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Shipping: Shipbuilding and Maritime Transportation

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Executive Summary

Shipbuilding and maritime transportation are the main sectors around which the shipping industry is built. Despite their great differences, both sectors are closely related, showing a strong and direct dependency on the performance of international markets.

Clearly dominated by Asian countries, the industry is highly competitive and globalised. To face this competition, the European shipbuilding industry has adopted a specialisation strategy and focused its activities to the construction of high value-added vessels. Largely thanks to its location along major trade routes the European maritime transportation companies have a leading position in the global industry.

The European shipping industry, and more specifically the shipbuilding sector, offers a number of important opportunities for the development of Blue Growth sectors. The need for highly-specialised new vessels is in line with the technological requirements of many of the BG sectors (e.g., development of renewables, seabed mining or biotechnologies). Also, its long working experience may turn into an important source of knowledge for emerging maritime industries. Underlining the characteristics of the industry in the different studied basins, this chapter describes the main features and socio-economic impacts of the European shipping industry (markets, industrial structure, employment, skills, etc.).

8.1 Introduction

Accounting for about 80% of global trade by volume, maritime transportation is the most important conduit for international trade. Population growth, increasing standard of living, industrialisation, exhaustion of local resources, road congestion, and elimination of trade barriers, all contribute to the continuing growth in maritime transportation (Christiansen et al., 2007). Thus, the shipping industry has a crucial role in the increasingly globalised economy.

Shipbuilding and maritime transportation are the two main activities around which the shipping industry is built – Asian countries are the current leaders (ECORYS, 2009). This is attributable to: (i) the historic shipbuilding tradition of Korea and Japan; and (ii), the rapid economic development of China. However, over the last years, new countries have emerged as potential shipbuilding nations (e.g., Brazil, India, Philippines, and Vietnam).

Together, China, Japan and S. Korea account for more than the 80% of the market for new orders. Ship construction is a long process, in which vessels are delivered several years after order. Thus, taking into account the order book increase of Asian shipyards (mainly China), their dominance is expected to continue in the following years. However, despite of the leading position of Asian countries in the industry, Europe remains as an important contributor to the development of this sector (SeaEurope, 2013a).

8.1.1 Sector Description: Shipping Cycles

The performance of the shipping industry is highly influenced by markets, as it is subjected to the constant changes of world trade volume. As pointed out by Stopford (1997), this is clearly explained with a simple example: "If the active merchant fleet is 1000 m. deadweight tonnage (dwt), and seaborne trade grows by 5 per cent, this will generate demand for an additional 50 m. dwt of new ships. If, in addition, 20 m. dwt of ships are scrapped, the total requirement for new vessels will be 70 m. dwt. If, however, instead of growing by 5 per cent seaborne trade remains at the same level, then there will be no need to expand the fleet and demand will be only 20 m. dwt. Taking the argument a step further, if seaborne trade falls by 5 per cent there will not be any demand for new ships". Thus, shipping is a highly cyclical industry, turning it into an irregular industry.

To understand how the shipping industry works, a good knowledge of these cycles is needed. As a result of shipping cycles the supply and demand for ships is balanced (Stopford, 1997). If the supply is low, the market rewards

investors willing-to-pay high freight rates. In the contrary, if the supply is high, the market squeezes the cash flow until the owners waive the offer and ships are scrapped. Therefore, cycles not only affect shipbuilding activities, but also maritime transportation businesses. As shown in Table 8.1, shipping cycles consist of 4 stages.

Table 8.1 Stages and characteristics of shipping cycles

Stage	Characteristics	Consequences
1: Trough	• Evidence of shipping overcapacity. • Freight rates fall to the operating cost of the least efficient ships in the fleet • Sustained low freight rates and tight credit create a negative net cashflow which becomes progressively greater	• Ships queue up at loading points and vessels at sea slow steam to save fuel and delay arrival • Shipping companies short of cash are forced to sell ships at distress prices, since there are few buyers. • The price of old ships falls to the scrap price, leading to active demolition market.
2: Recovery	• Supply and demand move towards balance • Markets remain uncertain and unpredictable. • Liquidity improves	• The first positive sign of a recovery is positive increase in freight rates above operating costs, followed by a fall in laid up tonnage. • Spells of optimism alternate with profound doubts about whether a recovery is really happening (sometimes false recovery periods!). • Liquidity improves second-hand prices rise and sentiment firms.
3: Peak/ Plateau	• All the surplus has been absorbed • Freight rates are high, often 2–3 times operating costs. • Only untradeable ships are laid up • Owners become very liquid • Second-hand prices move above 'book value' and prompt modern ships may sell for more than the newbuilding price	• Markets enter a phase where supply and demand are in tight balance: the peak may last a few weeks or several years, depending on the balance of supply/demand pressures. • The fleet operates at full speed • Banks are keen to lend • There are public flotations of shipping companies. • The shipbuilding order book expands, slowly at first, then more rapidly

(*Continued*)

Table 8.1 Continued

Stage	Characteristics	Consequences
4: Collapse	• Supply overtakes demand • Factors such as the business cycle, the clearing of port congestion and the delivery of vessels ordered at the top of the market cause the downturn • Spot ships develop in key ports • Freight rates fall • Liquidity remains high	• Markets move into the collapse phase • Sentiment about these factors can accelerate the collapse into a few weeks • Ships reduce operating speed and the least attractive vessels have to wait for cargo • Sentiment is confused, changing with each rally in rates

Source: Stopford, 1997.

