Comprehensive sectoral analysis of emerging competences and economic activities in the European Union:

Building and Repairing of Ships and Boats sector

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1. DEFINITION OF THE BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR

1.1. DEFINITION OF THE SECTOR

The Building and Repairing of Ships and Boats sector industry can be regarded as a particularly sensitive and strategic sector. It develops advanced technologies providing valuable by-products for other sectors, it provides the basic means of transport for international trade, and makes a decisive contribution to defence and security by equipping navies with technologically advanced vessels. In addition to this, the Building and Repairing of Ships and Boats sector provides high levels of employment for various subcontractors and module makers, and it also operates as an important economic multiplier with spin-offs into other sectors.

In this sense, the "Building and repairing of ships and boats" sector can be defined as a very complex manufacturing sector composed of an array of different sub-sectors.

In order to properly delimit the sector, it is suggested to follow the Statistical Classification of Economic Activities in the European Community, NACE-Classification Rev. 1.1 (there is a new NACE Revision 2, that it is explained in Annex 1 of this report). In this sense, the activities of the sector are comprised under the NACE Rev 1.1. Code 35.1 'Building and Repairing of Ships and Boats', and includes the following two main subsectors:

a) Building and Repairing of Ships (NACE Rev 1.1. 35.11), where this subsector comprises:

- Building of commercial vessels: passenger vessels, ferry-boats, cargo ships, tankers, etc.
- Building of warships
- Building of fishing boats
- Construction of drilling platforms, floating or submersible
- Construction of floating structures, such as floating docks, pontoons, coffer-dams, floating landing stages, buoys, floating tanks, barges, lighters, etc.
- Maintenance, repair or alteration of ships

b) Building and Repairing of Pleasure and Sporting Boats (NACE Rev 1.1. 35.12). where this subsector comprises:

- Building of inflatables
- Building of sailboats with or without auxiliary motor
- Building of motor boats
- Building of other pleasure and sporting boats such as canoes, kayaks, skiffs
- Maintenance, repair or alteration of pleasure boats

Interestingly also, the subsector NACE Rev 1.1 35.11 explicitly excludes the following subsectors:

- Manufacture of ships' propellers (NACE 28.75),
- Manufacture of marine engines (NACE 29.11),
- Manufacture of navigational instruments (NACE 33.20),
- Manufacture of amphibious motor vehicles (NACE 34.10) and the
- Manufacture of inflatable boats or rafts (NACE 35.12).

Meanwhile, the subsector NACE Rev 1.1 35.12 does not include the following subsectors:

- Manufacture of marine engines (NACE 29.11) and
- Manufacture of sailboards (NACE 36.40).

1.2. MAIN PRODUCTS INCLUDED

From a product perspective, it is possible to suggest that the shipbuilding activity (NACE Rev 1 35.11) comprises a very wide array of different ships and boats, intended to satisfy a large number of different needs and resulting therefore in very different hull shapes and sizes, speed requirements, and propulsion types (see Table 1 and Table 2 for a description of the most common vessel types).

Table 1. Main vessel categories and types

Vessel categories	Vessel Types
Tankers	Crude oil carriers, very large crude carrier (VLCC) and ultra large crude carriers (ULCC), liquefied natural gas (LNG) tankers, liquefied petroleum gas (LPG) tankers, Oil/Bulk Ore carriers (OBO), chemical tankers, product tankers.
Cargo Vessels	Bulk cargo, container vessels, roll on-roll off (RORO) vessels, reefer vessels (refrigerated cargo), ore carriers, paper carriers, liquid food product carriers (fruit juices, molasses)
Passenger Vessels	Cruise ships, car and passenger ferries, casino vessels, river boats, yachts
Fishing Vessels	Trawlers, seiners, factory ships
Government Services	Icebreakers, buoy tenders, search and rescue craft, fisheries patrol vessels, police and customs patrol vessels
Research Vessels	Hydrographic survey, seismic survey, oceanographic research, etc
Support Vessels	Tugs, fire fighting vessels, cable layers, dredges, barges, heavy lift ships, floating cranes
Offshore Oilfield Development Vessels	Floating production, storage and offloading vessels (FPSO), shuttle tankers, offshore supply and standby vessels, anchor handling vessels, drill ships, semi-submersible oil rigs, jack-up oil rigs, GBS rigs, tension leg platforms
Warships	Aircraft carriers, battleships, amphibious assault ships, command and control ships, cruisers, destroyers, frigates, submarines, minesweepers, operational support ships, military sea lift ships, diving support vessels, patrol boats, navigation training vessels, range support vessels

Source: Marine Institute of Memorial University of Newfoundland

Table 2. Most common types of tanker, cargo and passenger vessels

Type of vessel	Main characteristics
Tankers	The use of the word 'tanker' alone generally refers to oil tanker, carrying either crude oil or oil –related products such as petroleum, kerosene or naphtha. Generally speaking crude oil moves in large amounts in very large crude carriers (VLCC) and ultra large crude carriers (ULCC) (above around 100,000 tonnes dwt). The building of a tanker is subject to a number of distinctive elements, such as: • High steelwork content • Significant outfitting in cargo piping systems and machinery spaces
Chemical Tankers	Chemical tankers are designed to carry relatively small parcels of higher value chemicals (i.e. acids or polymers). Ships are typically relatively small, up to around 25,000 dwt. Chemical tankers are classed by the International Maritime Organisation (IMO) according to the level of hazard they represent: i) IMO class I represents the greatest hazard and requires ships with sophisticated tanks and cargo handling systems, often manufactured from stainless steel. ii) IMO class II represents a lower class of hazard with relatively normal tanks and cargo handling systems. iii) IMO class III refers to low hazard chemicals, such as many petroleum products. The building of a chemical tanker is subject to a number of distinctive elements, such as: • Generally smaller than oil tankers. • Cargo containment and pumping systems can be complex. • Use of special coatings and structural materials. • Medium level of outfitting.
LPG (Liquid Petroleum Gas) Tankers	LPG tankers are basically designed to carry liquefied propane or butane under pressure, with typical sizes up to around 25,000 dwt. The building of a LPG tanker is subject to a number of distinctive elements, such as: • The hull is relatively straightforward to build. • Cargo tanks use high tensile low-temperature-resistant steel. • Similar in complexity to build as a small chemical tanker. • The level of sophistication in the cargo containment system is relatively high compared to crude oil or petroleum products tankers, but is far below the complexity of an LNG (methane) carrier
LNG (Liquid Natural Gas) Tankers	Liquid natural gas (methane) is carried at temperatures of around –160° C and presents very significant technical difficulties in the design of the cargo containment system. LNG tankers are large and the potential hazard represented by the cargo imposes the highest standards of construction. Two containment systems have been developed. The original system uses spherical tanks (these ships are called 'spherical type'), whereas the alternative system uses more conventionally shaped tanks, and normally referred to as 'membrane type'. The building of a LPG tanker is subject to a number of distinctive elements, such as: • Complex containment and cargo handling systems. • High quality assurance inspection requirements during construction. • Limited to a small number of specialised licensed builders. Entry costs into this sector are very high • Relatively long cycle time in build.
Bulk Carriers	Usually, bulk carriers refer to 'dry bulk' cargoes, although they can also carry 'wet bulk' cargoes (fruitjiuces, molasses). The major bulk cargoes (i.e. coal, grain and iron ore) generally move in large quantities up to around 170,000 tonnes. Minor bulk cargoes (i.e. bulk sugar) are typically transported in ships carrying up to around 50,000 tonnes. The building of a bulk carrier is subject to a number of distinctive elements, such as: • High steelwork content. • Straightforward assembly with relatively low levels of outfitting.
Container ships	Container ships carry containerised cargoes. There are a wide range of sizes of container ships on a wide range of routes. Thus, the very large container ships carry boxes on trans-oceanic routes serving the main hub ports in the world. Meanwhile, smaller container ships distribute the containers from the main hub ports to local ports. The contents of the containers may include such diverse items as machinery, white goods, clothing, electronic equipment, and so on. The building of a container ship is subject to a number of distinctive elements, such as: • Long slender ship structure with more curvature in the hull. • Increased steelwork content compared to tankers and bulk carriers. • Higher outfit work content than other boats (i.e. tankers and bulk carriers).

Type of vessel	Main characteristics
Ro-Ro ships	'Ro-Ro' is an acronym standing for 'roll-on-roll-off', referring to the method of loading the cargo on wheeled vehicles or trailers via ramps that lower onto the quayside. Ro-Ro ships can be large, although there is no typical size. The characteristics of this ship type are large cargo volume and multiple internal decks. Typical Ro-Ro ships include dedicated vehicle carriers for transport of cars and other vehicles from the manufacturer to the distributors. The building of a Ro-Ro ship is subject to a number of distinctive elements, such as: • High proportion of steelwork in sides and decks. • The complexity in building largely arises out of the complexity of the structure • Sophisticated hydraulic cargo access system (doors and ramps) and other cargo loading systems. • Propulsion usually two to four medium speed engines
Ferries	Ferries are designed for transporting passengers and often vehicles in addition. It is possible to identify three main groups, this is: iv) Roll-on-roll-off (roro) ferries tend to be large ships, often operating on relatively short routes such as across the English Channel or the between Greek islands. v) A new generation of ships is emerging for longer routes, known as cruise-ferries. They offer a higher standard of passenger accommodation and some of the facilities offered by cruise ships. vi) Finally, fast ferries that tend to be smaller, may have multiple hulls (catamarans) and are often built from aluminium rather than steel. The building of a ferry is subject to a number of distinctive elements, such as: • High outfit content compared to steelwork content. • High electrical demand and speed lead to high power requirements. • Relatively long cycle time in construction
Cruises	Cruise ships are characterised by the complexity of the product and the standard of finish required. The size of ships has been increasing over time, where a typical modern cruise ship has a GT of around 75,000 tons. The building of a cruise is subject to a number of distinctive elements, such as: • Very high outfit content compared to steelwork content. Special outfit sub-contractors normally used for public spaces. Much of the work involved in construction is related to fitting of public spaces aboard the ship and the complex systems for running the vessel • High electrical demand and speed lead to high power requirements. • Complex systems required serving passenger areas. • Long cycle time in build (sometimes years).

