two and a half to three years after the convention is in place. Any further delay in the ratification process will create a larger backlog of technology orders. The US has decided to implement a Ballast Water Convention similar to the IMO regulation. This will force a significant part of the world fleet to implement a treatment system and might speed up the market. Independent from the defined implementation schedule some owners might implement the systems in advanced as soon as the convention is signed to operate a state of the art vessel on a competing transport market.

The profitability of many emission reduction technologies depends heavily on various fuel prices and their relative differences. Therefore the retrofit market depends highly on the future development of the fuel prices.

5.4.4 Chances and risks for European marine supplies industry

Ship owner perspective

The retrofit market is quite attractive but depends on a lot of different parameters which cannot be influenced by individual marine supply companies. In addition every ship owner has to define an own strategy to fulfil the rule requirements and to compete on the global market at the same time. Therefore it is not easy to predict in which technologies owners will invest and at which time.

In general vessels operate for 20 to 30 years on the market and the installed technology has to be flexible enough to deal with upcoming requirements.

The motivation for additional technology investments of ship owners are mainly based on the following criteria:

- Assure the compliance with regulations and the related requirements
- Reduction of fuel costs paid by the ship owner
- Increase of the expected charter rate
- Increase in the probability for profitable charter contracts
- Increase of the second-hand value of the ship

If one of these criteria is fulfilled there is a good chance that an owner will invest in a new technology. But there are different groups of ship owners. There are some owners focusing on the asset (not operating ships on their own) and there are owners as operators. The asset players are mainly focusing on winning long-term charter contracts. Therefore they only invest in technologies to increase the probability to get a charter contract. They are less interested in fuel costs and fuel efficiency. The operators are directly involved in the management and operation of the ship. They are paying for the fuel and have a strong incentive to increase the energy efficiency.

In the current situation, with many new regulations under preparation and rising fuel prices, the second-hand value of a ship becomes an important factor. This value depends on the ship's fuel efficiency and transport effectiveness. In the past energy efficiency was not a criterion for higher second hand values but this will change in the future.

Nowadays the second hand value of vessels is an important factor for ship financing. In many cases financing additional technology investments in operating vessels becomes a problem. The required technology is quite expensive and the second-hand values of vessels are quite low because of market overcapacities and many struggling ship owners worldwide. Banks are not ready to give credits for such kind of investments if the owner is not able to offer a reasonable own share.

Technology supplier perspective

Technical solutions satisfying the rules and standards are very often complex and require a lot of technical development. Approval procedures are not always clear and subject of changes during the rule definition procedure. Therefore the risk to fail by starting the development too early is quite high. On the other hand suppliers have to assure to be ready for the market in time.

Rule development on a global basis takes a lot of time. Even if implementation schedules have been defined they are always subject to change for different reasons. Therefore the suppliers can never be sure when a specific market starts and if the general market conditions are still positive related to their retrofit components.

The delay of rule ratifications (like e.g. the ballast water convention) creates a backlog of technology orders. It increases the time to market for the developed technologies and opens up opportunities for new suppliers getting into that market. The higher competition endangers the early investments in the development.

In general the maritime retrofit market requires a great endurance and a close cooperation with the standardisation bodies to be aware of all changes during the rule definition process.

Only the leading European system suppliers are able to support these long-time continuous procedures. This requires a global market orientation to achieve a profitable business.

5.5 Marine supplies - Offshore oil & gas market (not included in shipbuilding)

5.5.1 Economic drivers – energy policy, energy demand, energy mix

The International Energy Agency in the 2013 World Energy Outlook confesses “The world is not on track to meet the target agreed by governments to limit the long-term rise in the average global temperature to 2 degrees Celsius (°C).” Having said that IEA proposes four energy policies to keep the 2 degree target for 2020 alive. The number one policy out of that proposes “Adopting specific energy efficiency measures (49% of the emissions savings)” and does affect maritime transport the most. This will put more pressure on the quick implementation of IMO based energy reduction measures and as well emission reduction measures. Future prospects on this are further elaborated further down in subchapter “Greening of shipping”.

The other aspect is related to power generation and the form of energy used. The following figure shows the EXXON projection for 2040 on that. With some variations all available outlook-reports show the same tendencies. Basically the demand of energy is driven by non-OECD countries, creating double the demand of OECD countries. Besides nuclear energy, Gas and renewable energy will play an increasing role. Among renewables hydro power is the biggest contributor, but wind is catching up.

For the marine businesses in focus this tendency towards gas and wind energy includes major potentials for marine production.

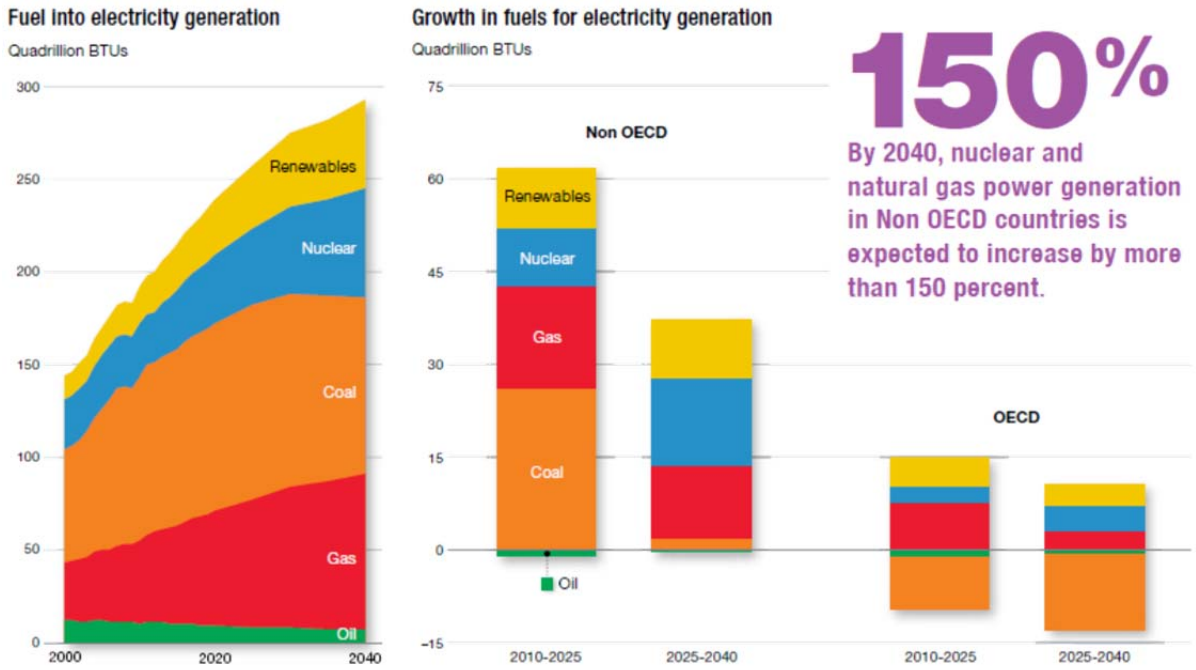


Figure 56: The outlook for Energy – A view to 2040 GWEC Global Wind Energy Outlook 2012 [Source: (21)]

Chance – offshore oil and gas – deep sea exploration and production

In spite of all discussions and successful attempts to develop renewable energy technologies, basically all future scenarios confirm the growing demand for oil and gas for the foreseeable future. This is driven by the medium to long term forecast for population growth, GDP growth especially for emerging economies in non-OECD countries. This effect is already driving the actual high investment activities in oil and gas exploration and production. Without this effect, the maritime industry would suffer much more from the

economic crisis as it is already the case. Driven by an expected annual CAGR[2] of 8-10%, total planned E&P[3] activities for the period 2013-2017 to 1.200 billion USD. 370 billion USD alone are foreseen by UK and Norway and are North Sea centred. Further major places for offshore developments are Brazil, West Coast Africa and Gulf of Mexico. The focus of these investments is basically offshore with a priority on deepwater. We have seen this development in the evaluation of the actual shipbuilding orderbook/forecast with numerous FPSO and other offshore ships on order, which shows alone a volume of 130 billion USD for the period 2013-2017 (which might be even conservative). In the light of the demand forecast and on the basis of a critical oil price of 60-80 USD/barrel this economic development will likely continue or even accelerate.

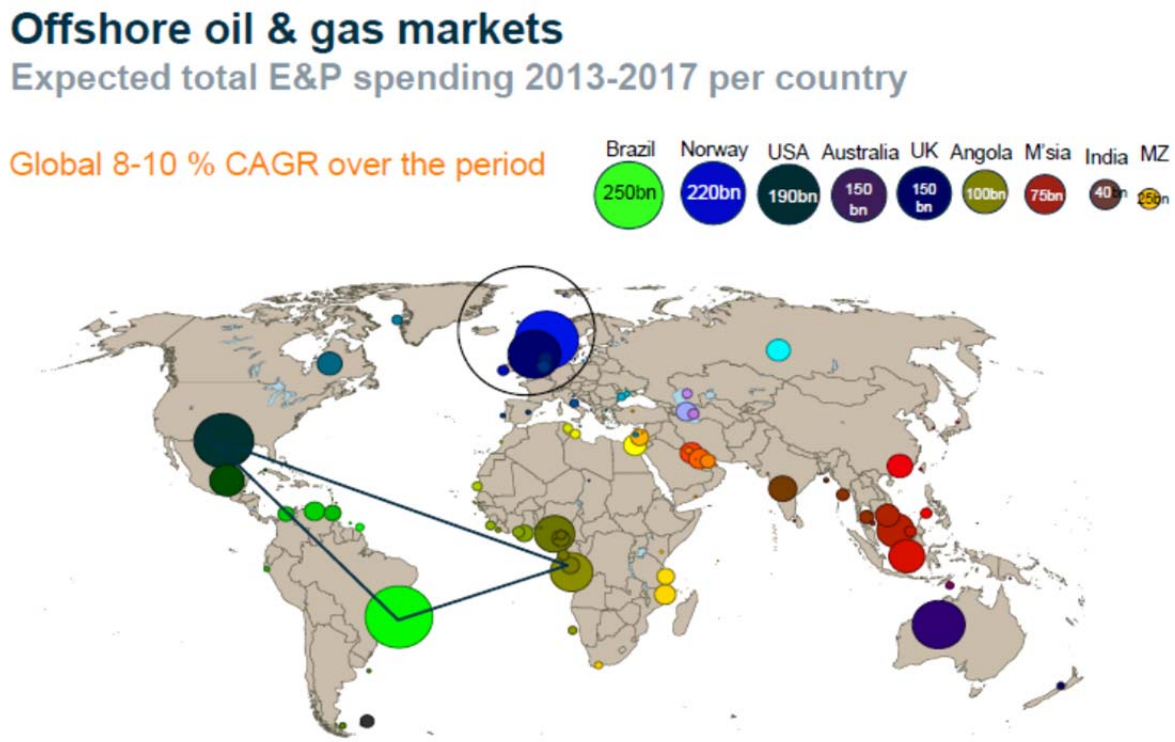


Figure 57: Offshore oil & gas market [Source: (22)]

5.5.2 Market size 2013 - 2017

This chapter discusses corrective market figures for offshore oil and gas rigs (floating and fixed), which are not included in the shipbuilding forecast. The shipbuilding forecast includes all offshore related shiptypes, e.g. drillships, FPSO, FSO, construction vessels (e.g. crane, pipe layer, cable layer etc.), AHTS, PSV and exploration vessels.

Beyond this the fleet of mobile offshore drilling units (MODUs) consist of the following main types:

- Jack-Up Rigs (Jack-ups)
- Semisubmersible rigs (Semi-subs)
- Drillships
- Drill Barges/Tender

[2] Compound Annual Growth Rate

[3] Exploration & Production

AT the end of 2012 the fleet of offshore structure comprised about 1.000 units. The following orderbook/forecast concentrates on jack-ups and semi-subs, because drillships and drill barges are included in the shipbuilding orderbook/forecast

- Jack-ups
  - Jack-ups stand on the ocean floor with their hull and drilling equipment elevated above the water on connected leg support
  - Jack-ups are generally preferred over other rig types in shallow water depths
- Semi-subs
  - Floating offshore drilling units with pontoons and columns in semi-submerged position
  - Semi-subs are either moored (anchored to the sea-floor with mooring chains) or dynamically-positioned by computer-controlled propellers or thrusters
  - Semi-subs are especially well-suited for ultra-deep-water development drilling

MODU type	2009	2010	2011	2012
Jack-ups ≤ 300 ft	326	334	337	342
Jack-ups > 300 ft	136	151	162	168
Jack-ups total	**462**	**485**	**499**	**510**
Semi-subs ≤ 5.000 ft	132	133	85	92
Semi-subs > 5.000 ft	64	72	134	133
Semi-subs total	**196**	**205**	**219**	**225**
MODUs total (without drillships and drill barges)	**658**	**690**	**718**	**735**

Table 6: Fleet of jack-ups and semi-subs (number of units) [Source: (23)]

The global offshore oil & gas expenditures are characterized by a further growth in the next few years.

The share of the offshore oil production reaches currently about 1/3 of the global output: By 2020 a share of 40% will be expected. The deepwater share will strongly continue to increase. But the situation in the supplies industry is mixed: While some companies reported growth in 2011 and 2012, other suppliers still suffered sales declines. Particularly suppliers with a great dependence on ship-newbuilding and certain ship types were affected by the sales declines. On the other hand, more broadly based suppliers and especially offshore suppliers could benefit from the growth of these markets.

The global offshore capital expenditure will amount to more than 700 billion USD in the period from 2012 to 2018. 62% of these investments are accounted for shallow waters (up to 499 m water depth) while 38% will apply to deep water areas (500m water depth and more).

The most important regions for deep water and ultra-deep water (1.500 m water depth and more) investments will remain North America, Africa and Latin America (mainly Brazil).

Arctic resources will become more and more relevant for further offshore developments The offshore arctic is primarily a natural gas play, 85% of all known undiscovered resources are natural gas against 13% which are oil. In the arctic a large number of super-giant fields have been explored.

A further important segment is subsea and seabed-based market for offshore production hardware with an estimated Capex of about 135 billion USD over the next five years. The so-

called “Golden Triangle” (Brazil, West Africa, and Gulf of Mexico) accounts for 65% of this Capex *[Source:* (24)*]*.