8.1.2 Importance of the Shipping Industry for the BE and BG Sector

The shipping industry directly contributes €56 billion to EU GDP (Oxford Economics, 2015). Ships and maritime transportation are necessary for most of the activities related to BE/BG, e.g: Sea mining and fishing activities; construction and maintenance of offshore infrastructures (oil & gas and MUP platforms, offshore renewable and aquaculture facilities); tourist transportation; on board biotechnological researches; etc. Therefore, a healthy and productive shipping industry will facilitate the successful development of BE/BG objectives.

8.2 Market

Due to their high reliance on market's performance, product demand and prices in shipping are highly volatile (SeaEurope, 2013a; Stopford, 1997). As a result, the current poor economic situation has strongly impacted the shipping industry, which is reflected in the dramatic demand decrease for newbuilding and the low levels of freight rates (SeaEurope, 2013a; UNCTAD, 2014).

8.2.1 Product Demand and Price

Despite market fluctuations the cost of constructing a ship usually breaks down as follows (ECORYS, 2009): materials account for around 53% of shipbuilding costs, while overhead and direct labour costs represent around 47%. The openness and competitiveness of the shipbuilding industry is an

additional factor influencing the prices of ships, which depends on the amount of shipyards competing for a given order (Stopford, 1997).

Regarding transportation, despite the moderate growth in world trade volume, freight rates remain low. This is due to: (i) the poor world economic development; (ii) the volatile demand; and (iii) the persistent supply overcapacity of the sector (UNCTAD, 2014).

8.2.2 Market Trends

Following the performance of global markets, the increase in demand for shipping activities is being driven by developing economies (principally Asian). This is occurring at the expenses of western economies, where despite signs of recovery, the future of many developed economies is still uncertain (DNV, 2012).

8.2.2.1 Shipbuilding

There are two main factors responsible for the dominance of Asian shipyards over the Europeans yards (ECORYS, 2009):

- Labour costs: Europe, Japan and S. Korea have similar labour costs, which are significantly higher than those from China.
- Steel price: Steel is the main raw material for shipbuilding and the one that determines to a greater extent the final price of ships. The global steel production and consumption is dominated by Asian countries (principally China). This creates a disadvantage for European shipyards that have to pay higher prices for raw materials.

In order to face this adverse environment the European shipbuilding industry has adopted a clear specialisation strategy, by focusing in the construction of high value-added technical and complex ships (SeaEurope, 2013b). Such a strategy permits the European shipbuilding industry to reduce the effect of having higher labour costs (ECORYS, 2009). Finland, France, Italy and the UK specialise in passenger vessels and ferries, Denmark in container ships and the remainder of the countries show a more diversified portfolio (IKEI, 2009).

8.2.2.2 Transport

The global maritime trade of goods continues increasing. Geographically, the growth rate of trade routes that connect developing economies (i.e., Middle East-Asia, South America-Africa-Asia, Europe-Middle East) has more than doubled that of mainline trades that connect with developed economies (i.e., Asia-North America, Asia-Europe).

As a result of the huge orderbook for newbuildings made during the economic boom in the early 2000s, the global fleet is characterised by its important supply overcapacity. Growth rates of developed countries remain low and the increasing demand for maritime trade of developing economies is not able to balance the supply and demand sides of the maritime transport market.

However, overcapacity does not affect equally all maritime transportation markets (DNV, 2012). Driven by the Oil and Gas sector, there is an increasing demand for Liquefied Natural Gas (LNG) tankers and specialised offshore vessels. Also, the demand for cruise tourism shows an increasing pattern. With regard to the latter, the sea basins considered may be well positioned as the cruise tourism market is mainly developed in the Caribbean, followed secondly by the Mediterranean and the remainder of European sea basins in the third position (CLIA, 2015).

8.2.3 Future Supply and Demand Gaps

Closely related with the growth of world economy, the future of the shipping industry remains uncertain. However, the need for new builds in the future will not only rely on the economic environment, but also in the regulatory framework. From the economic point of view, overcapacity times are characterised by the lack of investments in new builds and active scrapping markets, which last until the supply and demand are balanced. Therefore, a low demand for shipbuilding products must be expected at this point. In contrast, the upcoming regulatory framework can imply a source for new build demand. These regulations, mainly related with environmental and energy efficiency issues (e.g., polluting/greenhouse gases, ballast waters, efficient fuels), require the renewal or adaptation of the fleet (see Section 8.5). Given the poor economic situation, the investment capacity on technological development of the shipping industry is limited. In this context, the future for shipping companies appears extremely challenging as they will have to face a period where clear strategic decisions will be needed (DNV, 2012).

8.3 Sector Industry Structure and Lifecycle

8.3.1 Lifecycle

Shipping is an old and strongly fluctuating industry, which for many years has suffered from the image of being a declining industry. However, current industry requires ever larger ships and more sophisticated, safe

and environmentally-friendly ships (IMO, 2012). In line with the growing demand for highly advanced vessels, new technologies and practices have emerged over the last years. These mainly relate to the improvement of naval architecture and engineering or the implementation of green shipping practices (that reduce among others fuel consumption and pollution from shipbuilding and transportation activities). Therefore it can be considered that the shipping industry is facing a new growth stage (OECD, 2016).

8.3.2 Industry Sectors and Segmentation

The sectors, sub-sectors and segmentation of the shipping industry are summarised in Table 8.2.

The shipbuilding industry consists of four main sectors, i.e., ship construction, marine equipment, scrapping and naval ships. Consequently six segments are defined within the sector: tankers, dry bulk, container, passenger, specialised and mega yachts.

Maritime transportation is defined in four main subsectors: deep sea, short sea, domestic ferries and cruises.

8.3.3 Horizontal and Vertical Integration

Shipbuilding and maritime transport are separate industries that are inextricably linked and mutually dependent. In both, the degrees of vertical and horizontal integration are high (Figure 8.1).