Source: First Marine International Limited, 2003

Meanwhile, and referring to the building and repairing of pleasure and sporting boats sector (NACE Rev 1.1. 35.12), the main products included in this sector include motor yachts or sailing yachts over 24 meters in length (i.e. superyachts), and boats of less than 24 meters, as well as small boats below 10 meters length (i.e. surf boards, inflatable boats, canoes, kayaks or skiffs) and maintenance, repair or alteration activities.

To end with this section on the definition of the industry, it is worth mentioning that, as it will be explained in subsequent sections of this report, the shipbuilding sector in general is currently characterised by an increasing outsourcing strategy of the products and/or service supply chain.

In this sense, and according to the definition[1] used by the European Marine Equipment Council (EMEC), the marine equipment sector comprises those companies that supply products and services for the building, conversion and maintenance of ships (seagoing and inland). This includes technical services in the field of engineering, installation and commissioning, and ship maintenance (including repair). The production ranges from fabrication of steel and other basic materials to the development and supply of engines and propulsion systems, cargo handling systems, general machinery and associated equipment, environmental and safety systems, electronic control and bridge systems, telecommunications equipment and ICTs, etc (see Table 3).

[1] Definition included in the EMEC webpage (see http://www.emec-marine-equipment.org/)

Table 3. Main marine equipment systems and components provided by the marine equipment industry

Marine Equipment "Systems"	Marine Equipment "Components"
1. Propulsion, Power Generation Systems	• Diesel engine • Steam turbine • Gas turbine • Gears and couplings • Propeller • Shafts and bearings • Main engine accessories
2. Auxiliary Power Generating System	• Auxiliary engines (diesel) • Auxiliary boilers, etc
3. Electrical Systems, Plants and Cables	• Generators, e-engines • Switchboards, control panels • Cables • Power supply, batteries
4. Instrumentation, Control and Navigation Systems (Integrated Bridge Systems, Ship Management & Automation Systems, Cargo Control Systems)	• Control and alarm systems • Navigation and measurement systems
5. Communication and Entertainment Systems	• Communication systems • Data processing • Entertainment systems, audio, video
6. Lighting Systems	• Fittings-lighting system • Lights, electrical heaters
7. Steering Systems	• Steering gear • Rudder • Accessories
8. Special Ship Operation Systems	• Thrusters, special rudders • Roll-dumping, anti-heeling systems • Active stabilisers • Others
9. Mooring, Deck Machinery Systems	• Anchor, chain • Winches • Ropes, fenders, towing systems • Accessories • Lubrication and cleaning systems
10. Safety and Life Saving Systems, Environmental Protection Systems	• Boats and lifeboats • Davits, cranes, ramps • Life saving equipment • Fire fighting equipment • MARPOL equipment
11. General Outfitting Components	• Stairs, ladders, catwalks, railings, etc • Openings and closures • Glass • Workshop outfitting
12. Auxiliary Systems	• Separators • Pumps and compressors • Loose tanks • Valves and fittings • Auxiliary system aggregates • Heaters and coolers • Filters, cleaners
13. Heat, Ventilation, Air Conditioning Systems	• Heat, Ventilation, Air Conditioning Systems
14. Cargo Systems	• Cranes etc., sucker, conveyors, cargo lift • Hatch covers • RO-RO Equipment • Cargohold outfitting • LNG/LPG Plants • Fishing Vessel Equipment Systems • Special Equipment for Dredgers • Special Equipment for Construction Vessels
15. Accommodation Systems	• Frames, walls, staircases • Doors and openings • Lifts • Sanitation objects and appliances • Electric domestic appliances • Furniture and decoration

Marine Equipment "Systems"	Marine Equipment "Components"
16. Other Systems	• Special Offshore Equipment • Special Underwater Equipment • Special Navy Systems, Acoustics and Weapon Systems • Miscellaneous
17. Materials	• Steel Plates/Profiles • Steel - Pipes Self-explaining • Non-Ferro Metals • Rubber and Plastics • Glass and Ceramics • Textile Products • Assembly material • Welding Material • Paint and Coatings • Insulation Material

Source: BALance Technology Consulting et al, 2000

As it can be seen, this definition of the marine equipment sector is not a straightforward one, due to the fact that enterprises in the sector are usually active in several different fields (i.e. aviation, furniture or car manufacturing). In any case, some efforts have been attempted to delimitate and define the marine equipment sector (see for instance BALance Technology Consulting et al, 2000).

2. BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR IN THE WORLD

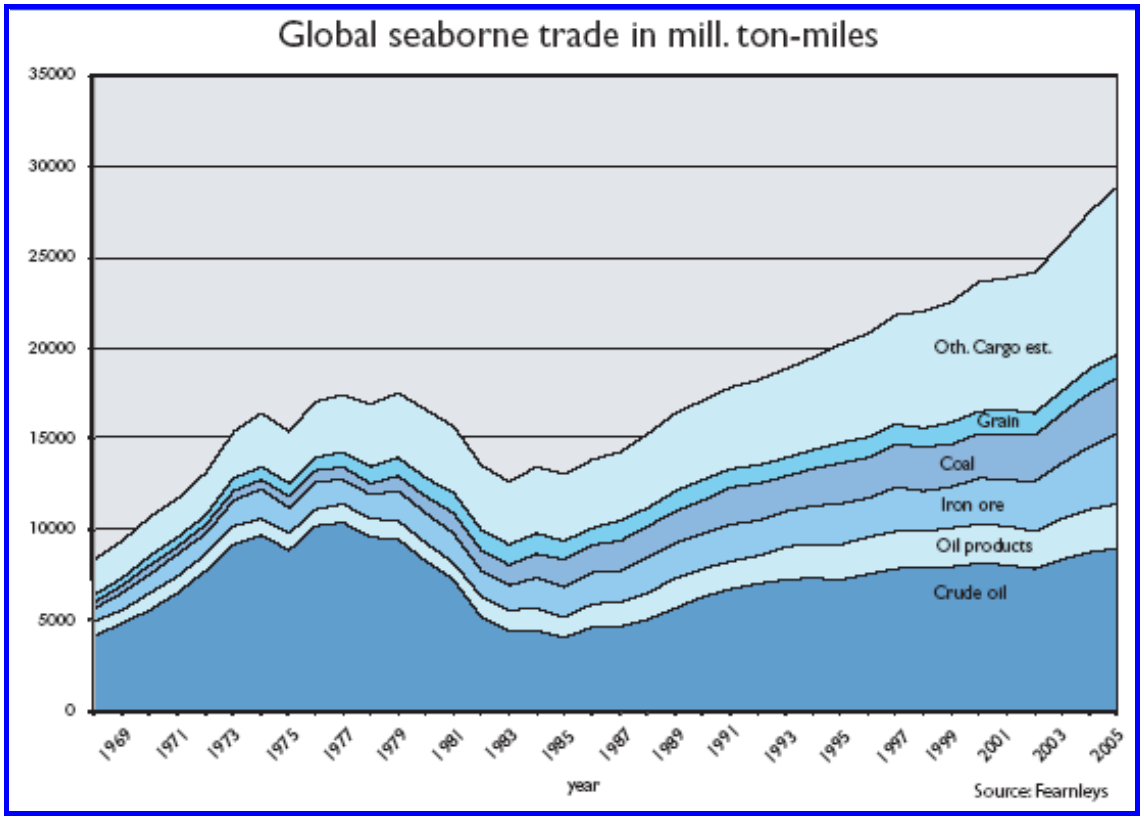
2.1. PRODUCTION

According to the latest available data for the Building and Repairing of Ships sector (NACE Rev 1 35.11), the total volume of deliveries world-wide amounted to a total of 34.6 million CGT in 2007. Meanwhile, and in 2007 also, world new orders reached 85.3 million CGT, which represents a 5.2% increase in relation to last year, which also increased a 44.8% in comparison to previous year. Therefore, the world order-book at the end of 2007 reached an all-time record of 177.7 million CGT which is more than 5.1 times the current annual output level (see Graph 2).

Interestingly also, and despite the fact that shipbuilding (as well as the ship repair industry) can be characterised as a sector suffering important cyclical fluctuations in demand, it is worth mentioning that the sector is experiencing a period of favourable market conditions with substantial increases in orders and outputs since 2000 onwards (CESA, 2008).

Thus, and during the last few years, there has been a growing seaborne trade, fostered by continued growth in the world economy (specially but not only the Chinese economy), growing globalisation of markets and increased use of ocean and short sea shipping for the movement of cargo. Not surprisingly, the total volume of deliveries world-wide has experienced a positive accumulative growth rate of 9.7% in the time period 2000-2006 (see Graph 1). On the other hand, and as a result of this increased trade, last years have experienced a remarkable increase in freight rates (Stopford, 2004).