Within the shipbuilding market in terms of investment into the segment of offshore special vessels will become more and more important. Besides mainly drillships, semi-subs and jack-ups require strong investments, other special ships as e.g. AHTS and FPSOs are also interesting markets.

MODU type	2013	2014	2015	2016+	Total
Jack-ups ≤ 300 ft	9	6	2	0	17
Jack-ups > 300 ft	43	22	21	1	87
Jack-ups total	**52**	**28**	**23**	**1**	**104**
Semi-subs ≤ 5.000 ft	0	3	3	0	6
Semi-subs > 5.000 ft	2	3	4	6	15
Semi-subs total	**2**	**6**	**7**	**6**	**21**
MODUs total (without drillships and drill barges)	**54**	**34**	**30**	**7**	**125**

Table 7 Orderbook for jack-ups and semi-subs (units) [Source: (23)]

Based on available average newbuild costs for MODU the following estimations are made for the production value of these offshore structures:

MODU type	2013	2014	2015	2016+	Total
Jack-ups ≤ 300 ft	1.685	1.168	401	0	3.254
Jack-ups > 300 ft	9.838	5.235	5.147	252	20.472
Jack-ups total	**11.523**	**6,403**	**5.548**	**252**	**23.726**
Semi-subs ≤ 5.000 ft	0	1.182	1.206	0	2.388
Semi-subs > 5.000 ft	1.128	1.734	2.358	3.607	8.827
Semi-subs total	**1.128**	**2.916**	**3.564**	**3.607**	**11.215**
MODUs total (without drillships and drill barges)	**12.651**	**9.319**	**9.112**	**3.859**	**34.941**

Table 8 Orderbook for jack-ups and semi-subs (million USD) [Source: (23)]

Main shipyards for MODUs

- Only a small number of shipyards around the world are capable of building mobile drilling units
- Large rig shipyards exist in South Korea, Singapore, China, India, Russia, the USA, and the United Arab Emirates
- Shipyards differ in the methods in which they construct rigs based on their level of automation, subcontracting and the level of serial production
- Mainly shipyards in Korea and Singapore remain the most active in terms of drilling rigs under construction. Shipyards in Singapore are particularly space limited, while shipyards in Korea are less space limited and use a „mega-block“ method of rig

construction in which very large (drillship) sections are fabricated separately and then assembled in a floating dock.

European shipyards are up to now not involved in this rising market for valuable and sophisticated drillships. The Italian state-owned shipbuilder Fincantieri is currently aggressively pushing ahead to win an ultra-deepwater drillship order. This would be the first order in Fincantieri's history. The latest design was co-developed by Fincantieri and the leading Norwegian supplier Aker Solutions.

For the construction cost distribution for jack-ups and semi-subs the following main component packages are very important:

- Steel is a main component of the rigs, mainly for jack-ups
- The drilling equipment package is the largest equipment expenditure
- The main components of the drilling equipment are derricks, draw works, iron roughnecks, top drives, mud pumps and BOPs (blow-out preventer)
- l Other equipment such as . engines, cranes, generators and dynamic positioning systems (e.g. thrusters) are further significant rig cost components
- The costs of shipbuilding labour in the USA and South Korea are roughly similar and about three times the labour costs of Singaporean shipyards.

The drilling equipment package is one of the largest equipment expenditure and is sourced mainly from the USA.

Leading European companies with significant supply shares for drilling packages and components are Aker Solutions/Norway and Huisman Equipment/Netherlands. Further important European companies are the leading offshore engineering companies Technip/France and Saipem/Italy (engineering and drilling). The drilling equipment business of the TTS Group/Norway was sold in 2012 to the leading US contractor Cameron.

Summary market forecast for 2013-2017

Following to what has been said above the market forecast has been based on the orderbook analysis and supplemented by assumptions from the authors. This leads to an average annual market volume for jack-ups and semi-subs of annually of 9,5 billion USD, totalling to 47,5 billion USD for the five years period 2013-2017.

This figure does not take into account the market for fixed offshore platforms. . It has to be taken into consideration that the actual market very much focuses on mobile units addressing deep sea applications and not so much on fixed rigs being limited to certain water depths. As a provisional estimate a market volume of annually 2 billion USD is taken into the calculation.

All together this creates an annual market volume of 11,5 billion USD, totalling to 57,5 billion USD for the five years period. Following the discussion on relative cost values for equipment above, 70% of this value are calculated for marine supplies, i.e. totalling to 40,25 billion USD for the period 2013-2017.

Additional Note: An additional market which has not been taken into account for this study so far is addressing offshore subsea technologies, which comprise tree technologies, subsea production, ROV/AUV, pipelines, cables etc. This is another market which may contribute a substantial share of market volume to the overall offshore market. According to the following figure it may contribute another 67,3 billion USD to the five years period 2013-2017, equalling to an average of about 13 billion USD annually.

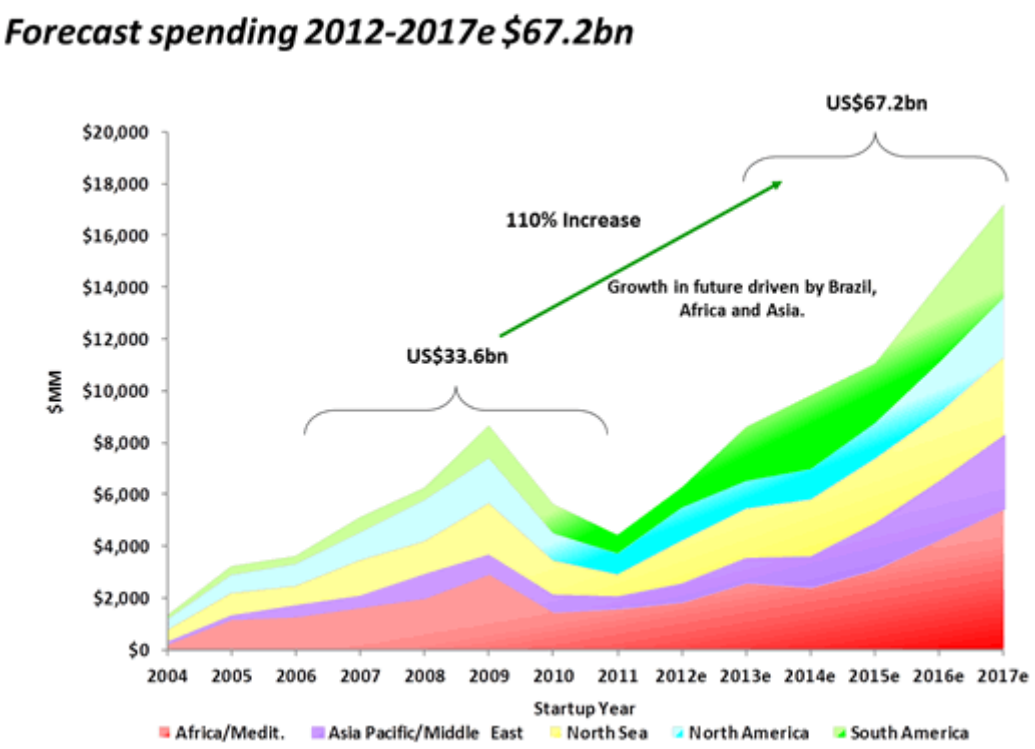


Figure 58: Global subsea Capex: [Source: (25)]

5.5.3 Market outlook beyond 2017

The future demand for oil and gas beyond 2017 will develop very dynamically in combination with thriving investment in offshore exploration and related activities to deepwater projects greater water depth as the search for new offshore reserves around the world continues. The growing use of natural gas is a significant driver for future investments.
About 35% of worldwide oil production occurred from offshore sources in 2004. This is expected to increase to 40% by 2015 and to 48% by 2030. This is mostly driven by the increase of production in deep water offshore fields, which should move from 10% share in 2004 to 25% in 2015 and to 45% in 2030. The deepwater offshore oil production is expected to increase by 11,5% per annum, moving from 2,5 million barrels per day in 2004 to 8,25 million barrels per day in 2015 *[Source:* (10)*].*

5.5.4 Chances and risks for European marine supplies industry

Future chances for European marine supplies in the international offshore oil & gas market are expected mainly for drilling packages and for traditional shipbuilding and offshore supplier packages. The following overview covers some leading European companies; the total number of involved manufacturers from Europe is considerably larger:

- Drilling packages
    - Leading European companies with significant international market shares are Aker Solutions. Norway and Huisman Equipment, Netherlands.
- Offshore engineering
    - Leading European companies with significant international market shares are Saipem, Italy and Technip/France
- Equipment packages from leading European shipbuilding and offshore suppliers for valuable and technologically-challenging offshore structures as e.g. MODUs, drillships and other offshore special vessels with the following examples in which European companies have a very strong international market position:

- Engines (e.g. Wärtsilä/Finland; MAN, Germany; Caterpillar/MaK, Germany, Rolls-Royce/Tognum, UK and Germany)
- Cranes/Winches (Cargotec/MacGregor/Hatlapa, Finland and Germany; Liebherr, Switzerland)
- Generators (Wärtsilä, Finland; Caterpillar/MaK, Germany; Rolls-Royce/Tognum, UK and Germany)
- DP thrusters (Rolls-Royce, UK with a global market share of about 70%)
- Electrics/electronics (Siemens, Germany; GE Power Conversion, France; ABB Marine, Finland and Norway; Kongsberg Maritime, Norway, Imtech Marine, Netherlands).

Potential risks for European suppliers are related to the very strong market position of US companies and contractors for drilling equipment package which are sourced on the international market mainly from the USA, further aggressive market entrance strategies from emerging countries as e.g. China and considerable local content demands from countries as e.g. Brazil.

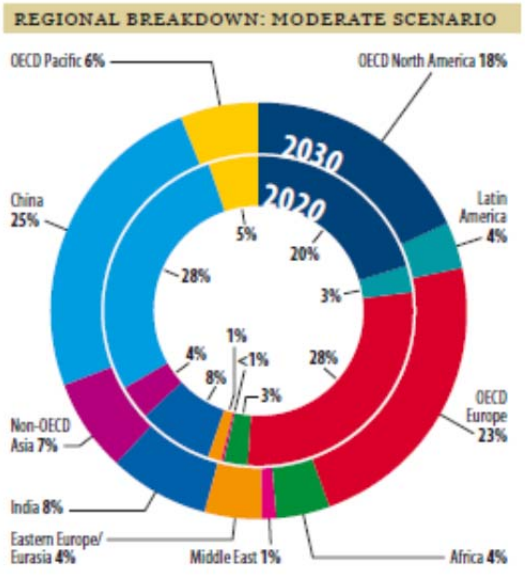
5.6 Marine Supplies - Offshore wind market

5.6.1 Economic drivers and long term outlook

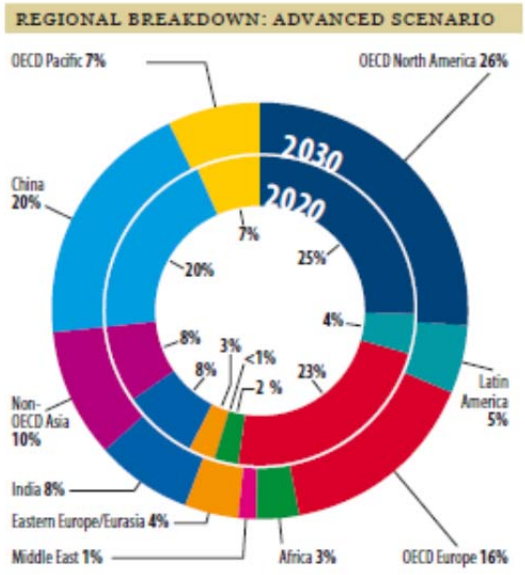
The development of the offshore wind industry is dependent to a large extend on national energy policies and their implementation. Due to that the development globally is not harmonised and unbalanced and shows for the time being some specific geographical hotspots for this market with OECD Europe, OECD North America and China in the driving seat for these markets until 2030.

The Global Wind Energy Council suggest in their 20t2 global outlook that by 2030 wind energy will contribute to the global energy demand with shares of 10 to 25%, depending on the demand scenarios proposed by the IEA (International Energy Agency). By applying the moderate growth scenario this may lead to 760 GW installed capacities in 2030 and 2.541 GW installed capacity by 2030. GWEC suggest also that about 10% of this capacity will be installed offshore. Average installation cost per MW are estimated to 1.200 EUR/KW, whereas offshore will be significantly higher and may drop from 3.900 to 3.000 EUR/KW (-20-30%, Roland Berger 2013).

These projections lead to average annual installation investments (CAPEX) for offshore wind installations of about 28,5 billion EUR and a global distribution of 29% Europe, 39% Asia, 23% Americas and 9% Rest of the World. Compared to the calculations made above for the period 2013-2017 this is a confirmation of the trend and a further increase of investments until 2030. 5 years investments would average to 140 billion EUR compared to 68.5 as projected for the period 2013-2017. When all global regions are on a comparable level of investment speed (Europe is presently a forerunner with a relative global market share of >70%), we will see a relative relocation of investments from Europe towards Asia and the Americas in the longer term.