Regarding the shipbuilding industry, the horizontal cooperation between shipyards is a very common practice. Shipbuilding requires a huge production capacity, which often is beyond the production capacity of the main contractor. As such, the important flow of subcontracts among main contractors permits them to maintain their production balances. In addition, it must be noted that the ship construction process is characterised by long development phases followed by long manufacturing phases. As a result, shipyards have to face periods where they operate at full capacity while in others they have to manage their capacities. Therefore, the horizontal co-operation between shipyards, permits them to manage orders and manufacturing personnel in times of temporary over or under-capacity (Balance, 2014). Vertical co-operation between the ship construction and the marine equipment sector exist due to the high complexity and fragmentation of the products needed in shipbuilding. This principally occurs into two main forms: supplies and subcontracts (Balance, 2014).

Table 8.2 Sectors and segments of the shipping industry (Author's compilation based on Stopford, 1997; Christiansen et al., 2007; ECORYS, 2009)

Shipbuilding	Sectors	Ship construction (incl. Newbuilding and Repair & Conversion)	Builds the hull and basic structures of a ship. In order to increase efficiencies in shipbuilding, there is an increasing trend of splitting new building and repair activities in different shipyards. As a result, a geographical displacement of ship repair activities is occurring towards areas close to the major transportation routes.
		Marine equipment	Defined as *"the supply industry to the shipyards"*. Increasing outsourcing and subcontracting of shipbuilding activities gave rise to the marine equipment industry. Accounts for a large part of the value-added of a ship (could be as high as 70–80%). Given the wide variety of products and services provided by the marine equipment industry it is considered a very heterogeneous sector.
		Ship scrapping	In charge of dismantling ships. It is a very basic industry in which either companies or their markets are normally located in developing countries (lower labour costs). Obtained steel panels use to be rerolled and reused in the local markets as raw materials (e.g., construction industry). Due to these characteristics this sub-sector is not of special relevance for European shipyards.
		Naval vessels	As it is dominated by political and strategic factors, it differs from the competitiveness point of view. In contrast with the previous sectors it is characterised by its relatively stable market.
	Segments	Tankers	Designed to transport liquids and gases in bulk (e.g., oil, gas, juice, wine, etc.). There exist different types of tankers depending on their size: Panamax (up to 70,000 DWT); Aframax (70,000–120,000 DWT); Suezmax (120,000–200,000 DWT); Very Large Crude Carriers (200,000–325,000 DWT); and, Ultra Large Crude Carriers (325,000–550,000 DWT).
		Dry bulk carriers	Less sophisticated, but highly efficient. Intended for the transport of dry unpacked cargo (e.g., coal, cement, mineral ores or grain). Classified depending on their size characteristics: Handies (10–49,999 DWT); Panamax (50,000–79,900 DWT); and, Capesize (>80,000 DWT).
		Container ships	A revolution for the shipping industry. Containerisation of goods facilitated the mechanised handling of the cargo and reduced burglary. Despite of some exceptions (e.g., cars), containers are the cargo standard unit for almost every manufactured item. Standard containers are 20 feet and 40 feet in length.

		Passenger ships	Two main categories: cruise ships and ferries (i.e., “fun” or “function”). Cruise ships are designed for leisure purposes and ferries to move people (and, vehicles) on regular itineraries quickly and cheaply. A wide variety of ferry types exist: ranging from small passenger ships to big Ro-Ro ferries (Roll-on Roll-off), that have the capacity to carry thousands of passengers and hundreds of vehicles.
		Specialised vessels	Vessels with some onboard machinery/equipment to perform specific tasks related to different marine industries (e.g., offshore vessels, dredgers, chemical tankers or LPG-LNG carriers).
		Mega-Yachts	Luxury yachts of 24 meter or more in length. Professionally crewed, very expensive and privately owned sailing or motor ships.
Maritime Transportation	Sectors	Deep sea	Inter-continental transportation that employs the larger size vessels. Deep-sea vessels spend long periods of time at sea.
		Short sea	Intra-continental transportation that employs the smaller size vessels. It redistributes cargo delivered to continental centres (e.g., Hong Kong or Rotterdam) by deep sea vessels, competing with land based transport. Subject to many political restrictions (e.g., cabotage).
		Domestic ferries	Transport of people, vehicles and cargo. Often used as shuttle service between ports. Short routes are served by small vessels, while large liners are used in longer routes.
		Cruises	Passenger transport with leisure purposes. Transportation on itself may not be the principal purpose, as ship’s amenities are part of the experience.
	Segments	Liner	Operate according to a published itinerary and schedule. Usually control container and general cargo vessels.
		Tramp	Operate with no fixed itinerary and schedule. Transport the available cargo under contracts of affreightment. Usually control tankers and bulk carriers.
		Industrial	Operators that own the cargoes shipped and control the vessels used in transportation. Strive to minimise the cost of shipping the cargo of vertically integrated companies (e.g., oil, chemicals, ores. . .).