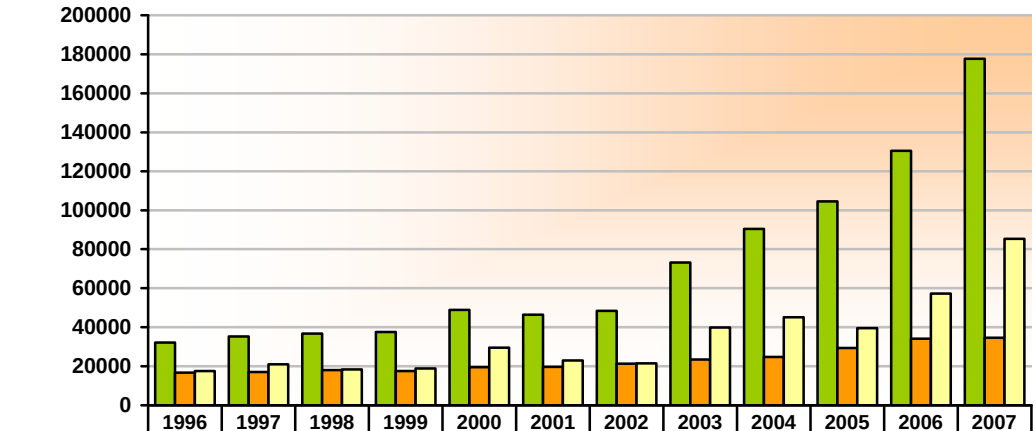
Graph 1. Development in world seaborne trade, 1969-2005



Source: CESA, 2006

All these elements have sparked in the last years an order boom for new ships, not only in Europe but also at world level, turning therefore the shipbuilding market from a classical buyers market into a sellers market in the last years (CESA, 2007 and 2008). Thus, the new order book and the total order book have experienced also important positive accumulative growth rates in the same time period between 2000 and 2007 (16.4% and 20.2%, respectively) (see also Graph 2). Reasons for this order boom can be found in Table 4.

Graph 2. World shipbuilding Industry- Completed Tonnage (in thousand CGT), 1996-2006



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Orderbook	32077	35313	36809	37513	48878	46413	48446	73218	90379	104446	130424	177700
Completion	16705	17099	18004	17509	19585	19742	21396	23412	24742	29353	34123	34600
New orders	17519	20935	18359	18926	29525	22970	21447	39939	45128	39588	57315	85300

Source: CESA, Annual reports.

Table 4. Main factors explaining the record production levels of recent years in the world shipbuilding industry

1. Reduced laid up tonnage: After twenty years in which there was always a surplus of shipping capacity, in the last decade, as the 1970s built fleet has been scrapped, the balance of supply and demand gradually tightened.
2. High freight rates: As a result the shipping market finally got back into balance and over the last five years we have seen much higher freight rates than had been experienced for at least 30 years in several markets (i.e. the tanker and the bulk carrier markets)
3. Running new ships is now cheaper than old ones: the economic cost of new ships has fallen dramatically making building a new fleet a more attractive proposition than it was a few years ago. This happened because falling prices has coincided with record low interest rates.
4. Tightening regulatory environment: has made old ships politically incorrect, encouraging new investment.
5. The "China factor". Over the last five years the Chinese economy has moved into a phase of growth which is similar to the rapid expansion of the Japanese and European economies in the 1960s. Over the last year this has driven bulk carrier rates to levels three or four times higher than has ever been seen previously, as they imported iron ore and steel products to supply the construction boom. In addition Chinese exports across the Pacific and to Europe has created a shortage of container ships.

Source: Stopford 2004

As a result of this change, and since mid 2002, newbuilding prices have indeed experienced a very steep increase and, after a short correction phase mid 2005, the price development has continued rather firm throughout 2006 and 2007. Moreover, the increase in demand for maritime transport experienced in the last years also explains the massive slow down in ships' scrapping compared to the previous years, notwithstanding high scrap metal prices (CESA, 2007).

From a product perspective, and according to the information provided by CESA, the world order book is being dominated by the Container Carriers (29.3% and 24.1% of the total order book in 2005 and 2006, respectively), followed by Product & Chemical carriers, Bulk Carriers and Crude Oil Tankers (17.0%, 14.0% and 13.8% of the 2006 world order book, respectively) (see Table 19). Of course, the order book may be subject to external influences. Just to give some data, in the last two years there has been an exceptional order intake for Tankers and Bulk Carriers, which can be partly explained by the ship owners' rally to close deals before the entry into force of the new IACS Common Structural Rules (CSR) for Tankers and Bulk Carriers on 1st April 2006.

Table 5. World order book on 31.12.2005 and 31.12.2006 (in % of CGT)

	2005	2006
Container Vessels	29.3%	24.1%
Passenger Vessels	3.6%	3.4%
Other non-cargo vessels	3.5%	5.3%
Products & Chemical Carriers	15.3%	17.0%
Ferries	1.5%	1.3%
General Cargo Vessels	3.9%	4.4%
Other Dry Cargo Vessels	0.3%	0.2%
Ro-Ro Vessels	0.9%	4.5%
LPG Carriers	2.6%	3.0%
Fishing Vessels	4.6%	0.3%
LNG Carriers	9.9%	8.8%
Crude Oil Tankers	9.6%	13.8%
Bulk Carriers	14.7%	14.0%
Reefers	0.2%	0.1%

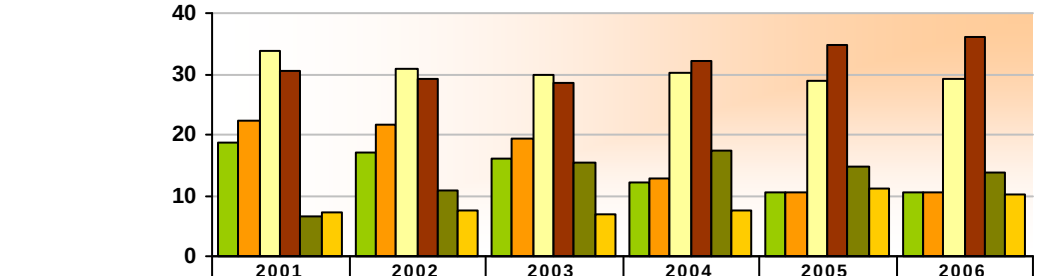
Source: CESA

From a regional perspective (see Graph 3), the available data shows that, focusing on deliveries, approximately a 79.2% of the total world production was delivered by East Asian shipbuilders in China, Japan and South Korea, whereas the EU reached a 10.4% of the total world production[2]. From a time perspective, the share of the East Asian shipbuilders in the total world production has grown up approximately ten percentage points since 2001, whereas the EU production has reduced its participation in more than eight percentage points in the same time period. Precisely, it is China the country that has experienced the most significant increase in the world production share in the last years, basically from 6.5% in 2001 to 13.8% in 2006, threatening also the position of other manufacturing countries such as South Korea. However, it is interesting to notice that the share of the European sector is much higher when value is taken into account (see also Graph 3), where this result is explained by the European specialisation in high-tech/high value added vessels, that will be explained later on.

[2] It is interesting to stress that approximately 40-50% of the total world fleet is still owned by European ship-owners.

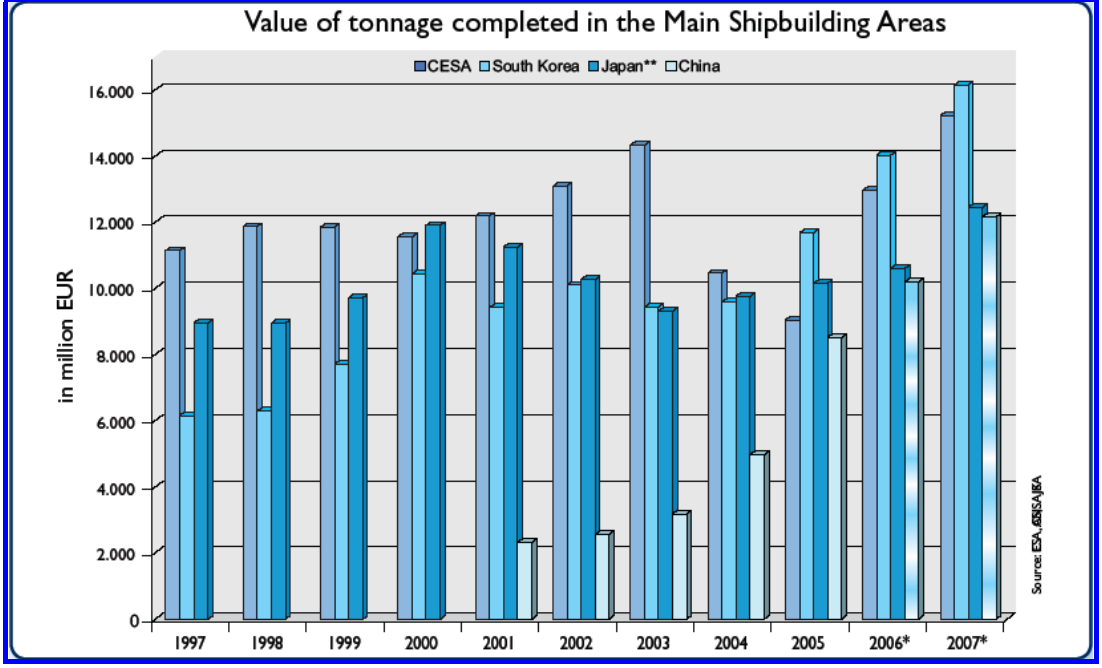
Graph 3. Distribution by world regions of completed tonnage and value of completed tonnage (2001-2006/2007), in thousand CGT and million EUR