	2020	2030
OECD North America	155,208 MW	296,705 MW
Latin America	21,903 MW	56,075 MW
OECD Europe	211,276 MW	371,627 MW
Africa	19,027 MW	64,336 MW
Middle East	2,150 MW	16,181 MW
Eastern Europe/Eurasia	10,383 MW	70,374 MW
India	59,351 MW	124,826 MW
Non-OECD Asia	27,083 MW	119,476 MW
China	214,445 MW	400,130 MW
OECD Pacific	38,523 MW	97,715 MW
Global Total	**759,349 MW**	**1,617,444 MW**



	2020	2030
OECD North America	290,805 MW	665,938 MW
Latin America	47,970 MW	134,411 MW
OECD Europe	262,797 MW	396,728 MW
Africa	28,117 MW	82,972 MW
Middle East	2,180 MW	37,024 MW
Eastern Europe/Eurasia	32,369 MW	104,707 MW
India	89,299 MW	191,711 MW
Non-OECD Asia	90,768 MW	250,342 MW
China	230,912 MW	499,614 MW
OECD Pacific	74,702 MW	177,690 MW
Global Total	**1,149,919 MW**	**2,541,135 MW**

Figure 59: Global wind energy outlook 2012, [Source: (26)]

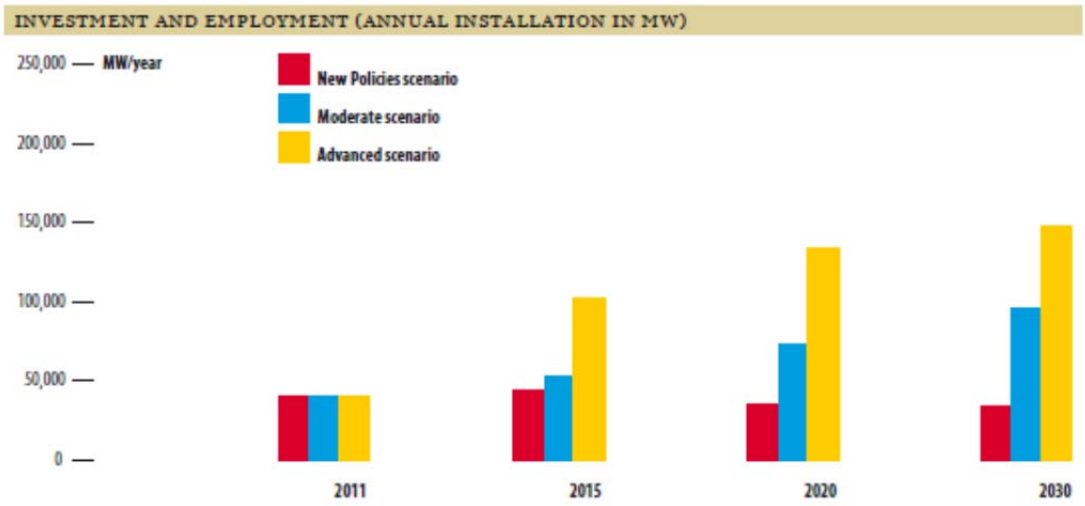


Figure 60: Global wind energy outlook 2012 [Source: (26)]

	2011	2015	2020	2030
New Policies scenario				
Annual Installation MW	40,594	43,516	35,695	33,552
Cost € / kW	1,250	1,259	1,258	1,217
Investment € billion /year	50,74	54,05	45,03	42,49
Employment job/year	646,751	740,513	657,651	705,503
Moderate scenario				
Annual Installation MW	40,594	52,699	74,060	95,740
Cost € / kW	1,250	1,212	1,173	1,122
Investment € billion /year	50,74	64,74	88,99	112,09
Employment job/year	646,751	878,083	1,213,359	1,682,633
Advanced scenario				
Annual Installation MW	40,594	101,711	134,104	148,483
Cost € / kW	1,250	1,168	1,135	1,119
Investment € billion /year	50,74	118,79	152,14	166,22
Employment job/year	646,751	1,599,173	2,122,821	2,620,369

Figure 61: Global wind energy outlook 2012 [Source: (26)]

5.6.2 Market size 2013-2017

The shipbuilding orderbook and demand forecast as given above includes all kinds of offshore ships, i.e. for the offshore wind sector basically offshore construction and maintenance vessels and offshore service vessel. It is anticipated that at the moment no additional types outside the shipbuilding orderbook have to be considered here. However, offshore wind structures and entire wind-farms as a whole are complex technical objects if not regarded as integrated industrial areas, which require multiple supplies. As for ships different supplies industry is involved, which have marine experience, including shipyards.

According to a 2013 study from Roland Berger ("Offshore Wind Toward 2020") the global investments until 2020 can sum up to 130 billion EUR with an increasing tendency, starting with 8,5 billion EUR in 2013 up to 27 billion in 2020. For the period 2013-2017 this represents a volume of 68,5 billion EUR (87 billion USD). Calculations have been made by using an average investment value of 3.900 million EUR per MW as indicated in the second figure below, cut down into different cost elements.

According to the study it is anticipated that Europe would have a share of 72% of this market, Asia 22% and North America 6%. These figures are challenged by some risks, which may slow down the development process. These risks are in financing, legal framework conditions, grid development and some technical challenges, especially for offshore wind

deepwater areas (>40m). In order to reduce cost, it is a big task to industrialise the production process of the windmills and foundations, but as well to develop and improve production logistics. This is especially true for those wind-farms in locations far away from the coast.

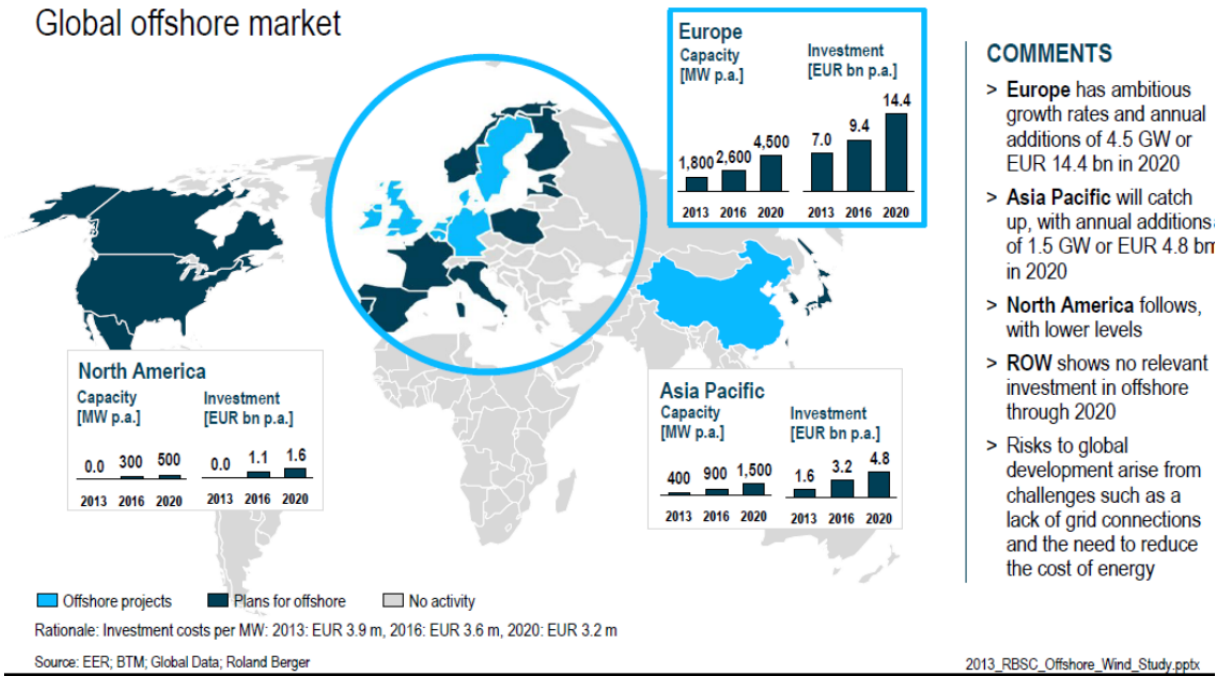


Figure 62: Offshore wind market Estimates), [Source: (27)]

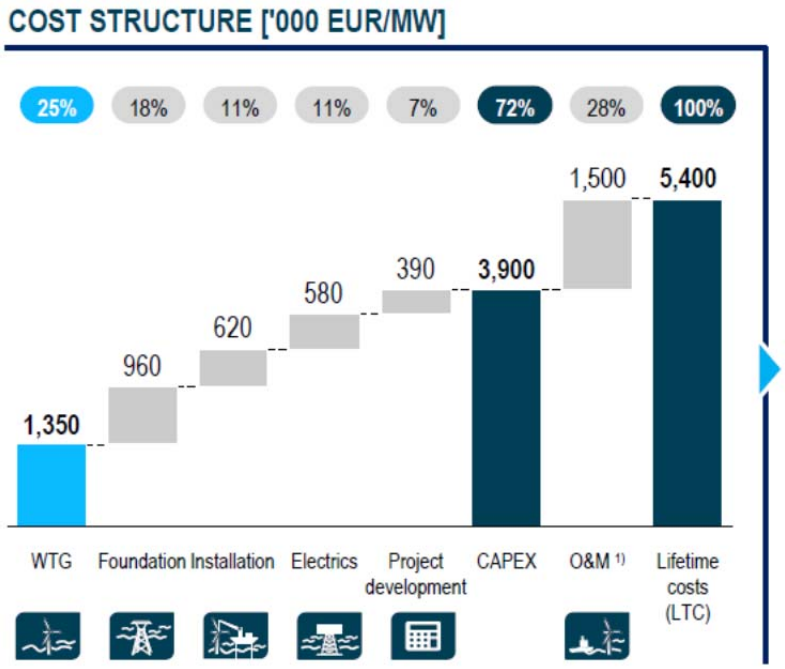


Figure 63: Offshore wind cost structure [Source: (27)]

It can be discussed what share of this market can be regarded as marine market. If we regard an offshore wind-farm as a comparable construction at sea as we do for other offshore industries, we can take the entire volume of the market as a marine market.

This is even truer as foundation structures, windmill towers and converter platforms as examples are being often built by shipyards as a secondary production path or even after a total conversion of the yard. Having said this, we estimate that about 30% of the entire

volume will be reported in the future by shipyards as production volume. In addition, lots of the technical supplies are coming from companies which are also serving other marine markets, like for the electrical engines, gears and wings. This creates a contribution to the marine supplies market and leaves a volume of 47,95 billion EUR for the marine supplies industry for the period 2013-2017.

5.6.3 Chances and risks for European marine supplies industry

In the transition from a land based business to a complementary offshore business, many companies, which originally have been involved in land based activities only, have learned a lot of lessons. The technological requirements for offshore wind installations are different and more demanding in many respects. This concerns the technology of the windmills as such, including foundations, addressing harsh environmental conditions, reliability in order to minimise maintenance and idle time, but also installation logistics for wind-farms. In addition traffic control aspects, safety and security measures for people working in wind-farms, environmental aspects, including education and training etc. have to be addressed and solved. To that end operators and investors for offshore wind-farms missed to learn early from experiences in offshore oil and gas installations and also to assimilate knowledge from shipyards in order to build offshore units and installations. This situation has recently improved. Some countries did even set-up projects in order to improve co-operation between wind-farm operators/investors and maritime businesses, i.e. shipyards and harbours and other maritime instances.

Nowadays, in order to be competitive with other energies, cost reduction is becoming a key element in order to get financing of wind parks in place. Slowly, both sides of the industry learn from each other in order to address these special aspects of offshore wind-farms.

In the end the essential risk in this market is the political will to change the energy market more in favour to renewable energies. This is on the one hand a global issue in the context of UN activities to limit emissions to certain levels in order to fight global warming and other pollution. On the other hand it is an issue of regional and/or national legislation in order to implement energy change. Different policies applied by world economies may affect the competitiveness of industry sectors. For some European countries national legislation is in favour of renewable energies and in particular also for offshore wind. Therefore, the prospects for the industry a positive and provide at least for the next 10-15 years a very positive market perspective. European suppliers in the sector play a prominent role in the sector, especially when it comes down to mechanical and electrical systems of the systems. This is true not only for the national markets, but also for export. Employment in the sector has increased considerably and for some shipyards the business share in offshore wind has increased (e.g. for converter platforms, foundations, final outfitting of installation vessels etc.). For the pillars and especially for some special types of foundations competition from China and other Far-East countries is becoming an issue. Besides the development of domestic markets these countries are very keen to develop their export shares on the basis of low pricing. Due to temporary postponement of wind-park investments (basically due to problems in financing and implementation of stable framework conditions), there is a risk that some European suppliers do not survive the “waiting period” until the real investment can start and cannot cope with the increasing price competition.

5.7 Marine supplies - Naval market

5.7.1 Economic drivers and long term market outlook

Although not in the original focus of the study, naval shipbuilding has been taken into consideration due to the significant market for marine suppliers. Detailed data for this market is difficult to find and can only be evaluated on a general level. Therefore the following analysis can only be regarded as a rough estimate.

The development of world and regional naval markets basically is aligned with growth figures for GDP, representing the economic power of nations to build-up strong forces. This, however, is superimposed by other influences like politics, strategic interest, access to the sea and seaborne economic interest, global and regional strength and potential naval tasks in international missions (e.g. anti-piracy). Further, it has to be considered that naval systems are heavily influenced by innovation in technology, especially by information technology and electronics driving naval ships also more towards automated and autonomous systems rather than labour intensive and manned ships. By this they also may become part of more complex and integrated technical products which are by mission acting also more integrated with other forces. Naval products in this respect can be regarded in some respect as frontrunners for innovation with spin-offs into civil markets. Especially super yachts are a good example for this with sometimes comparable propulsion systems and levels of complexity. Therefore, not only by size, the world market for navy ships is of substantial importance to the world shipbuilding industry. According to the following world naval market forecast by AMI International it contributes an average of 37 billion USD annually to the overall production value of shipbuilding representing a total of more than 3000 ships to be built in the period.

World Naval Market Overview: 2011-2031

Program Status	In Progress		Planned		Projected		Totals	
Region	Hulls	US$B	Hulls	US$B	Hulls	US$B	Hulls	US$B
Asia-Pacific	414	81862.5	212	75166.3	179	27775	805	184803.8
Caribbean & Latin America	123	5101	80	9282.8	87	12931	290	27314.8
MENA	165	11885.9	278	18376.4	241	14909	684	45171.3
NATO	200	65593.6	208	58772	190	29361	598	153726.6
Non-NATO Europe	22	557	12	2938.5	27	5305	61	8800.5
Russia	129	31215	5	5000	0	0	134	36215
Sub-Saharan Africa	0	0	12	1773	29	1310	41	3083
U.S.	324	186792.6	157	65100	25	34786.0	506	286678.6
Totals	1377	383007.6	964	236409	778	126377	3119	745793.6

Figure 64: World naval market overview, [Source: (28)]

According to the study the world market will continue to grow despite shrinking naval budgets in Europe and the US. However, in spite of significant growth rates in South East Asia, especially China, India and South Korea, the US market remain by far the single biggest market, representing almost 40% of the market projection. On the other hand South East Asia is overtaking European NATO Countries in overall market size for the forecast period. The above world naval market overview reflects the demand side. It has to be noted that whereas for the time being United States and major Asian countries (China, Japan, partly Korea) basically build navy ships for own use and only export limited numbers, the major

export markets are shared by a limited number of European global players (figures according LR – Global Marine Trends 2030).