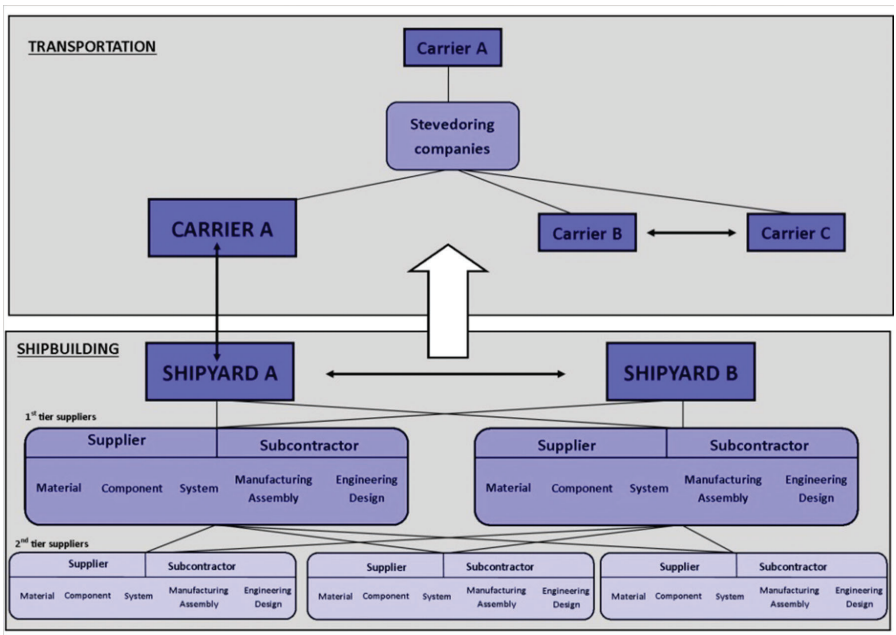

Figure 8.1 Vertical and Horizontal integration among industries in the shipping sector. Author's interpretation after Balance 2014 and Cariou 2008.

Considering maritime transportation, the size of carrying companies is an important factor determining horizontal and vertical cooperation issues. Although depending on market conditions the strategies vary, two main approaches are predominant. On the one hand, the biggest carrying companies opt for direct investment in new vessels in order to expand their market share. On the other hand, strategic alliances, slot exchange agreements or mergers and acquisitions permit small companies to increase the quality of their services (in terms of e.g., frequency, spatial extension) without investments. Finally, the transportation industry relies strongly on the "Hubs and Spokes" system, which uses strategically located points as centres for the further redistribution of goods in a given region. Thus, it implies a huge need for efficient transhipments, for which stevedoring companies become crucial to ensure and support the redistribution of goods at smaller spatial scales (Cariou, 2008).

8.3.4 Centres of Activity in Europe and Caribbean

Figure 8.2 shows some relevant statistics for the European shipping sector, considering the whole sector, the Mediterranean and Atlantic countries are of special relevance.

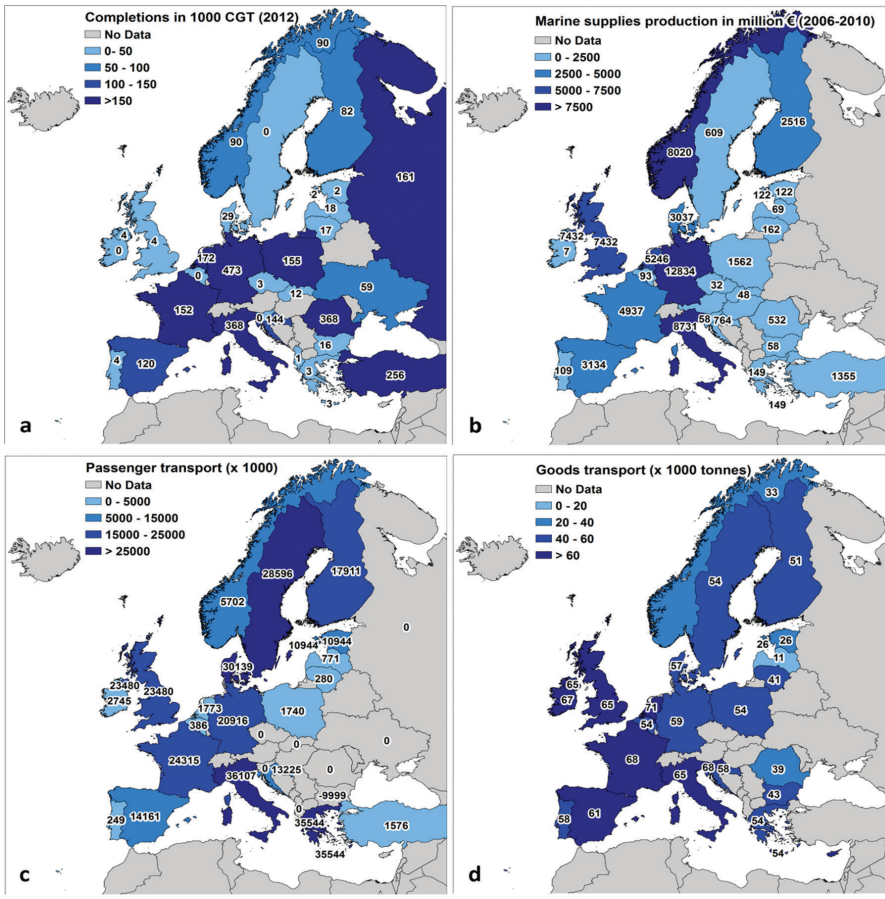

Figure 8.2 a) Newbuildings completions in 2012; b) Production value of the marine supplies industry in 2012; c) Passenger transport; d) Goods transport.

Sources: Balance, 2014; EUROSTAT; SeaEurope, 2013a.

Considering shipbuilding, Germany and Italy are leading countries either in the ship construction and marine equipment subsectors, followed by countries such as Turkey, France, Spain, Romania or Poland. In general terms, leading countries in ship construction also have an important marine supply industry. As an exception to this generality, countries like the UK, Sweden or Greece can be mentioned, which in contrast to their low activity in ship construction, are highly active in the supply industry. This might be due to: (i) the high technological development level of UK and Sweden; and (ii) the geographical location of Greece (close to important freight transportation and cruise routes). Although there is no data available about North-African

countries bordering the Mediterranean, their activity in shipbuilding can be considered as minor (SeaEurope, 2013a). However, given their location, their activities are presumably oriented to the repair of ships crossing the principal Mediterranean transportation routes.