Completion in tonnage



	2001	2002	2003	2004	2005	2006
EU	18,7	16,9	16	12,2	10,5	10,4
OECD Europe	22,2	21,5	19,3	12,9	10,6	10,6
Japan	33,7	30,9	29,8	30,2	28,9	29,3
Korea	30,4	29,1	28,6	32,1	34,6	36,1
China	6,5	10,8	15,3	17,4	14,8	13,8
Rest of the world	7,2	7,7	7	7,4	11,1	10,2

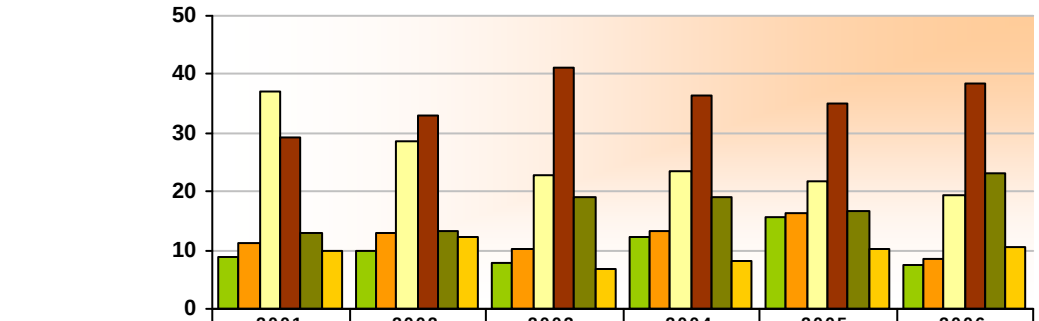
Value of tonnage completed



EU data refers to 12 countries up to 2003 and 14 countries since 2004 onwards.
Sources: Gerencia del Sector Naval (taken from Lloyd's Register), 2007 and CESA, 2008

As far as the regional distribution of the world new orderbooks is concerned (see Graph 4), and referring to the 2006 year, it is worth mentioning that the South Korean shipyards got the largest world share (38.5%), followed by China and Japan (23.0% and 19.5%, respectively). Meanwhile, the EU share was of 7.4%. From a time dynamic perspective, Chinese shipbuilders are getting an increasing share from world orders, as they have gained more than 10 percentage points of the total world orders since 2001, and surpassing Japan for the first time in 2006. These figures underline the resolution of China to become the number one shipbuilding country in the world (see Table 6.).
Meanwhile, the EU share has remained practically constant in the 2001-2006 time period.

Graph 4. Distribution by world regions of new orderbooks (2001-2006)



	2001	2002	2003	2004	2005	2006
EU	8,9	9,8	7,9	12,1	15,8	7,4
OECD Europe	11,1	12,9	10,1	13,2	16,3	8,4
Japan	37	28,6	22,8	23,4	21,7	19,5
Korea	29,1	33,1	41,1	36,3	35,2	38,5
China	13	13,2	19,2	18,9	16,6	23
Rest of the world	9,8	12,2	6,8	8,2	10,1	10,6

EU data refers to 12 countries up to 2003 and 14 countries since 2004 onwards.
Source: Gerencia del Sector Naval (taken from Lloyd's Register), 2007

Table 6. Existing tensions between Chinese and South Korean producers

- The world's three biggest builders of ships, Hyundai Heavy Industries, Samsung Heavy Industries and Daewoo Shipbuilding & Marine Engineering, are polite but firm. A visit to their shipyards on South Korea's south-east coast is encouraged. A trip to their research and design centres, which house 5,249 naval researchers and architects, is not. South Korea's shipbuilders are particularly secretive because Chinese rivals are luring away many of their most highly qualified employees. The two countries are competing furiously to be the world's biggest builder of ships. Some analysts reckon that, on current trends, China could pass South Korea by 2012.
- The shipbuilding industry has boomed in recent years in tandem with the global economy. The world is making one ship a day, and older vessels which would normally have been scrapped are being kept afloat. "What goes up, goes down. The boom will not last," says Ki Won-kang, Daewoo's chief production officer. For now, however, the strong demand for ships has resulted in a shortage of about 2,000 skilled labourers, according to the Korea Shipbuilders' Association. The most highly qualified staff, some of whom earn $100,000 or more a year, are leaving for Shanghai and Guangzhou and even higher salaries and bonuses.
- Measured by volume, almost 40% of global orders for new ships last year went to shipbuilders in South Korea, according to Lloyd's Register. China won 23% of new orders (up from just under 12% in 2001) and Japan almost 20%. Analysts suspect that China is already making more crude-oil tankers and dry-bulk vessels—the simplest kinds of ship—than South Korea.
- The South Koreans say they are not all that worried. "Some people say China will take our market share, but China is taking Japan's share, as they mostly build the same type of vessels," says Lee Kwang-ho, a spokesman for Hyundai. South Korean shipyards are concentrating on building highly engineered vessels, which the Chinese do not yet make in any significant number. Samsung, for instance, has launched the world's first ice-breaking oil tanker, which was ordered in 2005 by Sovcomflot, a shipping company owned by the Russian government. It has not built a dry-bulk vessel for four years.
- Norwegian and Australian buyers on Geoje Island, one of South Korea's main shipbuilding hubs, say that new shipyards in China and elsewhere cannot compete with South Korean quality or technical expertise. They also complain that Chinese firms often have trouble meeting production deadlines.
- Nevertheless, South Korean shipbuilders are taking the Chinese threat seriously. They may even be able to turn it to their advantage. Samsung and Daewoo have started to use Chinese shipyards to bring costs down: the wages of lower-skilled workers in Chinese yards are one-tenth of those of their South Korean counterparts. A delegation representing the South Korean firms was in North Korea this week investigating the possibility of doing the same thing in that country. Mr Ki says he plans to visit North Korea soon to see if Daewoo could establish a ship-repair yard or build parts of ships' hulls there. The two countries' proximity and the low cost of labour in the North, he hopes, could help to keep the South Koreans on top

Source: The Economist, April 10th 2008

From a qualitative perspective, the world shipbuilding market is to a large extent shaped by uncontrolled distortions of competition. Thus, and despite being faced with global competition[3], it is argued that this has not translated into globally applicable trade rules on subsidies and anti-dumping measures (taken from ECOTEC, 2006). In this sense, financial public direct and indirect subsidies available in certain countries but not in others distort prices in the sector and therefore force the shipyards to compete with each other at low costs. This situation poses particular threat to the European industry, as it is not well placed to compete on price (European Commission, 2003b).

Also, and over the last 10 years, there has been a constant increase in global shipbuilding capacity (CESA, 2007). Thus, and whereas this capacity amounted up to 20.6 million CGTs in 1998, in 2007 this capacity reached 28.9 million CGTs, where it is worth particularly stressing the expansions of South Korea and China in this period (see Table 7). Meanwhile, European shipyards account for approximately 20% of this capacity, only rarely used to its full potential (like in 2006). Some industry analysts suggest that this expansion of the world shipbuilding capacity has significantly contributed to global over-capacity and a destructive "price war" in the international shipbuilding market (European Commission, 2003b).

Table 7. World shipbuilding capacity, 1975-2010 (million CGT)

	1975	1980	1990	1998	2005	2007	2010
Europe	11.0	7.8	5.1	5.7	5.8	6.1	6.3
China	0.3	0.5	0.5	1.3	3.0	3.5	5.0
South Korea	0.4	0.6	1.8	4.5	8.5	9.2	9.6
Japan	9.0	7.0	5.5	7.1	7.7	8.3	8.3
Rest of the world	1.7	1.9	2.1	2.0	1.8	1.8	1.9
Total	**22.4**	**17.8**	**15.0**	**20.6**	**26.8**	**28.9**	**31.1**

Source: Gerencia del Sector Naval (taken from CESA sources), 2007

Looking at the future, and according to several estimations carried out by the CESA Working Group on Market and Forecast in 2006-2007, the world shipbuilding industry is currently in the middle of a major expansion of capacity, as global capacity is expected to grow to 31.1 million CGT by 2010. The construction of new shipyards (Vietnam, India, and the Philippines are paying an increasing attention to the shipbuilding activity, and Russia has announced ambitious national programmes including substantial state budgets to create new building capacity and establish the country as a shipbuilding nation), as well as the establishment of new building berths and docks by existing shipyards may explain this capacity expansion (CESA, 2007).

In any case, it is possible to assume that shipbuilding capacity will outstrip demand by approximately 30% in the near future (information taken from ECOTEC, 2006 and based on OECD estimations). This situation may lead to a situation characterised by a high demand for ships but decreasing prices, resulting in financial difficulties for shipyards (specially the European ones). Moreover, the very little regulation on most government supports to shipyards may cause unfair pricing and, therefore, disturb the global level playing field (EMF Executive Committee, 2005)[4].