Russia	24,5%	United Kingdom	10%	Italy	5,5%	China	3%
France	16,5%	Netherlands	9,5%	Spain	4%	South Korea	2%
Germany	13,5%	Sweden	8%	Australia	3%	USA	2%

5.7.2 Market size 2013-2017

With regard to the reference cost distribution for naval ships, in literature the following cost model can be found (Australia Defence SA Advisory Board, 2010, RAND Corporation, 2006). According to that labour accounts for 32 per cent of the 'end cost' of a surface combatant project, equipment 57 per cent and material 11 per cent. As with all models, the complexities are hidden in the detail – in this model, the labour category is defined only as shipyard labour. Labour costs are fully burdened, including direct and overhead costs for all types of labour (e.g., engineering, support, manufacturing). In this model, material includes basic items used in shipbuilding such as steel, paint, electrical cable, and insulation; and equipment includes major manufactured items such as systems for navigation, command and control, and machinery such as elevators, pumps, air conditioning and electrical distribution. To that end the structure of the model complies with the basic model applied in this study for merchant shipbuilding. On this basis it will be tried to integrate naval shipbuilding in to the forecast model also marine supplies and to amend the overall forecast for the marine supply categories accordingly.

As a first assumption the total market for naval marine supplies for newbuilding are calculated to 27 billion USD annually (4,1 billion USD for materials, 21,1 billion USD for equipment and 1,8 billion USD for external engineering services)

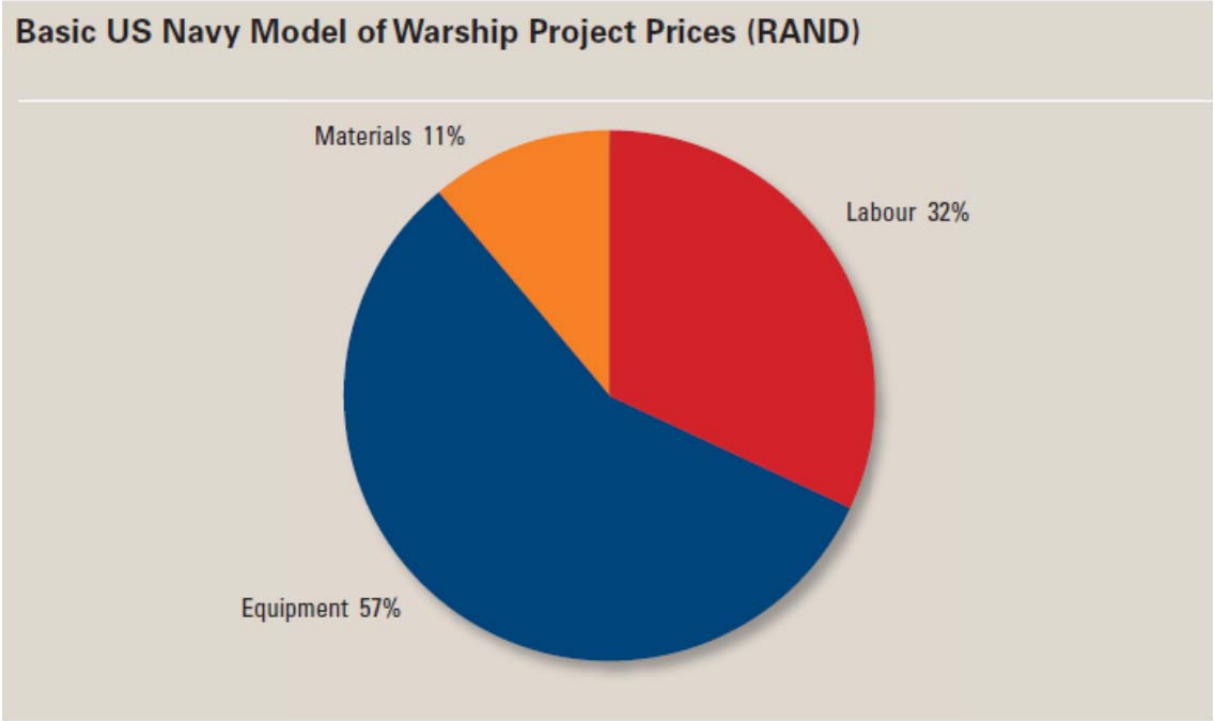


Figure 65: Basic navy model of warship project prices, [Source: (29) (30)]

In addition to the newbuilding market the global naval vessels maintenance, repair and operations market was estimated to be worth 4,8 billion USD in 2012 and is likely to increase

at a compound annual growth rate of 9,68% during the forecast period and reach a peak of 12,1 billion USD by 2022 (Irish consultants Research and Markets report "The Global Naval Vessels MRO Market 2012-2022"). This is averaging to around 6 billion USD annually for the forecasting period 2013-2017 of this study.

5.7.3 Chances and risks for European marine supplies industry

The naval markets depend on the national expenditures for their own navies and the political support and legislative basis to allow export. The market is primarily driven by the need to replace the existing fleets in the United States and Europe, but also by new interest of emerging economies to develop own significant fleets, e.g. in China, India, South, Korea and Brazil. However, US and NATO will still stand for about 60% of the expenditures in the foreseeable future, which give the shipyards in those countries and suppliers, i.e. European countries a sound basis for the foreseeable future. Nevertheless, the global economic downturn and European debt crisis have negatively impacted defence spending, and allocation for naval vessels is expected to decline. Following postponements or stretching of newbuilding programs, spending on modernizing and extending the working lives of existing naval fleets has increased in comparison to buying new equipment.

For marine suppliers it is also a positive development that the increasing number of international and coalition missions have created the demand for more integrated and technically compatible solutions, e.g. to align with NATO standards. Besides weapon systems, this affects at least communication systems and fleet logistics.

At the export side it is essential to understand the accessible market. Besides competitive aspects this very much depends on the national export legislation, which is different in European Member States. For shipyards this sometimes creates higher burdens than for equipment industries since in many cases only inner-European export aspects are concerned. Further, some of the major technologies are multi-national companies, which can decide which subsidiary of their group can become involved in export businesses. The position of the marine supplies industry in the sector is also quite favourable due to the technical strong position of systems and equipment. It is on the other hand the impression that the political support for export is unequal between the European Member States, which then is either a risk or a chance for the supply companies in the sector.

5.8 Marine supplies - Boatbuilding markets

5.8.1 Economic drivers and long term market outlook

As outlined in the statistical analysis above, boatbuilding industries provide a significant share to the overall production value of the European ship- and boatbuilding industry. Boatbuilding and Repair for EU-28 reached a peak in 2008 with a total production value of about 14,5 billion EUR and a related purchasing value for marine supplies of 9,1 billion Euro. Due to the financial crisis this figure declined to 9,6 billion EUR for boatbuilding and repair in 2010 (-34%) with a further decrease to below 8 billion EUR in 2011 (estimate). Top five EU countries are dominating the market, representing 86% of the total EU-28 production volume, i.e. Italy 25%, Germany 22%, France 14%, UK 13% and Netherlands 12%. In parallel to the production value, the purchase values did shrink to 5,9 billion EUR in 2010 (-35%) and 4,5 billion EUR in 2011 (estimate). These figures very much coincide with developments in the United States where according to US Statistics sales values fall from 12,5 billion USD in 2007 to 6,3 billion USD 2009 (-50%). This also confirms the observation that Europe in this case is less affected by the crisis than the US: Following that the branch in EU-28 has seen a related shrinkage of employment from 85.500 in 2008 to 67.250 in 2011 (estimate) for Boatbuilding and repair (-21%) and for the related supplies industry from 46.600 to 22.900 employees (-50%). According to ICOMIA (International Council of Marine Industry Associations) the market has presently settled on this level and shows a tendency to improve again, especially in Europe and Asia. The latter also based on the economic upturn and growing wealth of the population. This affects all parts of the industry including supplies industry. However, in summary the present global market for boatbuilding and superyachts below 500 GT is representing a production value of about 13 billion EUR, forecasted to grow again to 30,6 billion USD (23 billion EUR) in 2017 according to Lucintel Consultants (“Global Recreational Boating Industry Analysis and Forecast 2012-2017”). Long term trends are affected by the demographic change, competing sports, development of personal wealth in the existing main boating nations and also in potentially upcoming new boating nations. Taking these partly diametric aspects into account, it is estimated that the market for boatbuilding will level out on that higher value of about 23 billion EUR for the foreseeable future. As in other markets, China will develop a higher market share, as in other marine markets. Turkey and Poland are expected to expand their market shares in Europe.

5.8.2 Market size 2013-2017

Built on the aforesaid and as an average for the period 2013-2017, the overall global market value for boatbuilding is estimated to about 20 billion EUR per year, with an average value for marine supplies of 12,5 billion Euro.

Superyachts (>24m) in this context play a significant role. The present superyacht orderbook contains a total of 594 superyachts (<60m) with deliveries scheduled until 2016, which will be likely reported to statistics as boatbuilding. Those >60m (approx. >500 GT) are more likely represented by the shipbuilding orderbook, because the building yards are more in that business. However, these 594 superyachts < 60m with a total length of 21.369 m alone represent a market value of 12,8 billion EUR when applying 600.000 Euro/m as an average cost value (C&N superyacht index). The same source reports for the superyacht sector alone average sales values per year of 4,5 billion Euro, which represents about 25% of the overall global boatbuilding market.

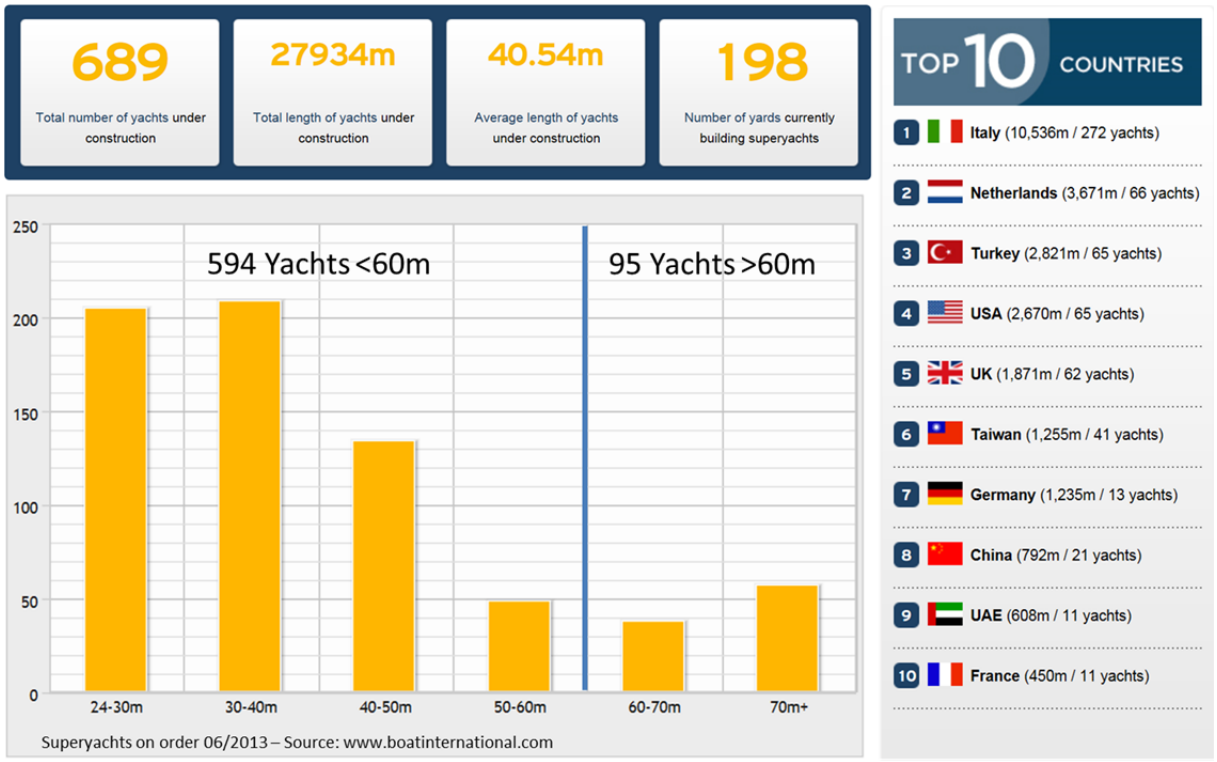


Figure 66: Super yachts on order >24m, [Source: (31)]

5.8.3 Chances and risks for European marine supplies industry

Besides the United States, boatbuilding industry including building of super yachts is a European domain of considerable size and with a strong market position. This is true for the boatbuilding industry below 24 m, the super yachts above 24m, which are often still series or type products, but especially for the one-off super yachts of sizes beyond 60m, where a few European countries almost cover 100% of this high-end market. The latter segment very often involves also classical shipyards, especially those with a background of naval shipbuilding, which benefit from their management experience and technical know-how for very complex ships. This situation is also true for the marine supplies industry in the sector, with high-end equipment in all sectors, advanced design and engineering capabilities and superior craft skills in order to serve the high quality demand in the sector.

This in itself is of course an asset, but also in this sector cost savings are an issue and become more a competitive factor. Competition from Taiwan, China and the United Arab Emirates are warning signals in the sector. However, at the moment the biggest concern in the sector presently is that demand is revitalising and that the optimism in the sector can materialise again in increasing production. The concerns in this respect are higher in the US, because the mid-size motor boat sector, which is the backbone of the US boatbuilding industry, is still in recession. Europe on the other hand is pretty strong in one-off products or customisable series, which are better positioned in the market. This comes in line with the suppliers industry, which in Europe is manifold with high end products and a great flexibility to server customer wishes. METS, the world largest trade fair for marine leisure industry, clearly shows the strong position of the European suppliers in this market, representing about 77% of the exhibitors. These are followed by the US suppliers representing 10% and other 14 nations representing the remaining 13%. The situation in the supplies sector is totally mapping the situation of the boatbuilding and super yacht sector from the yards side. A strong co-operation between yards and suppliers in this sector, both representing

furthermore a sector of SMEs, is a sustainable strength for the European industry which needs to be maintained. However, there is a danger that for some sectors, suppliers and sub-suppliers will gain market shares due to cost pressure. This process might be accelerated through increasing market activities from Far East companies, especially China, Taiwan, Indonesia and Singapore, but also through increasing activities of European countries still outside the EU, namely Turkey.