In relation to passenger transportation, some specific aspects can be highlighted. Apart from being located in main cruise routes, the high numbers of passenger transport in countries like Italy, Croatia, Greece, Sweden and Denmark could be due to the interisland transportation of national passengers in the case of the former and to the use of maritime transport as a way to connect Nordic countries and central Europe for the latter.

Estimates of activity in the Caribbean basin are more difficult tasks. On the one hand, the high number of non-unified countries, makes it difficult to obtain reliable information on the industry. On the other hand, Caribbean shipping companies are commonly subsidiaries or partners of larger foreign companies, as is probably their economic performance. However, as a general picture, several aspects can be highlighted: (i) most of the shipping activity will probably be built around tourist cruises; (ii) the only country with a relatively significant weight in the global shipbuilding industry is the USA (SeaEurope, 2013a); (iii) after being in a dormant state for the last 20 years, the Mexican institutions and business corporates are making efforts to reactivate the national shipbuilding industry (principally with a view to support the national oil & gas industry); and, (iv) given the geographical location along major transportation and cruise routes, most of the shipbuilding activity in non-US countries probably relies on repair facilities, principally for cruises and yachts (ECORYS, 2009).

8.3.5 Nature of Ownership

Rather than from a country basis, ownership of shipyards must be considered from a globalised perspective. In order to rationalise their production and make use of global competitive advantages (e.g. lower labour costs, technological advancements, expansion of transport routes), mergers and acquisitions between companies are common. leading to the emergence of major conglomerates dominating the world industry. As an example some of the most important European shipyards could be mentioned, which despite of being located in Europe their ownership has partially changed to Asian hands.

Another characteristic aspect of ownership in maritime transportation is the difference between the "beneficial ownership location" and the "ultimate owner's nationality". While the former relates to the country in which the company that has the main commercial responsibility for the vessel is located

(i.e., the registration flag), the latter refers to the nationality of the ship's owner, independent of the location of the vessel. Nowadays, most of the ships of the world fleet have a flag of registration different to the economy/country of their owner. The registration under a flag of a different country (also known as flag of convenience), permits reduced operating costs or can avoid the more restrictive regulations of the shipowner's country. In terms of owner's nationality, as observed for the shipbuilding industry, Asian and European countries appear as market leaders (Table 8.3).

8.3.6 Rules and Regulations

As a global industry, shipping is regulated by a series of international regulations. These conventions have been agreed in international forums such as the International Maritime Organisation (IMO), the World Trade Organisation (WTO) or the Organisation for Economic Co-operation and Development (OECD). They are ratified by the signing parties, to establish, among others, the rules and regulations in: technical matters; maritime safety and security; marine pollution; and liability and compensation (Annex 8.2).

Table 8.3 Top 20 fleets by beneficial ownership location and ultimate owner's nationality

Top 20 Fleets by Beneficial Ownership	Top 20 Fleets by Owner's Nationality
1. Panama	1. Japan
2. Liberia	2. Greece
3. Marshal Islands	3. Germany
4. Hong Kong, China	4. China
5. Bahamas	5. United States
6. Singapore	6. United Kingdom
7. Greece	7. Norway
8. Malta	8. Republic of Korea
9. China	9. Denmark
10. Cyprus	10. Hong Kong, China
11. Italy	11. Taiwan Province of China
12. Japan	12. Singapore
13. United Kingdom	13. Italy
14. Germany	14. Russian Federation
15. Norway	15. Canada
16. Republic of Korea	16. Turkey
17. United States	17. Malaysia
18. Isle of Man	18. India
19. Denmark	19. France
20. Antigua and Barbuda	20. Belgium

Source: IMO, 2012.

8.4 Working Environment

8.4.1 Economic Climate

Considering the current global economic situation, shipping cycles provide a good explanation of the close relationship between the economic climate and the performance of the shipping industry. Considering activities separately, the economic downturn has slowed the increase in global trade, but in the case of shipbuilding the impact has been very strong. Besides, instead of being an immediate impact, the economic downturn has taken some time to hit shipbuilding. This has been due to two main reasons:

(i) The long construction and delivery times of ships (2–4 years). Demands for new orders usually take place during economic prosperity, while their delivery can coincide with depression periods (with the subsequent high risk of overcapacity).
(ii) The new ordering boom occurred over the past decade. Although shipbuilders have had to face an increasing number of order cancellations, already committed contracts have soften to some extent the immediate impact of the economic crisis.

8.4.2 Employment, Skills and Migration

The shipbuilding and maritime transport industries employ more than 200,000 people in Europe, a value that increases significantly if indirect employments derived from outsources and subcontracts are entered into accounts (ECORYS, 2009; EC, 2011). The women workforce accounts only for 2% of the total (ITWF, 2015) and is mainly active in the cruise and ferry sectors.

In relation to its workforce, the European shipping sector faces two main challenges (Hart and Schotte, 2007):

(i) Ageing of the workforce. Although ageing affects the whole European workforce, this is slightly higher in the case of the shipping industry. With a large part of the workforce over 50 years old, a high loss of employees due to retirement might be expected in the coming years.
(ii) Specialisation of the workforce. Given its high level of specialisation, the European shipbuilding industry requires a highly specialised workers. However, as a result of either the ageing/retirement of the workforce or the further technological specialisation degree of the industry, a need for skilled personnel must be expected in the future. In relation to

seafarers, a demand of 45,000 officers and 145,000 ratings has been reported recently (EC, 2011).

The downturn in the shipping sector does not help to overcome these labour challenges, and as such the European industry might face a lack of national workforce in the future. Moreover, the contribution of workers from outside the EU is increasing (e.g., Philippines, Ukraine, Russia...), due to cheaper employment costs. At the EU level, eastern countries have a surplus of cheaper and younger workforce (e.g., Poland, Bulgaria and Romania).