Meanwhile, and far as the building and repairing of pleasure and sporting boats sector (NACE Rev 1.1. 35.12), some recent forecasts suggest that the global demand for recreational boats is estimated to reach (US)$23.8 billion in 2005 and is projected to grow

[3] It is worth stressing that not all the shipbuilding production is characterised by global competition. Thus, short sea cargo and small specialised shipbuilding (i.e. tugs, fishing boats and workboats) under 5,000 tonnes is more geographically restricted than the larger 'deep sea' sectors, due to the disproportionately high cost of contract management and supervision for a small ship when built at a distance (info obtained from First Marine International Limited, 2003).

[4] These forecasts have been carried out before the current uncertainty phase in the world economy since August 2007.

at a 7% annual rate to reach $33 billion in annual sales by 2010 (see Francesetti, 2006). On a global basis, North America represents the largest region in the world in total recreational boat production. Thus, the level of USA output (and the overall stock of boats) is not comparable to that of any other country in the world, and it has a turnover of roughly 10 billion dollars a year (data for 2004), that is to say, roughly half the world turnover. Meanwhile, European production is less important, although by no means inferior either as regards quality or importance. Indeed, the EU is the global leader in super yachts, production sailing yachts and custom and semi-custom power yachts (for instance, the Italian yards are the world top exporters in value, basically due to the exportation of superyachts (ECOTEC, 2006).

2.2. EMPLOYMENT

There is very little information on employment at world level. Thus, the only information found is available up to the 1998 year, and basically shows that the shipbuilding sector (NACE 35.11) has experienced a dramatic reduction in employment, so if in 1976 it had 508,350 people working in the sector, this figure had gone down to 168,919 people in 1998. This downward trend has been especially acute in the EU-15, with an annual accumulative growth rate of -6.8% in the time period (see Table 8).

Table 8. World workforce in shipbuilding activities, 1976-1998

	1976	1991	1992	1993	1994	1995	1996	1997	1998
EU (15)	314,830	106,533	95,658	84,162	79,564	75,634	71,589	67,669	66,985
Other Europe	18,500	5,300	5,100	3,800	4,000	29,019	30,948	23,422	23,594
OECD Europe	333,350	111,833	100,758	87,962	83,564	104,653	102,529	91,091	90,579
Japan	175,000	56,000	56,000	55,000	53,000	51,000	46,000	45,000	43,000
Korea	--	--	--	--	--	40,400	38,900	37,140	35,340
OECD Working Group 6	508,350	167,833	156,758	142,962	136,564	196,053	187,429	173,231	168,919

Source: Gerencia del Sector Naval (taken from 2007OECD Working Group 6)

3. THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR FROM AN ECONOMIC PERSPECTIVE

3.1. GENERAL OVERVIEW OF THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR FROM AN ECONOMIC PERSPECTIVE

According to Eurostat's estimates, the building and repairing of ships and boats sector (NACE 35.1, Rev 1) comprised in 2006 a total of 20.5 thousand enterprises that reported shipbuilding or repairing as their main activity. These enterprises generated a value added of EUR 11,476 million for a turnover of EUR 40,856 million (see Table 9). Interestingly, the sector as a whole made up around a 0.6% of value added and turnover of the total EU-27 manufacturing industry. The building and repairing of ships (NACE 35.11) was the largest subsector, accounting for a 74.4% of the EU-27's value added in the sector, whereas the remaining 25.6% was generated by the building and repairing of pleasure and sporting boats sector (NACE 35.12).

Table 9. Building and repairing of ships and boats (NACE Group 35.1), Structural profile, EU-27, 2004, 2005 and 2006

Sectors	No. of enterprises (thousands)			Turnover (EUR Million)			Value added (EUR Million)		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Building and repairing of ships and boats (NACE 35.1)	18.6	19.9	20.5	33,000	37,400	40,856	9,900	10,400	11,476
Building and repairing of ships (NACE 35.11)	9.5	9.5	9.8	25,000	28,000	30,758	7,000	7,600	8,542
Building and repairing of pleasure and sporting boats (NACE 35.12)	9.1	10.4	10.6	8,000	9,491	10,053	2,600	2,783	3,095

Source: Eurostat, 2007, based on the Structural Business Statistics (SBS)

Apparent labour productivity of the EU-27's building and repairing of ships and boats sector was relatively low at EUR 35.6 thousand per person employed in 2005, compared to EUR 47.1 thousand in the whole EU-27 manufacturing industry. Meanwhile, average personnel costs in the sector were EUR 29.0 thousand per employee, slightly below the EU-27 manufacturing average of EUR 31.0 thousand. The gross operating rate[5] was of 6.1%, well below the average 9.5% in manufacturing.

As far as external trade of the sector is concerned, the EU-27 has experienced a traditional trade surplus situation, with the only exception of the 2003-2006 years period. Interestingly also, this traditional trade surplus situation has also taken place in 2007, with a cover ratio of 158.9% (see Table 10). Generally speaking, extra EU exports account on average for a 1.2% of the total EU-27 industrial exports, which shows that the sector as a whole is very open to external markets.

[5] The gross operating rate can be defined as the share of gross operating surplus in turnover (a proxy-indicator of profitability).

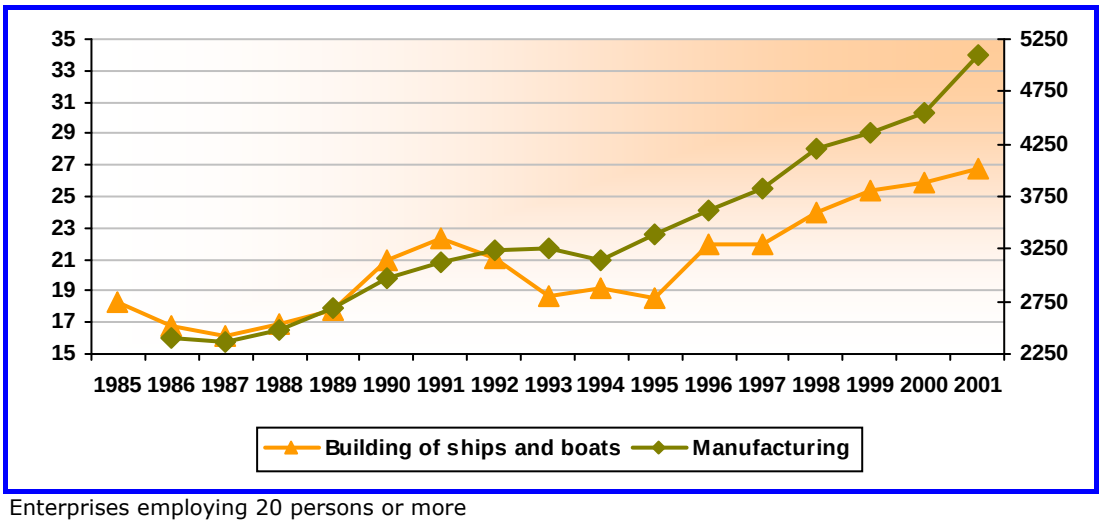
Table 10. External Trade in the European Building and repairing of ships and boats sector, EU 27, 2000-2006 (Eur Million)

	Export	Import	Trade Balance	Cover ratio %
2000	10,565.1	6,321.3	4,243.8	167.1
2001	11,485.9	6,701.7	4,784.1	171.4
2002	12,896.2	8,352.6	4,543.6	154.4
2003	10,960.9	12,010.0	-1,049.1	91.3
2004	10,498.0	11,084.2	-586.1	94.7
2005	11,556.8	12,618.0	-1,061.2	91.6
2006	13,383.2	16,148.4	-2,765.2	82.9
2007	15,040.8	9,463.6	5,577.2	158.9

Source: Eurostat (Comext)

Interestingly also, Eurostat also provides some interesting long-term series on structural business statistics. In this respect, the available information for the time period 1985-2001 (only referred to EU-15 and to enterprises with more than 20 employees) shows that turnover of the sector as a whole has shown a positive evolution since 1997 onwards (data are in current prices without any correction for increases in producer prices), although the total manufacturing turnover is shown to have outgrown shipbuilding and repair by close to 66% over the observation period (see Graph 6). As a result, the share of shipbuilding and repair in EU-15 total manufacturing has fallen in this time period from 0.76% to 0.52% (Eurostat, 2008).

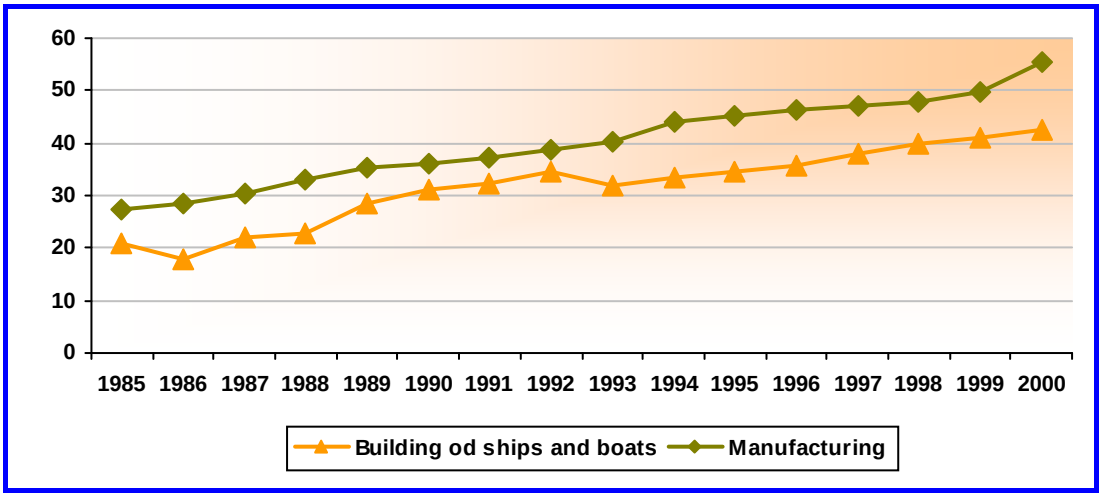
Graph 5. Evolution of turnover in the EU-15 building and repairing of ships and boats sector (EUR Billion), 1985-2001



Enterprises employing 20 persons or more
Source: Eurostat, Structural Business Statistics (SBS)

Meanwhile, the evolution of the apparent labour productivity (defined as gross value added per person employed) shows that productivity levels in the EU-15 building and repairing of ships and boats sector has shown an upward trend in the time period 1985-2000 (last info available). In any case, and in comparison to the average for the European manufacturing, productivity levels are lower, where existing differences are kept during the whole analysed time period (see Graph 6).