6 Position and future potential of the European marine supplies industry

6.1 Summary of market forecast 2013-2017

As a summary from the discussion of the different marine supplies markets in chapter 5 we calculate the annual market size to about 102 billion EUR (135 billion USD). The biggest single market for marine supplies is created by the ship newbuilding market for merchant ships, representing about 37% of the total market volume. This includes supplies for offshore vessels (floaters) serving the oil and gas and as well as the offshore wind industry. The second biggest market for marine supplies is represented by naval shipbuilding, including repair, maintenance and overhaul, representing a market share of ~25%. In the third position we see supplies for ship-repair and maintenance with an estimated share of ~14%, or ~16% when we include the special market demand for retrofitting caused by new environmental regulations. The remaining demand for marine supplies is coming from boatbuilding (~9%), offshore oil and gas (fixed installations) (~6%) and offshore wind (without vessels) (~7%). It should be noted that the two offshore markets in the forecast do not include offshore shipbuilding; this is included in the shipbuilding orderbook/forecast.

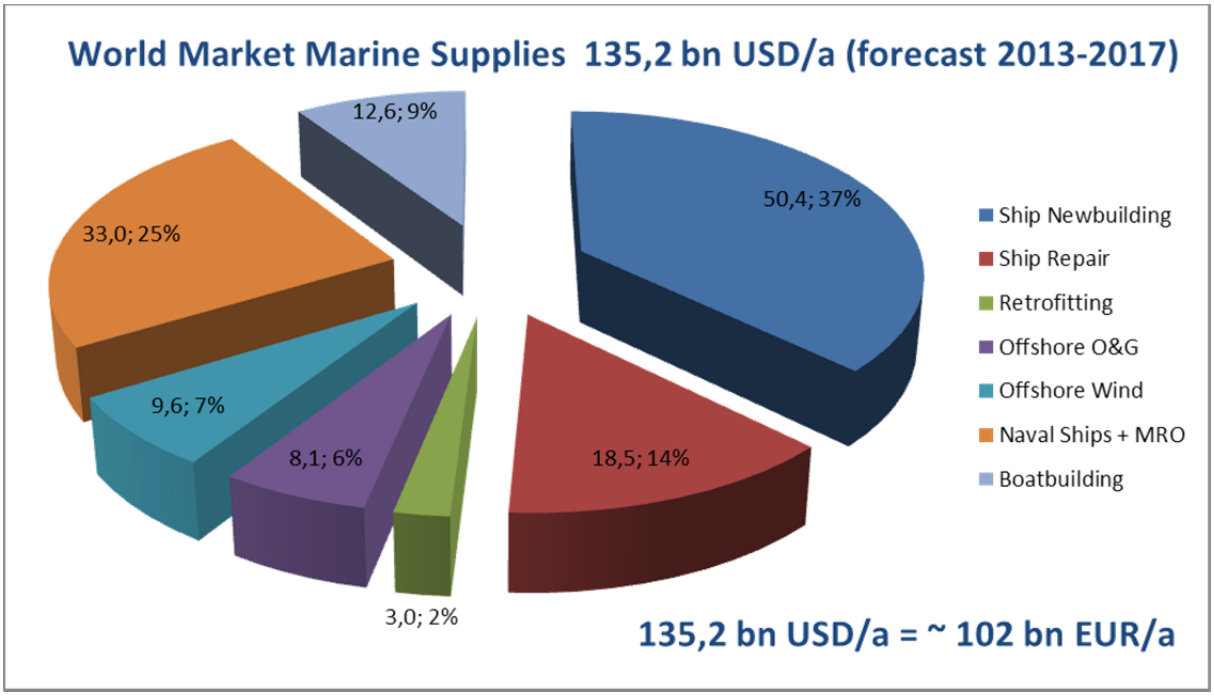


Figure 67: World market marine supplies (forecast 2013-2017)

The data for the forecasting period build on a shipbuilding market forecast representing a significant lower market volume than in the past years, but also a different shiptype portfolio. This forecast shiptype portfolio is of higher specific value, which creates demand/forecast figures for marine supplies where the proportional market value is increasing in relation to the shipyards. The following forecast portfolio shows that for outfitting intensive ships the market demand for the following five years has not been fully saturated, i.e. additional contracting demand can be expected.

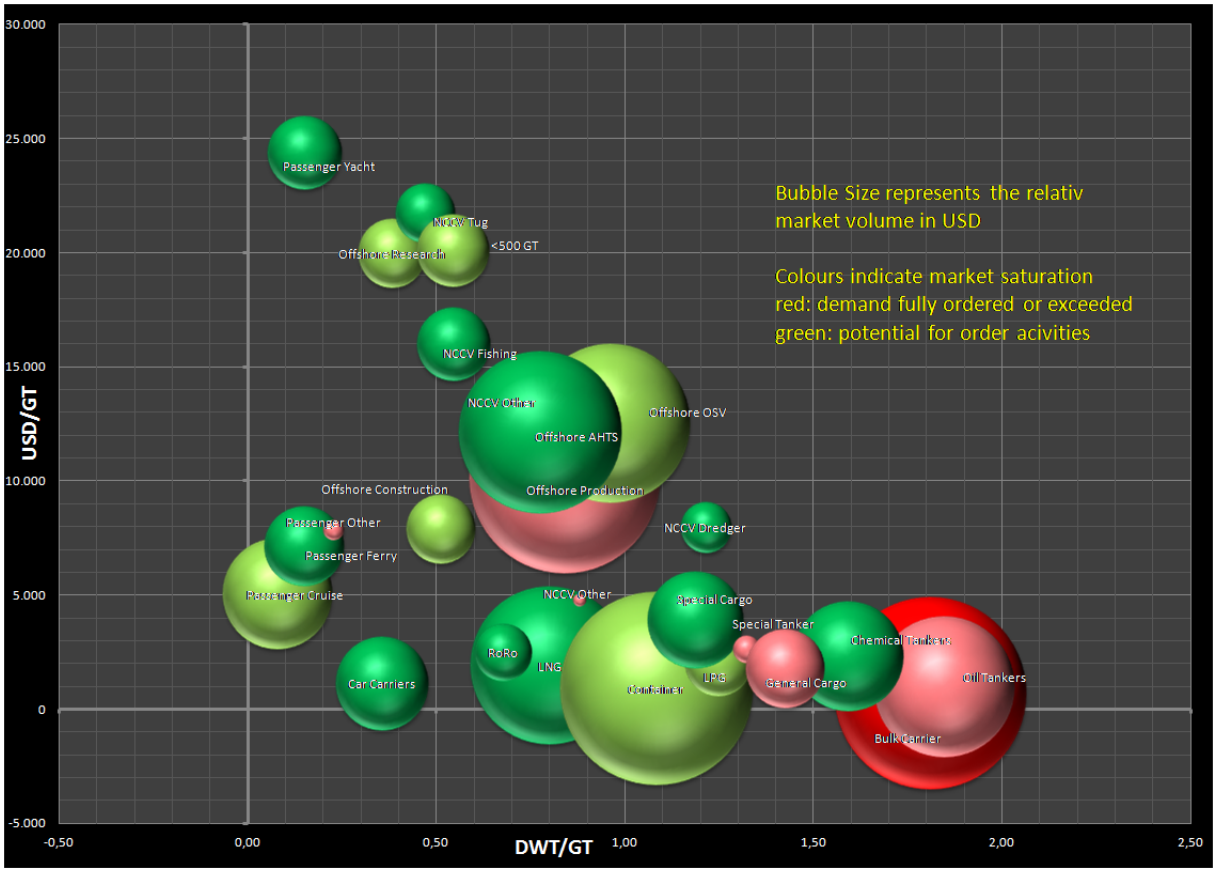


Figure 68: Shipbuilding market forecast 2013-2017

Boatbuilding as private consumer market has declined as well, but is presently levelling out and shows again potential for growth. The naval market has also seen some decline due to the pressure on public households, but on a global scale can be seen as a reliable market with again potential to grow. The offshore markets for oil and gas and as well for offshore wind are an actual driver of the market prosperity with forecasts for substantial capital expenditures in the following years. This is also cushioning the pressure on the marine markets in due to compensating demands especially on the supply side. The development for these offshore markets are on the one hand depending on the energy demand and price development in the context of GDP growth (for oil and gas) and on the political commitment to change the energy mix in favour of renewable energies (offshore wind and others). The same applies to the special market of retrofitting of the existing fleet, which very much build on the timely implementation of new environmental legislation. This will have an impact on either an increasing demand for conversion of existing ships or early scrapping and newbuilding activities. Although the authors feel confident with the order of magnitude of the given market projections, it should be noted that some of the maritime market forecasts used as information source for projections of marine supplies demand appear to be quite optimistic. However, there are other substantial marine markets of substantial size , which have not been considered in the course of this study, but which may merit consideration, e.g. offshore subsea markets, harbour technologies, shipyard technologies, surveillance. These markets are often served by the same enterprises which produce marine supplies.

It needs to be noted that compared to the statistical evaluation for the global annual demand in period 2006-2010 (compare chapter 4), the world market marine supplies forecast for 2013-2017 suggests a market size which is about 30% lower than the average size of the industry in the period 2006 to 2010. The downsizing of the overall marine market is continuing since 2008. For European shipyards and boatyards this resulted in a decline of the ship and boat production volume and related purchasing volumes, which are as well in the range of 30%, presently down to the level existing in 2005. However, it may be expected

that the industry has already seen the bottom of the market decline and is adapted to the market expectations for the following years.

The mixed perspectives for the further development of the European maritime supplies industry have been confirmed by the results of a consultation of industry experts by means of a detailed questionnaire on the development of the different markets. However, the responses might not be fully representative as the consultation couldn't reach the large share of small suppliers operating regionally, which are mostly not organised in any association. The result is given in the following figure. With the exception of merchant shipbuilding which for Europe is expected to show slow erosion in the coming years all markets are expected to either will not see major changes or will moderately grow. Again the offshore markets are expected to grow strongest among the different marine markets.

Merchant Shipbuilding

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	0	2	4	6	5
World ex Europe	0	10	4	3	0

Ship Repair and conversion

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	0	11	6	1	0
World ex Europe	2	10	5	0	0

Retrofitting

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	3	8	4	2	0
World ex Europe	1	10	6	0	0

Boatbuilding >24m

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	2	7	7	1	0
World ex Europe	0	6	11	0	0

Naval Shipbuilding

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	1	3	10	4	0
World ex Europe	2	5	9	1	0

Naval Ships maintenance and repair

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	1	7	8	1	0
World ex Europe	0	8	9	0	0

Offshore Oil & Gas

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	4	12	1	0	0
World ex Europe	8	8	1	0	0

Offshore Wind

	Strong Growth	Moderate Growth	No change	Slow erosion	Market loss
Europe	7	7	2	1	0
World ex Europe	3	11	2	1	0

Figure 69: Market expectations by marine market [Experts' answers to study questionnaire]

Expectations on the market development for the major marine trades have been asked for in the same questionnaire. The experts' opinions on that are represented by the following table. For European suppliers strong growth is expected for engineering, design and consulting services. Further solid market positions with either no change or moderate growth are expected for accommodation, auxiliary systems, electrical plants and electronic systems. More diversified opinions exist for propulsion systems, ship operation systems and cargo handling, where there seems to be a danger for slow market erosion in favour of production movement to overseas countries. This trend is already very strong for steel, pipes and ducts and also paint and coating materials.

Engineering, design and consulting services				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
4	9	4	0	0

Materials – Steel				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
0	0	3	13	2

Materials – Pipes and Ducts				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
0	1	6	8	2

Materials – Paint, Coating (paints, painting services)				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
0	4	7	5	1

Systems/Equipment – Ship Operation				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
2	4	6	5	0

Systems/Equipment - Cargo Handling Equipment and Special Cargo Plants				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
4	7	3	4	0

Systems/Equipment – Accommodation				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
1	7	5	3	1

Systems/Equipment - Propulsion, Power Generation				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
0	9	3	5	0

Systems/Equipment - Auxiliary Systems, Apparatus & Accessories for engine operation, ship operation, cargo handling, accommodation				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
1	7	7	3	0

Systems/Equipment - Electrical Plants and Electronic Systems				
Strong growth	Moderate growth	No change	Slow erosion	Market loss
2	9	6	0	0

Figure 70: Market expectations by marine trade [Experts' answers to study questionnaire]

According to calculations on the years 2006-2010, the market share of EU28 marine suppliers resulted to about 33% of the world production value (~39% including Norway and Turkey). At the demand side EU-28 represents ~24% (~30% including Norway and Turkey). For the time after the financial crisis it has been assumed that the relative market shares of equipment and system suppliers, which are active in global businesses, did not shrink. However, those enterprises which are working in a regional or national environment suffered from the shrinking purchasing demand of shipbuilding, boatbuilding and repair. For the different markets it can be said that ship newbuilding in Europe was at a decline in this phase by losing some of the merchant ship markets entirely, e.g. containerships. This created a

lower demand. On the other hand some shipyards specialised in passenger vessels and yachts maintained their position or even gained some ground in those markets. Furthermore, some of the lost markets could be compensated by new markets in the offshore business. For the other markets it is expected that Europe can for the foreseeable future maintain the market volume and related purchasing volume for supplies, especially in the naval market and in boatbuilding (super yachts). However, due to the increased building of naval vessels in Asia, the European market share may shrink. Ship repair and retrofitting markets have to be further observed, because it is not clear whether or not the retrofitting market will materialise and at what time. It might also well be that environmental regulations will create an earlier newbuilding demand in combination with earlier scrapping. European shipyards and subcontractors will have to continue fighting for their market shares. Equipment and system suppliers are in a somewhat better position as they will benefit from this market also on a global scale. Offshore Oil and Gas markets containing some hope at least for the specialised smaller vessels. It is expected that the more steel intensive ships and platforms are all built in Asia. However, this is a big market for the supplies industry, because the relative supply value on special equipment for these vessels is even higher than for cruise ships. The equipment and system suppliers will see an increasing competition in these markets from Asia as well, because they want to increase the local content. The offshore wind sector depends highly on the political framework conditions. It seems that most forecasts for the erection of offshore wind-farms have been too optimistic and construction may materialise in a slower pace. On the other hand offshore wind creates a totally new market, where European suppliers have a strong position due to the early development of the European market. New chances for export develop and create new employment. Especially for these markets it is also very important for European suppliers to create reference applications within Europe in order to be in the position to serve overseas markets.