8.4.3 Economic Indicators

8.4.3.1 Gross Domestic Product

In comparison with other economic sectors, EU's shipping industry is a highly productive sector (Table 8.4): Accounting for 1% of EU's GDP, its contribution was estimated in €147 billion in 2013. Each worker contributes with €85,000 to EU GDP (EU average €53,000) and the GDP multiplier of the industry is 2.6. This means that for every €1 million of GDP the industry creates another €1.6 million is created elsewhere in the EU economy (Oxford Economics, 2015).

8.4.3.2 Wages

Figure 8.3 shows the wages for different categories of workers in the shipping sector. The first three refer to the transportation subsector, and the latter, to the shipbuilding sector. The range of wages is very large in Europe, defined by high wages in Western Europe, falling the further east in Europe. In the specific case of shipbuilding, it is estimated that in Europe wages account for 21–23% of the total cost of a ship (ECORYS, 2009).

Given the following reasons these figures should be treated with caution (EC, 2011): influence of additional elements of working conditions (leave ashore, voyage length, specific national fiscal facilities); lack of published information on real seafarers' salaries at national level; difficulties to understand the applicability of collective agreements and bonuses; or aspects

Table 8.4 Economic impact of the EU shipping industry (from Oxford Economics, 2015)

Impact	People Employed	Contribution to EU GDP
Direct	615,000	€56 billion
Indirect	1,100,000	€61 billion
Induced	516,000	€30 billion
TOTAL	2,200,000	€147 billion

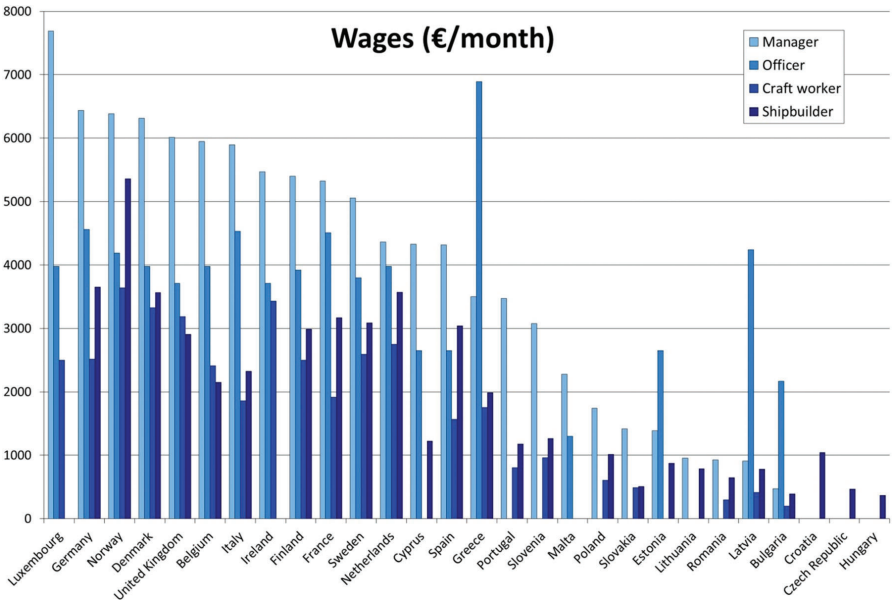

Figure 8.3 Wage distribution among EU countries for different working categories in the shipping sector.

Sources: EC, 2011; EUROSTAT.

related to the flag of convenience. With these considerations in mind and despite differences among categories, the results reflect clear differences, with western countries having higher salaries.

8.4.3.3 Export potentials

The export potentials of the European shipbuilding industry can be discussed in two main aspects:

(i) Skills: due to its high specialisation level, the workforce of the European shipbuilding sector is highly skilled. In fact, although mainly driven by their wage differentials and labour youth, Eastern countries act as net exporters of skilled workers (mainly to western European countries and US) (t'Hart and Schotte, 2007).

(ii) Shipping products: Considering CESA (Community of European Shipyards Association) countries, two main patterns can be observed, which can be related to labour costs and the specialisation on high value-added segments, respectively (CESA, 2013b). On the one hand, eastern countries act generally as net exporters. Favoured by their low labour

costs, the market share of these countries is mainly focused in non-complex vessels. As such, they can be seen as valuable "low-cost" countries for buyers which do not need highly technical vessels. On the contrary, countries with high labour costs like Finland, Germany or France also show high export rates, which are due to their important specialisation in high value-added segments. The same occurs to the marine equipment sub-sector, where despite the current growth of Asia in this field, European companies are leaders and act as net exporters (Balance, 2014).

8.4.4 Infrastructure and Support Services

Considering that maritime transport has been the main form of trade between developed economies, these countries have large infrastructures of support and distribution. However, emerging economies are expanding quickly, at the expense of the slowdown in developed countries. The globalisation of the economy requires new epicentres of distribution and the use of even bigger ships for the optimisation of goods transport. Therefore, the existing shipping infrastructure might be in trouble arising from the difficulty to host and manage the growing demand outside the historical trade routes. In this sense, the development of offshore shipping infrastructures appears to be an effective solution. They would also potentially boost blue growth sectors, since they would have the ability to provide the necessary infrastructure for the development of different offshore economic activities.

8.4.5 Cluster and "Triple Helix" Features

By adopting the "triple helix" approach (cooperation between government-industry-university), maritime clusters can serve as a basis for guiding the economic and sector policy development, which would facilitate the growth of maritime activities (DSA, 2010). Ideally, these clusters require some essential "core sectors" around which surrounding industries depend for demand and activity. Due to the strong linkage with other maritime industries (e.g., offshore oil and gas, offshore renewables, cruise tourism, capture fisheries or marine aquaculture), the shipbuilding industry has a crucial role for the future development of Blue Growth (OECD, 2016).