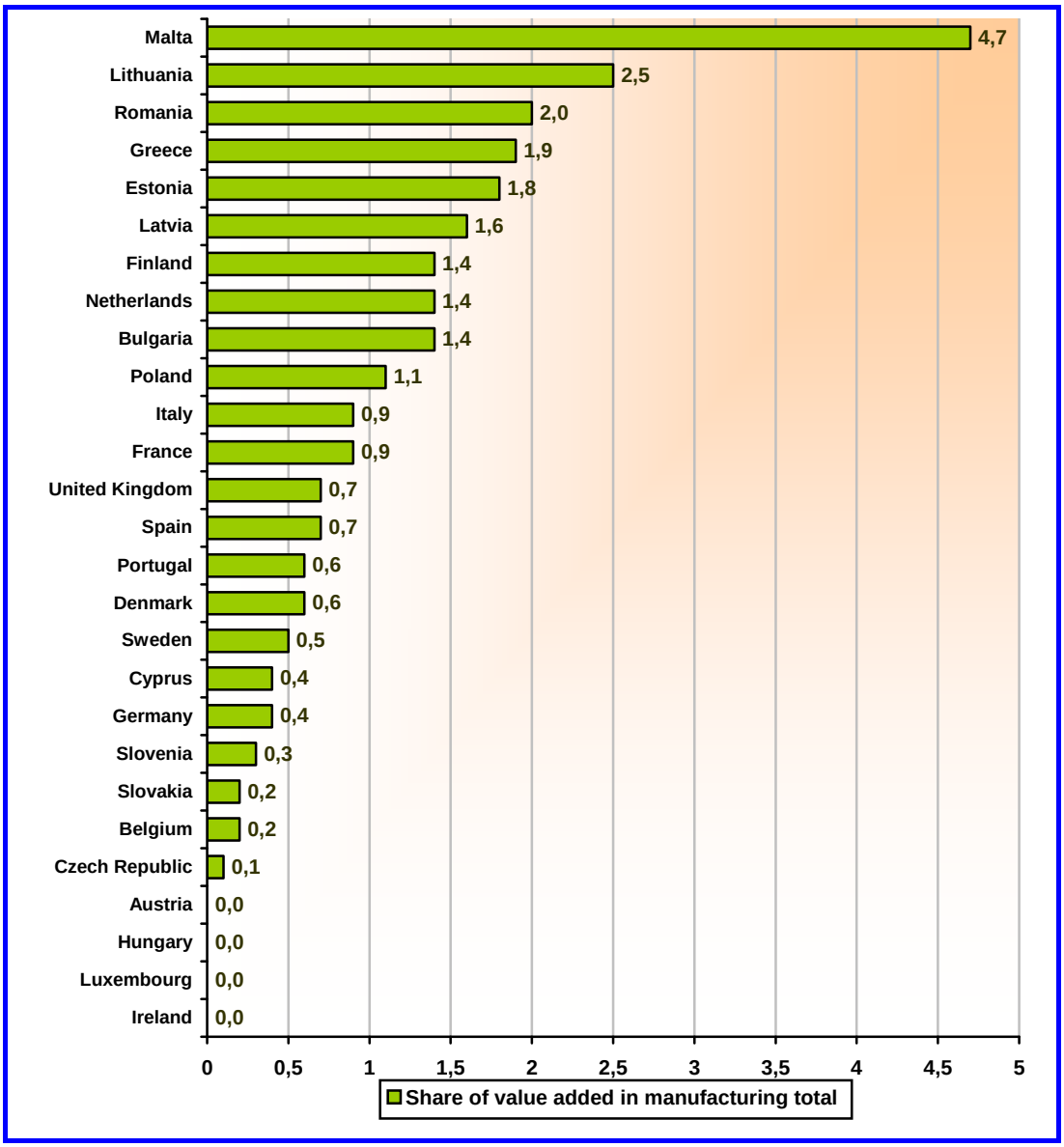
Graph 6. Evolution of apparent labour productivity (gross value added per person employed) in the EU-15 building and repairing of ships and boats sector (EUR thousand), 1985-2000



Enterprises employing 20 persons or more
Source: Eurostat, Structural Business Statistics (SBS)

From a country perspective, the building and repairing of ships and boats sector is quite unevenly distributed across the EU-27. Thus, the sector is practically absent in the five landlocked Member States of Czech Republic, Luxembourg, Hungary, Austria and Slovakia, as well as in Ireland or Belgium. By way of contrast, and in economic terms, the sector plays a very important role in countries such as Malta, Lithuania, Romania, Greece, Estonia or Latvia, where more than 1.5% of the total manufacturing value added is generated by the analysed sector. Interestingly also, the sector seems to be of relative importance in countries such as Finland, The Netherlands, Bulgaria or Poland, with percentages ranging from 1.4% to 1.1% (see Graph 7). Meanwhile, in countries such as Italy, France, United Kingdom or Spain, the sector represents between 0.7% and 0.9% of the value added generated by the national manufacturing sectors, whereas in Germany this percentage is only of 0.4%.

Graph 7. Share of sector value added of the building and repairing of ships and boats sector / total manufacturing, 2006



All data referred to 2006 with the exceptions of Bulgaria (2005), Estonia (2005), Malta (2002), Netherlands (2005), Poland (2005), Romania (2005) and Slovakia (2004)
Source: Eurostat, Structural Business Statistics (SBS)

In any case, and taking into account the EU-27 aggregate value added total (see Table 11 and Graph 8), the most important Member States in terms of their contribution to the European total added value in 2005 were Italy and France (EUR 2.036.4 and 1,975.8 million, respectively), followed by Germany and the United Kingdom (1,662.7 and 1,606.8 million, also respectively). Other EU-27 countries relatively important correspond to Spain, The Netherlands, Poland and Finland (978.9, 835.0, 533.8 and 472.2 million EUR, respectively). Interestingly also, the largest EU-27 countries with the highest apparent labour productivity[6] correspond to Germany, The Netherlands and France (63.7, 60.8 and 54.1 thousand EUR, respectively), followed by Finland or Italy (52.4 and 47.3 thousand EUR, also respectively).

[6] Apparent labour productivity is defined as gross value added per person employed

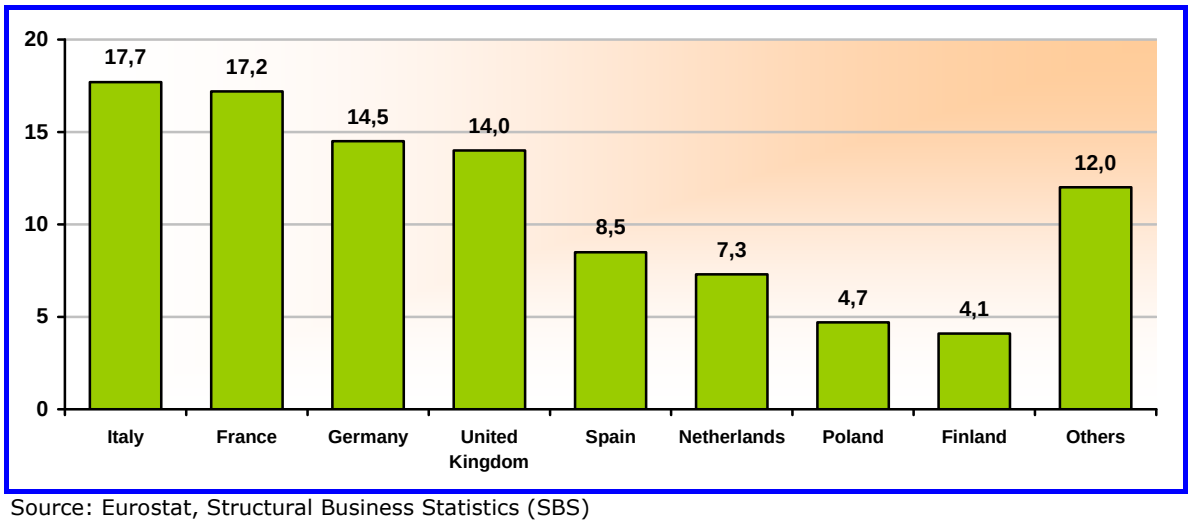
Table 11. Main economic indicators of the building and repairing of ships and boats sector, 2006