6.2 The role of technology and innovation

Many challenging future issues can be identified to underline the continuous demand for innovation. This includes new transport routes, new transport tasks, economic operation of ships and offshore plants, greening of transport, global liability for accidents, exploration and exploitation of resources in extreme environments, offshore renewable energy production, residential and recreational areas at sea and under the sea, new generation of pleasure craft and many more. Innovation need to be found for new products, services, process technologies, logistics, etc. The world has accelerated the development speed and new players from the emerging economies are challenging the established companies, but by the same time are offering new and growing markets. With the exception of a few special ship types, Europe has lost the entire shipbuilding market to Asia. Today there is merely any shipyard in Europe left which can process steel in amounts exceeding 100.000 t in a competitive way. The market of steel intensive ships has been moved to Asia, where about 15 shipyards exist which can process 1.000.000 t of steel per year (or even much more, e.g. HHI 4 mt/a) and are well suited to produce large bulker, tanker, container vessel and other steel intensive ship including offshore drilling and production vessels. Europe has still a leading position for cruise ships, mega yachts, research vessels, special RoRo vessels, advance ferries and a selection of other non-cargo carrying and small vessels. All together a small volume in terms of dwt or GT, but very a very high density of outfitting per ship volume. This comes along with a demand for high-end products representing a very high monetary value of built. in systems and components. European stakeholders, shipyards and suppliers, can only compete in these markets and maintain a competitive position, due to continuous innovation in engineering processes, product innovation, the superior proficiency to manage processes and logistics and close co-operation with strategic partners in order to maintain the timely advantage in innovation.

Having said this and in order to maintain a competitive advantage, the European marine industry must maintain and should further establish advanced innovation management processes, which logically build on a first phase of ideas management, a second phase of knowledge generation and finally enters in a successful exploitation of the results.

In order to identify the right topics for innovation the industry creates since 15 years a research and development master plan, nowadays under the name WaterBorne Strategic Research Agenda. This master plan more or less follows the opinion of experts, which have discussed the potential topics for innovation and research over a longer period. The research agenda is then used in the discussion with the European Commission on considerations of maritime research topics in the RTD framework programmes.

In discussions with peers and earlier intelligence activities it became obvious that experts regard information and communication technology, energy technology and environmental technology as generic technologies of highest importance for specific maritime technology developments. New Materials, robotics and automation technologies and integration of production systems are following closely. The figure below illustrates this ranking and gives ideas on further important generic technologies, which have the potential of sustainable market changes (game changer technologies). This seems to be trivial when looking at it the first time. But these technologies need to be understood in detail and with a view to potential application in the maritime field. Only then new ideas for products or process improvements can be generated. Since there is a general tendency to think in systems with smaller or larger boundaries, the co-operation with different partners, e.g. shipyards and suppliers is of vital importance. The attempt of the maritime industry to establish a so called maritime public private partnership (PPP) under the upcoming framework programme Horizon 2020 can only work, when this kind of co-operation is systematically implemented in the management structure.

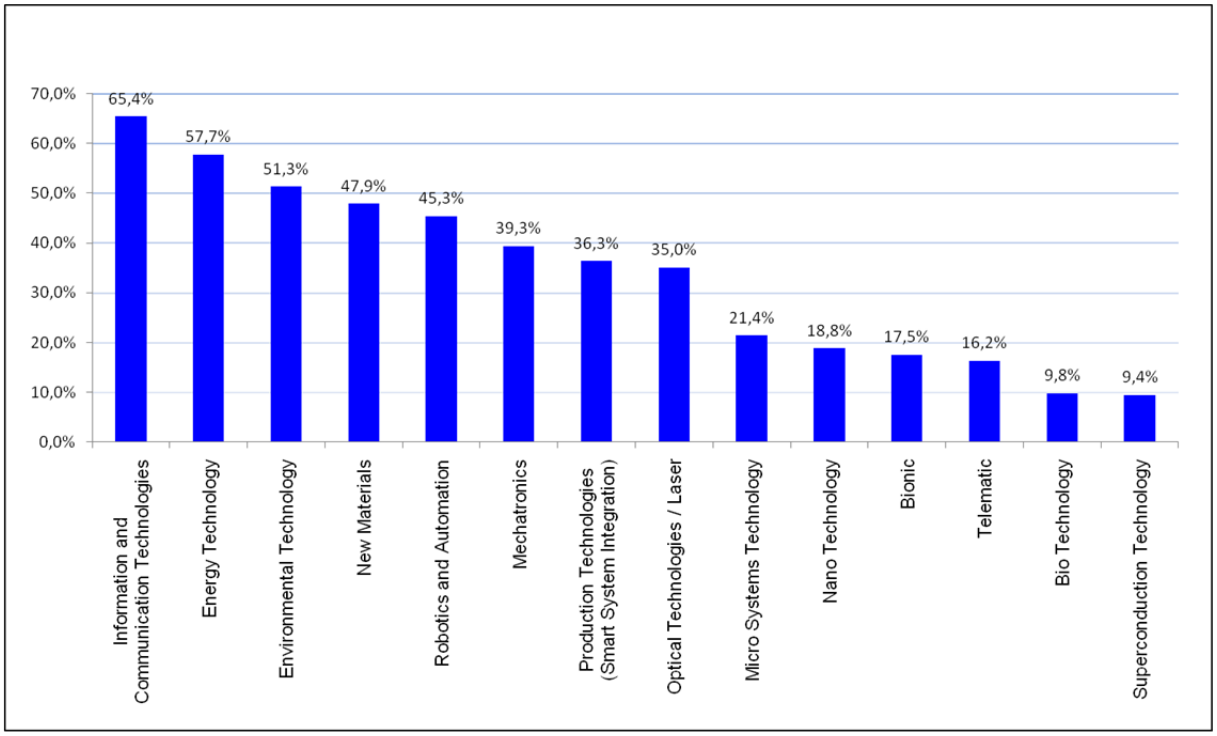


Figure 71: International peer evaluation on trends in innovation [Source: (32)]

Following the discussion on important generic technologies, more specific marine products oriented technologies have to be evaluated as well. Again international experts and peers have been asked in the course of a German governmental study about their opinion which maritime technologies are essential and important for the future. As a result, the experts regard environmental technologies, technologies to improve energy efficiency, oil spill fighting, offshore wind technologies and offshore oil & gas technologies as of highest importance for new innovation and research activities in marine technology. Further areas and ideas are mapped in the next figure.

For the future of ship suppliers in Europe it is essential to team up with customers at the shipping side, offshore developers and also with shipyards in order to understand the

challenges of the time accurately and to develop adequate products and services. This is a complex task and should always be performed with a view to the market and marketable products and not necessarily with a focus on research funds only. Apart from any fundamental research topics, which are essential to develop and explore generic technologies, applied research and development should always have a market in focus with clear ideas on the point in time when the new market will sustainably materialise. There should be also an idea on the potential market volume in order to be in the position to justify research and developments efforts. In the last picture in this chapter, some examples for maritime technologies are listed and an idea on the market potential is given by the position in the portfolio.

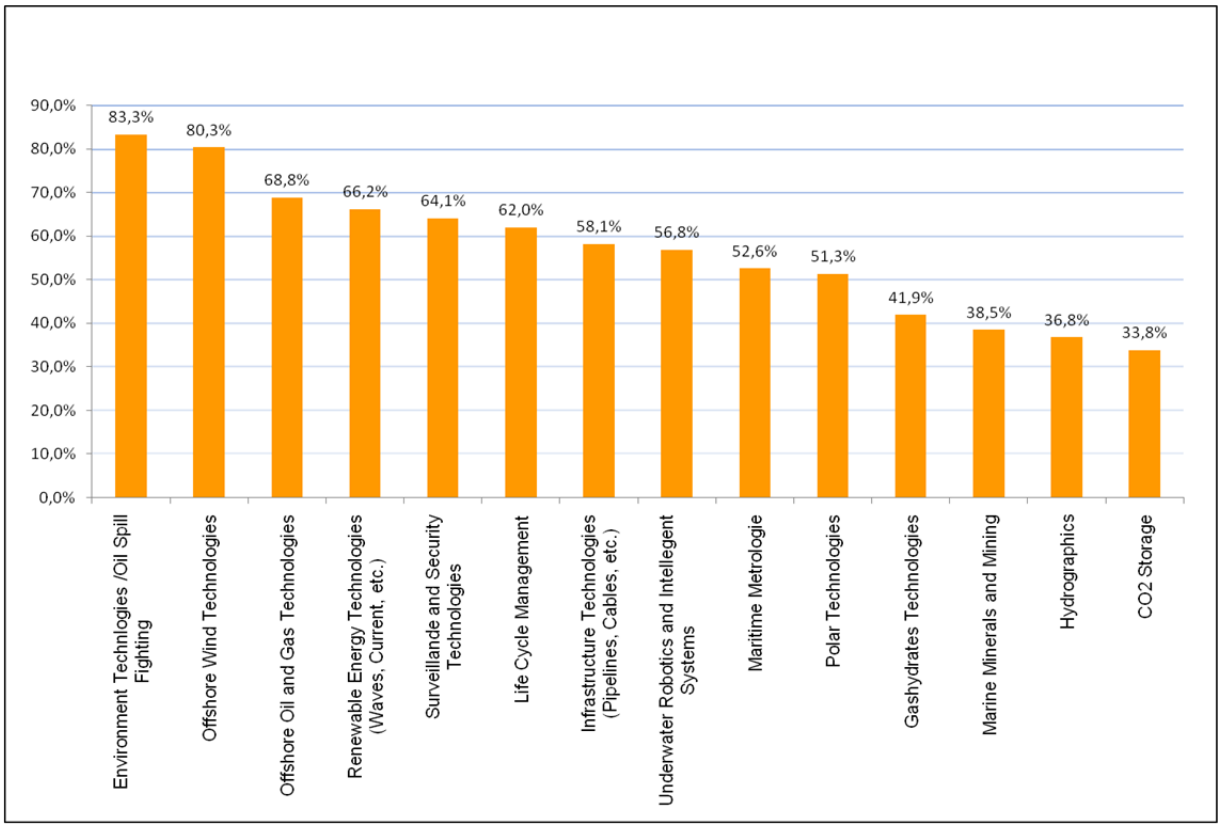


Figure 72: International peer evaluation on trends in innovation *[Source: (32)*]

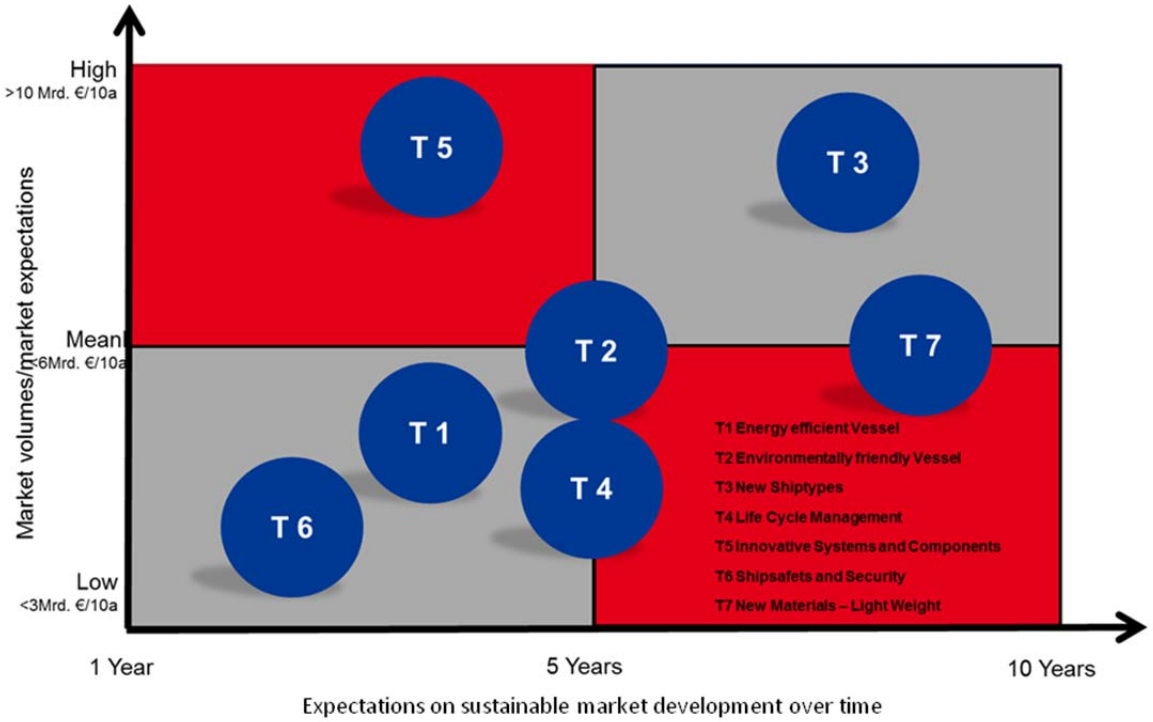


Figure 73: International peer evaluation on trends in innovation, [Source: (32)]

6.3 Changing role of shipyards in shipbuilding value chains

The business of large offshore AHTS and OSV is dominated by a few companies worldwide providing general and parametric designs for both shiptypes. These companies are some specialised shipyards, but with increasing tendency major equipment and system suppliers. By selling their designs, they are also tempting to manage the entire contract and to supply the full propulsion package often also in combination with packages for auxiliary systems, ship automation and deck machinery. The ships finally are produced in shipyards worldwide, following tendering procedures. By applying this approach, the companies are not only in control of the entire contract but also contribute the most valuable equipment and system components, i.e. covering a major share of the entire contract value (35-50%). The figures below illustrate the situation. STX OSV meanwhile has been sold and is now a part of the Fincantieri group.