8.5 Innovation

Table 8.5 shows the main drivers, market opportunities, barriers and technological responses for innovation in the shipping sector. Driven principally

Table 8.5 Drivers, market potential, barriers and technological responses for innovation in the shipping sector

				Technological Barriers			
	Trend	Drivers	Market Potential	Development	Scaling Up	Expression of Demand	Technological Response
Market Trends	1. Fuel efficiency & cost reduction	Increased competition: pressure to reduce operating costs Increasing oil prices	Fuel efficient systems Alternative fuel types[1]	Financial: High perceived risk Difficulties to fulfil technical standards Lack of skilled labour	Reluctance of shipping companies: hamper innovation (lack of learning by doing)	Conservatism of shipping companies Lack of newbuilding: no incorporation of new technologies	Improved designs (hull, reduced resistance) Propellers Propulsion Improving Devices Wind assistance devices Optimised operation Improved engine efficiency Waste heat recovery systems
	2. Environmental awareness and CSR	Increased environmental awareness of consumers	Limited. Almost always linked to a direct business case: more likely to take place in segments operating close to consumers	Technologically do not differ significantly from those described for Trends 1, 3, 4, 5, 6. Due to the lack of direct regulatory pressure, the main barrier relies on the willingness of shipping companies (which can see the increasing environmental awareness of consumers as a potential investment/business opportunity.			Similar to those described for Trends 1, 3, 4, 5, 6. Positive factor: Environmental awareness and CSR development more progressed in Europe (potential "home market")

Regulatory Trends*	3. NO_x abatement	Global regulation: e.g., IMO, MARPOL EU regulation: e.g. Air Quality Directive National/local regulation: e.g., tax levies in Norway	Selective Catalytic Reduction[2] Dual fuel engines LNG engines[3] Exhaust Gas Recirculation[2]	Relatively few. Active European industries in the development of green innovations	Reluctance of shipping companies: hamper innovation (lack of learning by doing)	Regulatory/ market uncertainty Lack of supporting infrastructure	Development of new LNG engines Installation of SCR systems Retrofit of existing engines
	4. SO_x abatement	Global regulation: e.g., IMO, MARPOL EU regulation: e.g. Directive (2005/33/EC)	Low sulphur content fuels (MDO, LNG) Scrubbers[4]	Relatively few. Active European industries in the development of green innovations		Regulatory uncertainty	Development of new LNG engines Use of on board scrubbers
	5. CO_2	Global regulation[5]: e.g., Energy Efficiency Design Index (EEDI), Ship Energy Efficiency Management Plans (SEEMPs) EU regulation: Transport White Paper	Electrical energy efficient technologies	Similar to those described for Trend 1.		Regulatory uncertainty	Improved fuel efficiency of engines Low carbon content fuels Reduced engine power

(*Continued*)

Table 8.5 Continued

				Technological Barriers			
	Trend	Drivers	Market Potential	Development	Scaling Up	Expression of Demand	Technological Response
Regulatory Trends*	6. Ballast water and sediment treatment	Global regulation: Convention for the Control and Management of Ships' Ballast Water and Sediments	Ballast water management systems[6]	Relatively few. Active European industries in the development of green innovations		Regulatory uncertainty	Integration of ballast treatment systems on board which kill organisms and bacteria
Others	7. Offshore renewable energy	European Renewable Energy Directive (2009/28/EC)	Specialised support vessels Platforms and foundations for turbines	Lack of yard infrastructure and skills	Limited. Barriers presumably related to the state-of-the-art of the renewable sector rather than to the shipping sectors	Regulatory and budgetary uncertainty	Adaptation of technologies and vessels to make them suitable for even deeper and further offshore areas

Climate Change							
				Barriers			
	Trend	Drivers	Market Potential	Access to the Arctic Route	Financing	Exploration of Oil & Gas	Technological Response
Others	8. The Arctic dimension	Opening up of cross-Artic routes Increased access to Oil & Gas and other mineral resources	Icebreakers Ice strengthened vessels Zero-emission ships	Uncertainty in route accessibility High icebreaking fees: current routes remain commercially preferred	High cost of icebreakers: lack of financing	Environmental concerns Lack of financing	Improved design of icebreakers and ice strengthened vessels

Source: DNV, 2012.

*See Annex 8.2 for main regulations. DNV, 2012.

[1]The demand for marine distillates could be as high as 200–250 million tonnes annually.

[2]At least 30–40% of newbuilds will be fitted with EGR or SCR by 2016.

[3]In the next 8 years, more than 1 in 10 newbuildings will be delivered with gas fuelled engines.

[4]Scrubbers will be a significant option after 2020.

[5]Newbuildings in 2020 will emit up to 10 to 35% less CO_2 and EEDI will be the driver for more than half of the reduction.

[6]Ballast water treatment systems will be installed on at least half of the world fleet.

by market and regulatory trends, these relate principally with green shipping opportunities. Also the development of the offshore renewable sector as a driver for innovation in shipping is shown and can be considered indicative of the high potential for knowledge sharing between both industries. In this sense, it can be assumed that given its high cross-sectorality, the development of BG as a whole will also imply an important boost for innovation in shipping and skill transfer among sectors. Finally, several potential aspects for innovation that arise as a consequence of climate change are also shown.

As previously mentioned, the lack of skilled workforce may be a barrier to innovation in the European shipping sector. It is at this point where the adoption of the triple helix approach can be of great importance. It can help to improve the sector's image, promoting the specialisation of labour and innovation.