	Number of enterprises	Turnover (Million EUR)	Value added at factor cost (Million EUR)	Apparent labour productivity (Gross value added per working person, thousand Euros)
Belgium	177	289.0	86.7	50.1
Bulgaria	274	129.0	45.0	4.7
Czech Republic	85	32.1	17.8	27.4
Denmark	269	1,138.9	162.2	30.1
Germany	650	7,229.7	1,662.7	63.7
Estonia	110	119.4	28.3	11.9
Ireland	23	30.1	13.1	44.5
Greece	881	601.1	305.0	38.6
Spain	2,234	3,772.1	978.9	35.1
France	2,632	6,624.8	1,975.8	54.1
Italy	4,110	7,008.2	2,036.4	47.3
Cyprus	39	8.7	4.2	28.5
Latvia	124	92.1	27.9	10.6
Lithuania	107	158.2	64.6	12.7
Luxembourg	0	0.0	0.0	0.0
Hungary	152	15.7	4.1	8.2
Malta	65	3.5	0.8	10.3
Netherlands	1,580	3,942.0	835.0	60.8
Austria	55	51.7	22.0	54.4
Poland	2,124	1,792.5	533.8	15.4
Portugal	652	351.9	109.2	23.7
Romania	465	603.8	185.4	6.3
Slovenia	121	58.8	19.7	27
Slovakia	9	37.9	10.7	10.7
Finland	601	1,957.9	472.2	52.4
Sweden	1,359	730.8	267.7	46.4
United Kingdom	1,548	4,076.1	1,606.8	49.1

All data referred to 2006 with the exceptions of Bulgaria (2005, except Apparent labour productivity for 2003), Estonia (2005 for Turnover, value added and apparent labour productivity), Netherlands (2005), Poland (2005), Romania (2005), Slovakia (2004), Ireland (2005 for Value added and apparent labour productivity) and Malta (2002)

Source: Eurostat, Structural Business Statistics (SBS)

Graph 8. Main contributing Member States to EU-27 added value in the building and repairing of ships and boats sector, 2006 (%)

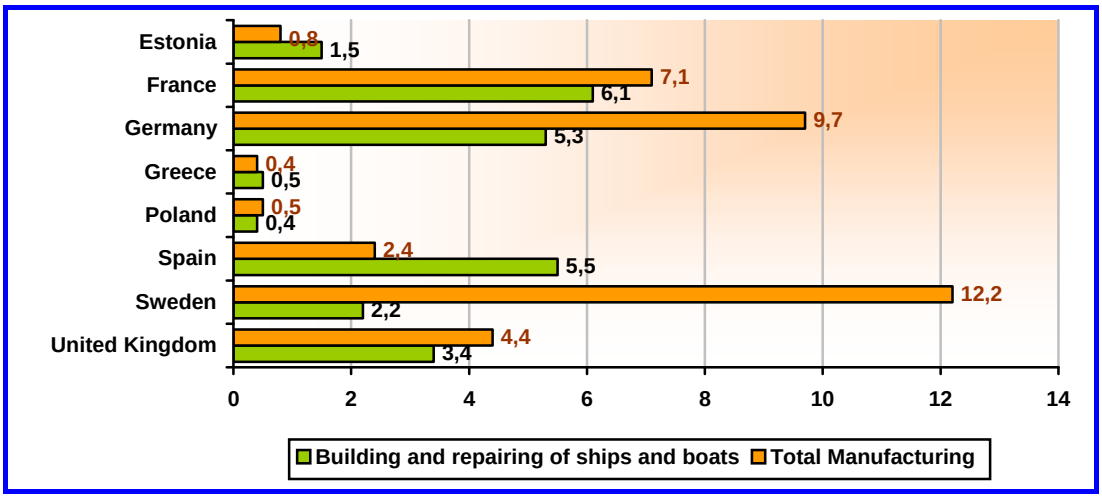


Source: Eurostat, Structural Business Statistics (SBS)

Spain, Italy, Germany and Poland were the leading exporters (intra- and extra-EU combined) of ships and boats in 2006, each with over 10 % or more of all exports made by EU-27 Member States. Italy and Poland recorded the largest trade surplus and Greece the largest trade deficit.

Finally and as far as R&D activities are concerned, the available data from Eurostat shows that the European building and repairing of ships and boats sector is very active in the R&D domain, so investments in R&D activities represent a range between 0.4% and 6.1% of the value added in a selection of main European Member States producers (see Graph 9)[7]. Interestingly also, most of the existing R&D expenditure (up to 95%) is carried by the shipbuilding sector, whereas the contribution of the building and repairing of boats sector is much more limited.

Graph 9. Knowledge intensity in the building and repairing of ships and boats sector and total manufacturing: Share of R&D expenditure in value added, selection of countries, 2005



All data referred to 2005, with the exception of Germany and United Kingdom (both countries data for 2004)
Source: Eurostat, Structural Business Statistics (SBS)

3.2. GENERAL OVERVIEW OF THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR BY CONCRETE SUBSECTORS

3.2.1. Building and repairing of ships

According to the available information from Eurostat, the building and repairing of ships sector in EU-27 had in 2006 a total of 9,800 enterprises that generated a turnover of EUR 30,758 million and an added value of EUR 8,542 million[8]. In any case, and according to CESA sources, approximately 280 shipyards constitute the core of the industry, whereas the remaining companies represent its large network of suppliers.

The largest European shipbuilding Member State in terms of turnover is Germany (EUR 6,055.2 million), followed by France, Italy, Spain, The Netherlands and the United Kingdom

[7] No information from other relevant EU Member States producers is available in the Eurostat's Structural Business Statistics.

[8] These figures do not correspond with the figures provided by CESA. Thus, and according to CESA estimates, the European turnover reached in 2005 a total of EUR 9,041 million, whereas in 2006 this figure was of EUR 12,968 million. This important difference with the Eurostat's figures is probably explained by the fact that Eurostat also includes enterprises involved in the marine equipment sector.

(4,635.2, 4,241.1, 3,254.1, 3,035.3 and 2,840.5 million EUR, respectively). Other countries with a significant presence of shipbuilding activities include Poland and Finland (1,650.9 and 1,548,9 million EUR, also respectively). All in all, these six leading countries account for a 88.6% of the total EU-27 shipbuilding turnover (see Table 12).

Table 12. Main economic indicators of the building and repairing of ships sector, 2006

	Number of enterprises	Turnover (Million EUR)	Value added at factor cost (million EUR)	Apparent labour productivity (Gross value added per working person, thousand Euros)
Belgium	128	254.9	77.1	52.2
Bulgaria	262	128.2	44.8	7.0
Czech Republic	66	30.6	17.3	28.9
Denmark	66	816.9	214.9	63.1
Germany	233	6,055.2	1,327.4	63.8
Estonia	75	124.6	24.8	12.2
Ireland	11	23.6	11.5	51.2
Greece	615	539.8	270.0	38.6
Spain	1,735	3,254.1	833.8	35.3
France	750	4,635.2	1,359.6	58.2
Italy	1,517	4,241.1	1,248.3	50.2
Cyprus	7	3.0	1.8	34.0
Latvia	98	88.3	26.1	10.8
Lithuania	97	145.7	59.6	12.3
Luxembourg	0	0.0	0.0	0.0
Hungary	59	7.5	1.6	8.9
Malta	15	61.0	37.1	10.3
Netherlands	560	3,035.3	604.0	79.9
Austria	6	15.4	6.0	54.5
Poland	1,732	1,650.9	488.6	15.9
Portugal	218	295.7	94.2	27.2
Romania	421	599.3	184.1	6.3
Slovenia	26	4.8	1.4	13.6
Slovakia	9	39.9	10.0	9.8
Finland	148	1,548.9	333.9	54.3
Sweden	265	317.1	130.2	51.0
United Kingdom	680	2,840.5	1,133.9	51.5

All data referred to 2006 with the exceptions of Bulgaria (2005), Denmark (2003 for turnover, value added and apparent labour productivity), Ireland, (2005 for turnover, value added and apparent labour productivity), Malta (2002), Netherlands (2005), Poland (2005) and Romania (2005)
Source: Eurostat, Structural Business Statistics (SBS)

Meanwhile, the largest EU-27 producing countries with the highest apparent labour productivity rates correspond to The Netherlands, followed by Germany and France (79.9, 63.8 and 58.2 thousand EUR per worker, respectively). Finland, The United Kingdom and Italy also have important labour productivity rates (54.3, 51.5 and 50.2 thousand EUR per worker, also respectively), whereas the figures for Spain and Poland are less important (35.3 and 15.9 thousand EUR, respectively).

From an historical perspective, the European sector as a whole has experienced significant transformations since the late seventies early eighties onwards, basically linked with technological advancements and increased global competition coming from aggressive low-price strategies of Asian yards, specially in South Korea and recently China.