The question for the future is whether or not this approach has a potential for application by some strong marine supply companies to other mainstream shiptypes. With regard to many shipyards which have partly lost or given away (outsourced) their engineering competences to design offices, classification societies and model basins this is a threat for their future development, because they are downgraded to “workbenches” which can only compete over price. For suppliers (subcontractors) linked to European shipyards this is a major challenge. With European shipyards going out of the market these suppliers are forced to enter into more international markets and competition, which is a challenge in itself and can only be survived though superior knowledge and innovation in products and processes. Design offices, model basins and also classification societies start experiencing this and are not unaffected by this trend.

On the other hand for globally active system and component suppliers this opens new potential markets for their core systems and equipment. This is especially true for bigger companies which build a leading market position on financial power, which can help financing of larger shipbuilding contracts.

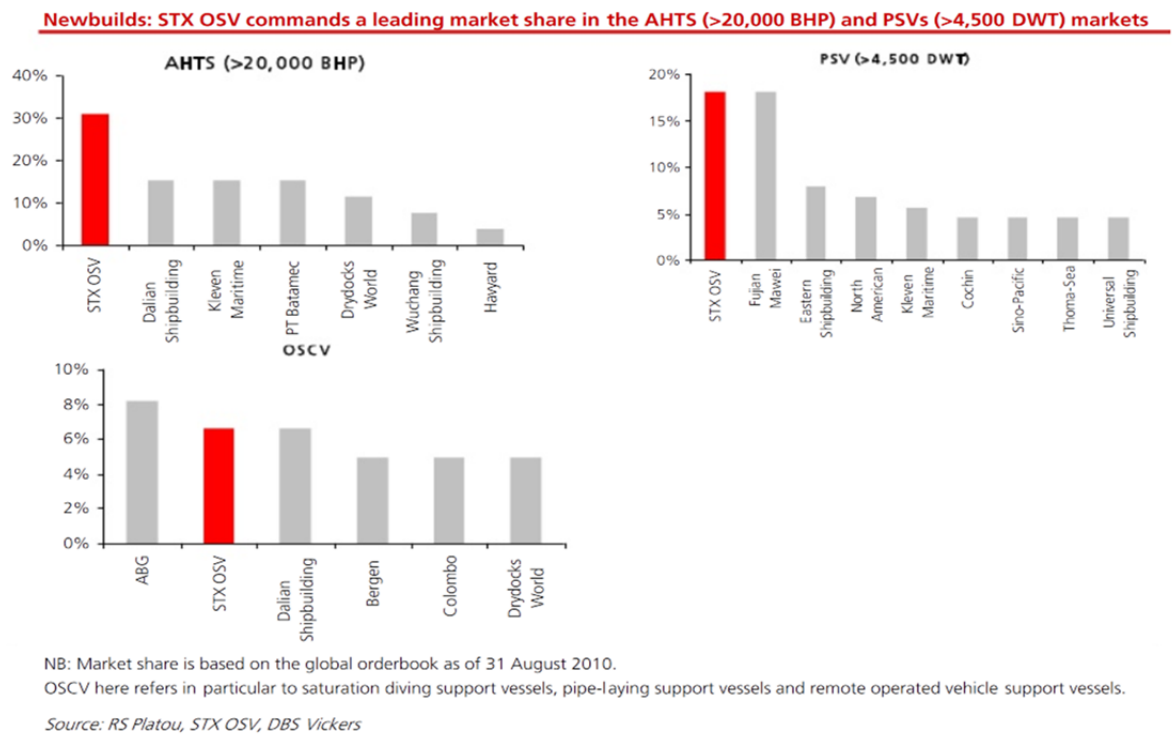


Figure 74: Large OSV Newbuilding Market Shares [Source: (33)]

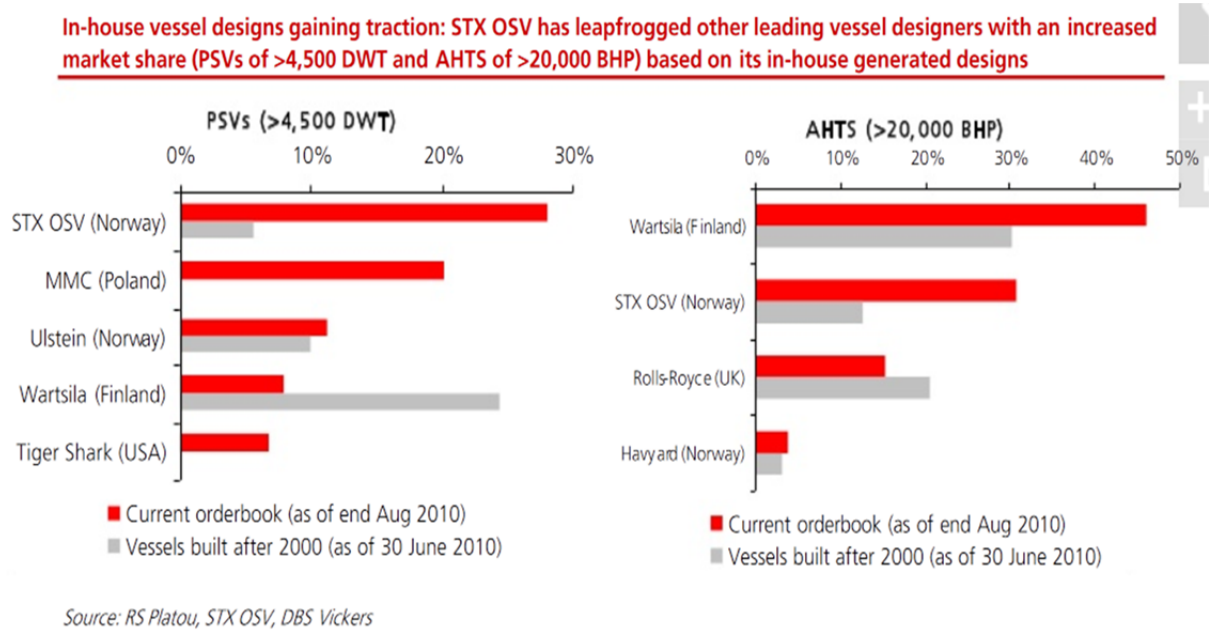


Figure 75: Large OSV Design Market Shares [Source: (33)]

7 SWOT analysis and recommendations

The given background as described above and with the marine supplies industry being a very heterogeneous industry, it is very difficult if not impossible to perform a SWOT analysis which is valid for all players in this industry. Furthermore, European countries do not provide the same framework conditions in terms of cost basis, finance, academic and educational system etc. All this leads to the situation that some arguments are valid in an opposite sense for different European countries and companies.

As a trigger for the discussion with experts, the authors have drafted a number of SWOT arguments, which have been built on longer term observations of the marine supplies market including some direct consulting work for suppliers directly. Consultation of stakeholders took place by means by means of an extended questionnaire and a workshop. The participants have been in agreement with the drafted arguments and have contributed a number of complimentary SWOT arguments which allow drawing a fairly general picture of the situation and present mood in the industry. It needs to be said that all comments received are from major marine companies and associations representing the industry on a European level or on a national level. No comments have been received from subcontractors working in the vicinity of shipyards or are depended on regional demand.

In order to take account of the received contributions, we have divided the analysis in two blocks. One block addresses the strengths and weaknesses and the second block the opportunities and threats. Within those blocks the arguments raised have been distinguished according to aspects related to “markets”, “innovation”, “supply chain” and “framework conditions”. Very few arguments have been raised beyond these four aspects.

7.1 Strengths and Weaknesses

As a summary the following table provides an overview on identified strengths and weaknesses for the European supplies industry.

Strengths of European marine supplies industry	Weaknesses of European marine supplies industry
Market: • Good market position for technological high end products • High export share with global customer base • Understanding of owner requirements, flexibility towards tailor-made products • Provision of integrated and sustainable solutions, systems • Quality/Reliability of products, strong brands • After sales services, global service networks • Market penetration by serving different maritime markets, equipment certified by the majority of classification societies	**Market:** • Declining European shipbuilding industry and shipping owner base will lead to knowledge drain, development partners will disappear • European Market is too fragmented • Although good general market position, maritime products often have a minor importance in bigger companies’ product portfolios.

Strengths of European marine supplies industry	Weaknesses of European marine supplies industry
Innovation: • Innovative Products, good quality • Engineering/Design capacity • Added value concepts • Exchange to other branches /diversity of sales markets for similar products • The maritime industry research agenda increasingly maps needs of marine suppliers	**Innovation:** • De-centralised R&D • Risk averse behaviour of customers • Potential for IPR violation through uncontrolled know how transfer • Limited investment capital available for innovation and research • Innovation not established as management process on a broad level – often technology driven and partly lack of market focus
Supply Chain: • Experience and know-how of the manufacturers • Long-term partnerships between shipyards and suppliers, especially with subcontractors • Networking and teamwork by cooperation in normal business and research activities	**Supply Chain:** • No consequent supply–chain management • Supply chain is fragmented and does not benefit from a coherent benchmarking regime • Limited approach by customers towards grouped purchasing. • Outsourcing by shipyards not sufficiently accompanied by process integration and QA
Framework Conditions: • Strong European industry base in general, strong mechanical engineering and electrical engineering • Powerful research environment and educational system • Strong competitive environment with numerous flexible companies • Good infrastructure, reliable logistics	**Framework Conditions:** • Heterogeneous industry structure, few big, many very small companies • High wages and costly social system - High cost of production • Material cost comparably high • Access to finance • Currency exchange rates • In comparison to other European industries reluctant political support • Significant administrative burdens and cumbersome regulation

With regard to **market aspects**, European suppliers are very self-confident in their strengths, claiming a strong market position and technological leadership. They basically build this on a deep understanding of requirements, high export shares, openness to new ideas and flexibility and access/stakes to different maritime markets. At the weaknesses side they feel sometimes not adequately positioned in their own companies (maritime share of product portfolios comparably small) and feel the market drainage due to shrinking shipbuilding industry and decreasing shipping activities. However, due to the still uncertain market development some feel it is difficult to choose a way forward in developments and investments.

Only few points have been raised with regard to **innovation**. Basically they build the strength on the good design and engineering capabilities in combination with the good product basis. Further, products may add additional features (added value) beyond those originally required. They claim as weaknesses that only low risks are taken by customers and that

investment capital for innovation and research is insufficient. Further, handling of IPR and fragmented R&D is claimed to be not satisfactory.

Against expectations, for **supply chain** organisation more weaknesses than strengths have been identified. In spite of reported good networking and co-operation in normal business and research, weaknesses are listed in general supply chain integration and management, co-operation in purchasing and co-operation between smaller and larger firms. Outsourcing of some trades by shipyards may have led to cost reductions, but not necessarily to process improvements due to missing integration activities and quality assurance of outsourced functions.

The highest number of comments has been raised with regard to **framework conditions**. On the strengths' side we find the powerful European basis of technical industries with competition between each other, a strong academic and educational environment and a good infrastructure. Political support is claimed to be insufficient on different levels not ensuring a level playing field. This is reported as weakness in combination with high cost for personnel and material and the lack of sufficient financing instruments. With regard to the functioning of clusters and role of associations no coherent opinion could be identified. For some regions maritime clusters have been established and have contributed to the strengthening of the maritime industry by targeted supporting activities. Most other maritime clusters are "business networks" only with very limited impact on the integration of the fragmented industry base in their region and improvement of market access. The same feeling applies for associations where a number of very strong and active national associations exist besides other very weak and inactive ones. Furthermore the representation of shipyards and suppliers is not everywhere organised in the same way. This also makes it difficult to establish a strong European association which can address all aspects of shipbuilding and marine supplies industry.

In comparison to that observed strength and weaknesses of competing overseas countries, especially Asia, are basically the opposite of those observed for Europe. In addition, on market aspects it has to be noted that the proximity to larger end-markets in Asia is an advantage, especially also in combination with increasing domestic markets and future sino-pacific growth. Further advantages can be seen in larger scale effects and learning curves due to larger shipbuilding series. As a special weakness for parts of Asia a low presence in niche markets of high added value (for non-cargo vessels, green technology, innovative products) is observed in combination with missing credible global service operations to match the global shipping market requirements. Besides a less performing infrastructure, innovation activities in the area are perceived to be at a low level. However, the latter is changing rapidly with huge R&D capacities are being built up and strategic product offensives to increase domestic market shares and to trigger export have been launched.

7.2 Opportunities and Threats

As a summary the following table provides an overview on identified opportunities and threats for the European supplies industry.

Opportunities of European marine supplies industry	Threats of European marine supplies industry
Market: • Emerging markets through environmental policies – advanced regulations create new market opportunities for systems and components (newbuilding and retrofitting) • Emerging new offshore markets in oil and gas (deep sea, polar) and wind – opportunities for diversification including service and maintenance activities • Increasing technology demand for ship operation and external control, increasing system integration • Geographically emerging and growing markets e.g. Russia, India and Brazil • Industry consolidation – overcoming industry fragmentation towards larger global players with broader market access • Closer co-operation with shipping companies to gain opportunities for prominent ranking on makers lists	**Market:** • Slow recovery of global shipbuilding markets due to existing overcapacities in some fleets • European home markets are continue to shrink, i.e. reference markets disappear • "One-of-a-kind" shipbuilding compared to series in Asia also provide negative scale effects for suppliers • Trend towards standard vessels – less sophisticated equipment • The market shifts towards a buyers' market – higher price/cost pressure also on supplies Local content requirements are increasing in Asia and emerging economies like Brazil
Innovation: • Closer co-operation with shipping companies and shipyards towards better regulation and shipping standards • Far-sighted and market oriented R&D work in combination with consequent exploitation will lead to high market shares in new technology areas • Emerging markets open "an ocean of opportunities" for innovation and technology development • European environmental policy leadership may provide opportunities for early technological references • Co-operative research strategies jointly with shipyards and shipping companies/offshore operators – besides systems and components address transport chain and other value chains	**Innovation:** • Violation of IPR • Competing countries begin to invest more heavily in R&D – technological leadership is challenged • Uncontrolled knowledge transfer to Asia and emerging countries • Investment in research and product development for markets which do not or too slowly materialise (e.g. due to regulations) –investments are not safeguarded
Supply Chain: • Enabling supply chains and value chains by appropriate models of co-operation with shipyards and offshore operators can create unique selling points	**Supply Chain:** • Strategies towards national supply chains and value chains in strong shipbuilding countries and emerging economies can weaken market positions.