8.6 Investors

Table 8.6 summarises the main investment and financing facilities in the shipping industry.

Table 8.6 Investment and financing facilities

Category	Typical Features	Types
Private funds	• Main source of start-up capital	• Owners private funds • Private equity firms
Commercial bank finance	• Most important source of ship finance • Provide access to capital while leaving borrowers with full ownership of the business • Specialised financial activity	• Mortgage-backed loan • Corporate bank loan • Loan syndications and asset sale • Shipyard credit schemes • Mezzanine finance • Private placement of debt and equity
Capital markets	• Large companies raise finance by issuing securities. • Offers wholesale finance and a quick way of raising money • Difficult funding source for small companies	• Public offering of equity • Bond issue

Category	Typical Features	Types
Special purpose companies	• Standalone structures, set up for particular transactions • Reduction of finance costs by transferring ownership of vessels to • a company which can use its depreciation to obtain a tax break	• Limited partnerships

Source: Stopford, 2009.

8.7 Uncertainties and Concluding Remarks

Table 8.7 summarises the strengths, weaknesses, opportunities and threats (SWOT) of the European shipping industry.

Table 8.7 SWOT analysis of the European shipping industry (Modified from ECORYS 2009)

Strenghts	Weaknesses
• Level of innovation • Innovative SMEs and strong position of marine equipment industry • Strong linkages yards & marine equipment: Efficiency • Spillovers between shipping and BG sectors • Specialisation in niche markets	• Cost levels (wage and steel) • Potential difficulties in knowledge protection (especially among SMEs) • Access to finance • Fragmented government responses • Access to skilled labour
Opportunities	**Threats**
• New segments, continuous innovation • Greening of the industry • Existing transport policies • Enhanced requirements regarding shipping standards	• Demand shift from European to Asian buyers • Competitors moving up to the ladder • SMEs not surviving the crisis • Support from competitor's governments to their industry • Critical mass required to maintain/refresh high skilled workforce. Europe may be too small compared to competitors. Ageing workforce • Price competition in light of economic crisis

8.8 Conclusions

Although the development of new maritime industries needs a strong shipping industry, the structure of this sector at the global scale presents a number of features that can influence its productivity at the European level. The shipbuilding industry is clearly dominated by Asian countries (Japan, Korea, China), while the demand for new construction is driven by developing economies, which are growing at the expense of the slowdown in developed economies. The sector is characterized by its volatility and reliance on global markets, and thus, good economic times favour its fast growth, while crisis times hit it strongly. In addition, the competitiveness of shipping companies is strongly linked to labour costs, which are higher in the European sector. In order to face its Asian competitors, the European industry has adopted a clear specialisation strategy in higher value-added and technologically complex segments. However, given the wage differences between Eastern and Western countries the global specialisation strategies are replicated at the intra-European level. Eastern countries (intra-and extra-EU) act as "low cost" countries, building ships of lower value-added and technological level. On the other hand, the western countries, overcome the fact of having higher wage costs by specialising in high value-added and technological segments. Given that the entry into the EU of some of these "low cost" countries is relatively new (or it might be expected by the mid-term future), the impact of these inequalities in the sector is unknown.

Related to maritime transport activities, the growing demand of developing countries requires new epicentres for the distribution of goods. The need to transport more goods, can lead to problems of lack of infrastructure and logistics, either inside or outside the transportation mainlines. From a socio-economic point of view, the ageing of the labour force together with the poor image of the sector can put at risk the renewal of the qualified labour force. From the whole labour force, women only represent 2%, their presence being limited in practice to the cruise and ferry segments. However and despite the poor global economic situation, new market trends and the international regulatory framework can act as a boost to the sector. Moreover, the promotion of maritime clusters can improve the image of the sector, and: (i) make it more attractive for future workers; (ii) increase the transfer of knowledge between maritime economic sectors; and (iii) encourage the involvement of women.

Annex 8.1 – List of CESA Members

- Belgium
- Bulgaria
- Croatia
- Denmark
- Finland
- France
- Germany
- Greece
- Italy
- Lithuania
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Spain
- United Kingdom

Annex 8.2 – International Regulation in the Shipping Sector

Maritime safety and security and ship/port interface	International Convention for the Safety of Life at Sea (SOLAS)
	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)
	Convention on the International Regulations for Preventing Collisions at Sea (COLREG)
	Convention on Facilitation of International Maritime Traffic
	International Convention on Load Lines (LL)
	International Convention on Maritime Search and Rescue (SAR)
	Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation (SUA)
	Protocol for the Suppression of Unlawful Acts Against the Safety of Fixed Platforms located on the Continental Shelf
	International Convention for Safe Containers (CSC)
	Convention on the International Maritime Satellite Organization (IMSO C)
	The Torremolinos International Convention for the Safety of Fishing Vessels (SFV)
	International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F)
	Special Trade Passenger Ships Agreement (STP)
	Protocol on Space Requirements for Special Trade Passenger Ships

(*Continued*)

Annex 8.2: Continued

Marine pollution	International Convention for the Prevention of Pollution from Ships (MARPOL)
	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION)
	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LC)
	International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)
	Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol)
	International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS)
	International Convention for the Control and Management of Ships' Ballast Water and Sediments
	The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships
Liability and compensation	International Convention on Civil Liability for Oil Pollution Damage (CLC)
	Protocol to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage
	Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (NUCLEAR)
	Athens Convention relating to the Carriage of Passengers and their Luggage by Sea (PAL)
	Convention on Limitation of Liability for Maritime Claims (LLMC)
	International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS)
	International Convention on Civil Liability for Bunker Oil Pollution Damage
	Nairobi International Convention on the Removal of Wrecks

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