Opportunities of European marine supplies industry	Threats of European marine supplies industry
Framework Conditions: • Further harmonisation and standardisation of regulations in Europe to remove legislative barriers • High energy cost may trigger even more demand for energy efficient vessels • Further environmental regulations may lead to further increase of "green cost", but may drive technological markets for powerful systems and components	**Framework Conditions:** • Accelerated strategic expansion of the Asian maritime supplies industry mainly in Japan, Korea and China, in conjunction with increasing export activities also to the European market • Increasing activities of strategic investors from North America and Asia to acquire stakes in European global acting companies. This may lead to accelerated exodus of companies • Comparably high (e.g. environmental) requirements cause high production costs in Europe • Subsidies in competing countries

New and emerging markets are in the focus of European suppliers when it comes to opportunities. Besides the vague hope for a quick improving shipbuilding market, hope concentrates on offshore and retrofitting. Market demand for more efficient and environmental ships with higher requirements for ship operation, external control and increasing system integration are driving forces for more market dynamics in the high-end sector. Geographically new emerging markets (Brazil, Middle East) and the perspective of new free trade agreements add further opportunities to build trust with shipping companies in order to gain favourite positions on the makers list. On the downside the shrinking European market (shipbuilding and shipping) generate some concern, especially with regard to loosing reference markets for high-end products. It is also expected that the price pressure will continue to increase driven by overcapacity in shipbuilding leading to low prices in general. In combination with trends towards more standardised vessels and increasing requirements for local content, European employment in marine supplies in Europe may come under even more intense pressure.

European opportunities rest on innovation and research. A lot of innovation needs are created through above mentioned emerging markets for more efficient and more environmentally friendly ships and other marine products. Besides direct product innovation, ideas towards more integration, more holistic and life-cycle sustainable solutions are in the focus. Offshore markets create demand for totally new solutions in the area of underwater, arctic and safety applications. Building on existing strength is way ahead. However, other overseas economies strategically increase their efforts in R&D and innovation. Protection of IPR and hindering of involuntary know how transfer must be in the focus.

With a view to the reported weaknesses above, it was expected that many opportunities should exist to enable and integrate the value chain between suppliers and their customers. However, these opportunities seem not to be in the focus of industry (with exceptions), but leaves room for ideas. This is especially true in comparison to the relatively stringent value chain integration practiced in Korea and the potentials which are unearthed in this sector in order to improve competitiveness. Beyond the natural interest of the shipyards to be in the driving seat for the organisation of these processes, it should be also a major objective for suppliers and subcontractors to offer pro-actively procedures to better integrate and harmonise supply processes.

Threats seem to prevail over opportunities when it comes to framework conditions. Strategic moves of overseas countries towards own marine supplies industries, more local content

requirements, the lack of a level playing field with regard to political support, financing and subsidies, uneven implementation of environmental regulations etc. are challenging the strong position of European marine supplies industries. Furthermore, take-overs from US and/or Asian competitors might be seen in the future. At the opportunities side more and better regulations with higher requirements for high-end equipment and systems and higher energy cost are the driving forces to maintain a strong European industry, at least for innovative products.

Again for the overseas competitors all listed opportunities and threats are perceived in the opposite sense. As special threats it can be noted that with the increasing wealth in emerging economies also the cost level is rising quickly. Besides wages this applies also to social charges and exchange rates of some currencies. Furthermore the strong competition between Asian countries is not only a threat for them, but may also trigger quicker development of their competitiveness which in turn becomes a threat for European suppliers.

7.3 Recommendations

The study shows that European marine supplies industry plays a strong role in the very heterogeneous global marine markets. Nevertheless, the heterogeneous structure of the industry with a comparably high number of companies including many SMEs does not make it easy to create harmonised and focussed strategies. Furthermore strategies of individual single companies, especially global players with a tendency to relocate production to Asia, may deviate from a strategy applied by European policy in order to support competitiveness of marine suppliers and finally to create growth and employment in Europe. In order to address these latter objectives, we come to the following recommendations for the suppliers and subcontractors themselves, but also jointly with key customer industries (shipyards, shipping companies, offshore operators) and policy makers.

Improve Market Access - Maintenance and/or development of global market shares - For globally acting suppliers with competitive systems and components in their supply portfolio the global market counts. Nevertheless, European markets provide suppliers with a base-load for their products. Furthermore they are also serving most of the different marine markets and therefore are not necessarily depending on newbuilding of ships only. In order to maintain and improve their market position, for suppliers it is essential to ensure international market access and to keep close contacts to the final customers, e.g. shipping companies, offshore firms, governmental purchasing instances etc. In order to cope with this important aspect three recommendations are given

- It would be beneficial if technical oriented joint groups (suppliers, shipyards, shipping companies, offshore operators) could be formed at European level. Maybe the marine supplies system groups as defined in the report can give a first orientation for that. These groups should discuss innovation needs, affected actual and future regulation and operational needs in engineering, production and after sales services. This kind of co-operation could strengthen the market position of European suppliers, improve the relation between the stakeholders in the value chain and trigger future activities including contributions to the research agenda.
- It is recommended to think about opportunities for joint European initiatives to strengthen extra EU-28 export activities and to facilitate access to new emerging markets, especially offshore. The added value of these initiatives beyond the value of activities from national associations should be discussed and evaluated. Initial geographical oriented activities could focus on Brazil, Gulf countries (Middle East) and India and discussions could address the difficult aspect of local content. Aspects of emerging markets are further discussed below.
- A third recommendation can build on the first two by strengthening the ability of European suppliers to offer competence and products with regard to entire ship and offshore systems. Some major market stakeholders already are doing this for some system groups and by integrating components in their own companies by intensive

M&A actions (e.g. in propulsion systems). The possibility to support consortia of maritime suppliers to integrate products and services towards systems solutions in form of co-operations should be considered. In analogy to the "smile curve" it must be clearly a European objective to build, maintain and consolidate high value adding functions in the context of ship systems; i.e. research, engineering, branding, sales and after sales services. In other words, support system building by strengthening of supplier co-operation and management and as well new business models for joint sales and after sales activities. This may also include joint initiatives towards high efficient and flexible production value chains in Europe in order to counterfeit exodus of production to low cost countries.

Support emerging markets I – presently the marine industry is facing an exceptional situation of emerging or quickly evolving high-end markets for marine supplies. This is true for the offshore markets, where oil and gas exploration and production moves to deep sea and polar areas requiring new and deep sea related products. It also applies to offshore wind markets and other ocean based renewable energies which face challenging times to develop suitable products in order to serve policies focussing on energy change. In both markets European marine suppliers have already a strong position, but need to consolidate this and develop further opportunities to serve with their products also overseas markets. Since these markets are not represented by the shipbuilding and ship supplies industry associations, networking and establishment of strategic partnerships with representatives of related markets is of vital importance.

Support emerging markets II – Requirements following environmental legislation aiming at a reduction of ship emissions create a market of significant size will for a timeframe of probably 10 years, a special business cycle of ship conversions (retrofitting) and/or they will trigger ship new-buildings. At least for this period European repair/conversion shipyards and suppliers offering products in the area are recommended to team up for the development of tailored conversion solutions. This also may include engineering activities and financing packages.

Maintain excellence in Innovation and Technology – This is the key issue besides high product quality, long term system reliability, after sales services and cost competitiveness for the globally acting European suppliers in all marine markets. Apart from the marine knowledge, they build their products on the grounds of fundamental know-how in mechanical engineering and electrical engineering. To maintain their global position it is essential to keep this level high and to maintain a position at the forefront of innovation. It also requires good knowledge of the market (customer) needs, technological trends, co-operation with shipyards etc. This applies to all ship-types, boats and offshore products, because the product portfolio of European suppliers is not limited to niche products. However, for normal merchant ships co-operation with shipyards has fully moved to Asia and co-operation is developing there. For some special shiptypes including high-end NCCV, Cruise ships, mega-yachts etc., European yards are still the leading edge development partners. This applies to offshore products. However, it can be seen that also design offices and research centres are gradually moving outside Europe, i.e. following end-user markets. In order to fight this trend it is recommended to focus on European joint industry projects to drive technology and innovation in marine technologies, to continue building a European, commonly shared technology platform rather than promoting national initiatives and to create rules for better protection of IPR and to avoid unintentional know-how transfer.

Maintenance and vitalization of European maritime markets including markets in smaller European regions – This issue addresses the needs of those suppliers being more subcontractors, assembly partners or "workbenches" for subassemblies which are more dependent on regional maritime markets and in most cases SMEs. For these suppliers the existence of their marine markets in their closer vicinity is of vital importance. In other words they only survive on the basis of the orderbook and competitiveness of "their" shipyards and boatyards in Europe. It is recommended to look into the situation of subcontractors more closely and to discuss programmes to improve their role in the supply chain, to generate exit

strategies towards more trans-regional businesses and to help them participating in RTD measures using special SME funding regimes.

Improve competitiveness in value chains – Apart from technological performance of products, it is more and more essential that suppliers can very competitively integrate themselves into the supply chain of their customers. This is on the one hand true for the subcontractors, which work very closely with shipyards and are involved in the planned building process. On the other hand it is also true for the system and component suppliers which are often also integrated in the building process through planned assembly and testing activities. Besides the shipbuilding or offshore value chains the value chains for shipping with regard to spare part provision is an important issue. It is essential that suppliers manage global spare part and assembly networks which allow serving the shipping industry needs very quickly. All these different value chains need specific attention and it is recommended to support suppliers in their attempt to improve these, e.g. by respective research projects.

Structural Improvements in Industry (Associations, clusters) – The analysis of the marine supplies industry structure shows that the majority of companies and maybe half of the employment is not represented by any industry association. This is due to the fact that many companies are very small and regional companies, but also midsized companies are not necessarily member in an association. It would be beneficial if associations and regional cluster organisations would think about an attempt to get these companies somehow represented or teamed-up, e.g. for joint marketing exercises. Clusters in general should think about strengthening their structures and activities. Industry associations should be involved in order to accommodate the integration process and to interlink with typically supporting regional clusters. Good examples in Europe show that this has an impact on all maritime players. Co-operation between European clusters should be enhanced by advanced networking activities in order to remove national barriers. This may also include 'unusual alliances' to drive strategy and to establish links with other industries. The European structural funds may provide suitable instruments for this.

Maintain the knowledge base – enhance education and training – European marine supplies industries build their capabilities on a strong academic/educational framework with well-developed engineering skills, a strong general industry base and healthy competition in their markets. It is therefore strongly recommended that on the basis of existing programmes education and training in the marine disciplines are enhanced, maintained and if necessary adapted to the demand of new emerging markets and technologies. Industry and universities are requested to jointly develop adequate curricula and to offer related studies. This may also include maritime programmes to establish and support lifelong training measures and as inter European educational exchange programmes.

Strengthen the policy dialogue – The European marine supplies industry is affected by a number of policies on national, European and global level. It is essential that the framework conditions are harmonised on all levels. Even globally a common European view on environmental issues, pro/cons of available technical solutions, taxation, logistic and infrastructure might be appreciated. In order to cope with all these different dimensions of the discussion, a strong European maritime association is essential as discussion partner and lobbying instance for the European and international institutions.

Increase visibility as high tech industry and market – For many years shipbuilding had a difficult public reputation. That has improved over time and shipbuilding is now recognised as a high-tech branch. The contribution of the supplies industry in this context is to a large extent invisible. This needs to be changed and the manifold contributions of mechanical engineering industries or electrical engineering to the ship as a high tech product need to be better communicated. This in the end will also create a better awareness on the fact that marine supplies industry is not only located around the European shipbuilding centres close to the coast.

Align work on regulations and research to create innovation on time – It seems that the uncertainty if and when a market triggered by new legislation will emerge creates sometimes difficult situations for frontrunners of technological innovation. Often it is the case that these

markets are not materialising within the expected timeframe, but are postponed due to political discussions. In order to better protect investments of companies it is therefore recommended to improve the alignment of RTD measures with the likely development of regulations. Legislation and application of regulations needs to be in a way that a level playing field is given. This is also essential to minimise risks and to generate better possibilities to finance larger contracts.

In order to follow-up some of the recommendations, European marine industries should consider to further strengthen their co-operation on a European level. Many aspects given above are already addressed in the Leadership 2020 strategy and also strategic papers like the WaterBorne Research Agenda or the concept for a public private partnership under the Horizon 2020 framework focussing on the vessel for the future. However, in these strategies most activities seem to be addressed more from the client side of marine supplies industry and from some key suppliers. With regard to the large number and variety of European suppliers as outlined in this report, even if we would only take the top 100 into account, the strategies could address a larger number of marine systems. It would be favourable if a larger number of suppliers could be motivated and integrated in the European discussion. On top it needs to be said that the different marine markets are represented by different associations like SeaEurope (shipbuilding, repair, naval shipbuilding), EBI (boatbuilding), EWEA (offshore wind). Offshore Oil and Gas does not have such a European association, but act on the basis of powerful company networks. For shipbuilding and marine equipment in the narrower sense of ship systems and equipment, the new association SeaEurope has been formed in 2012. For this EMEC as the European association for marine equipment has merged with CESA (shipbuilding) and now represent the marine industry in a broader sense. However, it seems that internal structures in SeaEurope have still to be developed further in order to address marine supplies aspects. Overarching maritime co-ordination activities on European level as provided by the Maritime Industries Forum (MIF) in former years are actually not active. Similarly, it has been observed that some of the national associations are not covering the broad spectrum of the European supplies industry either, which makes a European co-ordination even more challenging. Especially subcontractors are normally not represented by these associations and also design, engineering, consulting firms are not covered specifically. Similarly, the Waterborne Research Agenda only meets the needs of the marine supplies industry to some degree.

8 Annexes – see separate documents

Annex 1: Structure of the marine supplies industry

Annex 2: European marine supplies industry portfolios (as a result from statistical analysis and extrapolation)

Annex 3: European marine supplies industry – Identification of major players, examples for market consolidation, system suppliers, M&A and globalisation

Annex 4: Shiptype portfolios including fleet analysis, shipbuilding orderbook/forecast 2013-2017 and marine supplies market forecast 2013-2017

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