Just to give some data, the European industry's overall market share in completed tonnage has fallen to 10.4%% in 2006 from 16.9% in 2002 and 18.7% in 2001 (see Graph 3), basically at the expense of the share of the East Asian shipbuilders. This situation has had a particularly clear negative impact on the sector employment, where this issue will be analysed with more detail in next chapter. In addition to this, some countries have been forced to redefine their involvement in shipbuilding in general (i.e. Sweden or some of the

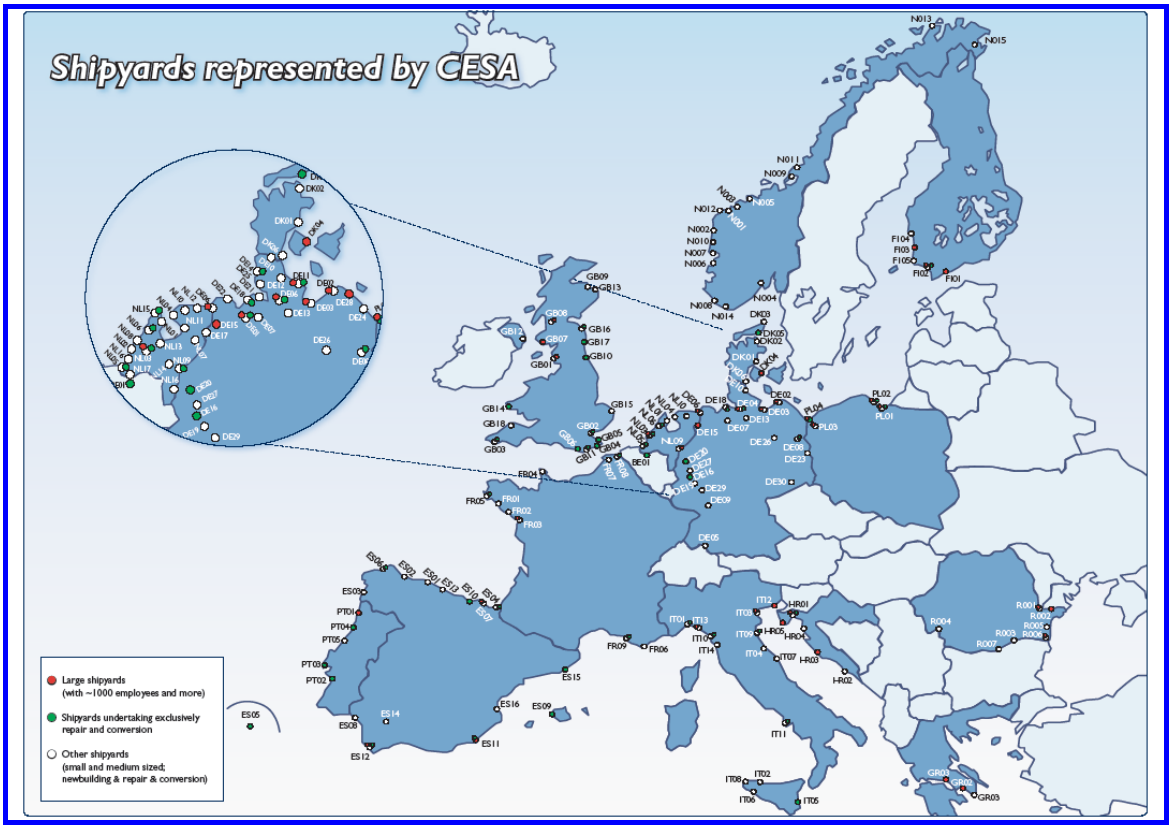
former Soviet countries). Thus, and just to give the example of Latvia, this current Member State was traditionally focused on naval construction and repair under COMECON, and has had to shift its shipyard activity towards merchant vessels and repairing activities (ECOTEC, 2006).

In any case, and since 2003 onwards, the sector is experiencing a period of favourable market conditions with substantial increases in orders and outputs. Thus, and according to CESA's estimations for their associates, the European yards' turnover in 2007 reached a new record high. The three consecutive yearly increases of new orders in European shipyards have substantiated production increase in 2007 and increased the turnover by 1.7 times more in comparison to 2005 (CESA, 2008).

Currently, European shipyards are particularly specialised in the production of highly sophisticated and complex ships with the highest added value, with a particular focus on investments to further increase efficiency in pursuit of top productivity (for an overview of the European current product specialisation see section 3.4 of this report).

To finalise this section, it is possible to provide a very brief overview of the presence of shipyards from a regional perspective (see Graph 10). In this sense, some of these yards are located in structurally lagging regions (e.g. Galicia in Spain, the North-East region in the United Kingdom, Sicily in Italy, etc), so for these regions shipbuilding activities are key sectors in terms of generation of economic and employment opportunities, especially in view of the lack of alternative options.

Graph 10. Geographical distribution of shipyards associated to CESA in Europe



Source: CESA

3.2.2. Building and repairing of pleasure and sporting boats

The building and repairing of pleasure and sporting boats sector in EU-27 had in 2006 a total of 10,600 enterprises that generated in 2005 a turnover of 10,053 million EUR and an added value of 3,095 million EUR. This sector represents a 27% of the total added value generated by the whole NACE 35.1 sector (information obtained from Eurostat).

Generally speaking, the sector has experienced a remarkable growth in the past years, basically linked with several factors such as a good economic environment, an increasing leisure-related culture amongst Europeans or, finally, an increasing ageing process of the European population, with a very significant share of population in their forties/fifties. All these elements have helped to foster the demand of this type of boats.

The EU-27 total turnover of the sector is generated by five countries, that is to say and in this order, Italy, France, United Kingdom, Germany and The Netherlands (2,767.1, 1,989.6, 1,235.6, 1,174.6 and 906.8 million EUR, respectively). These five countries, account for a 79-80% of the total EU-27 turnover and added value (see Table 13). As it can be seen, Italy is the largest European boat builder, heavily influenced by its world leading position in the production of yachts (specially super yachts -high value yachts over 24m-), whereas France is particularly specialised in the production of sailboats. Meanwhile, the UK is the largest European producer of inboard/stern drive motor boats over 12m. Germany, France and Italy are the main competitors in the building of sail and power craft less than 24 metres. Production of exclusive super yachts (boats over 24 metres in length) in The Netherlands, Italy and Germany makes a very significant contribution to the European recreational boating industry (ECOTEC, 2006). In any case, it is possible to identify a marked market trend towards the production of bigger and more technically advanced craft.

Table 13. Main economic indicators of the building and repairing of pleasure and sporting boats sector, 2006

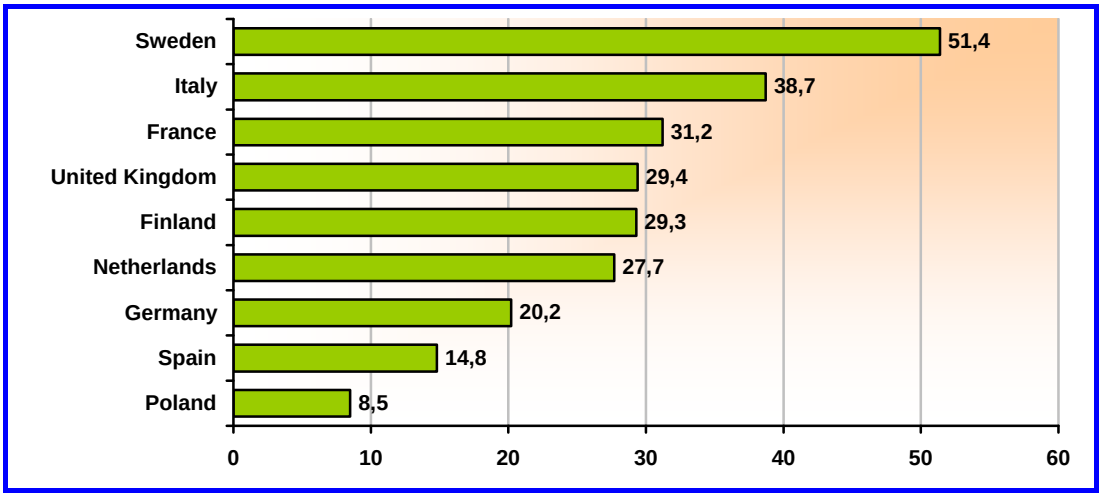
	Number of enterprises	Turnover (Million EUR)	Value added at factor cost (million EUR)	Apparent labour productivity (Gross value added per working person, thousand Euros)
Belgium	49	34.1	9.6	38.2
Bulgaria	12	0.8	0.2	-
Czech Republic	19	1.5	0.5	10.1
Denmark	203	195.0	71.0	41.1
Germany	417	1,174.6	335.2	63.1
Estonia	35	13.1	4.4	15.3
Ireland	12	6.5	1.6	23.1
Greece	266	61.2	35.0	38.2
Spain	499	518.0	145.1	33.7
France	1,882	1,989.6	616.2	46.8
Italy	2,593	2,767.1	788.2	43.5
Cyprus	32	5.7	2.3	25.3
Latvia	26	3.8	1.7	9.0
Lithuania	10	12.5	5.1	21.1
Luxembourg	0	0.0	0.0	-
Hungary	93	8.2	2.4	7.8
Malta	50	3.5	0.8	10.4
Netherlands	1,020	906.8	231.0	37.4
Austria	49	36.3	15.9	54.4
Poland	392	141.7	45.2	11.3
Portugal	434	56.2	14.9	13.0
Romania	44	4.5	1.3	3.7
Slovenia	95	54.0	18.2	29.2
Slovakia	0	0.0	0.0	-
Finland	453	409.0	138.4	48.4
Sweden	1,094	413.7	137.5	42.8
United Kingdom	868	1,235.6	472.8	44.1

All data referred to 2006 with the exceptions of Bulgaria (2005), Denmark (2003 for turnover, value added and apparent labour productivity), Ireland, (2005 for turnover, value added and apparent labour productivity), Malta (2002), Netherlands (2005), Poland (2005) and Romania (2005)
Source: Eurostat, Structural Business Statistics (SBS)

Meanwhile, the EU-27 countries with the highest apparent labour productivity rates correspond to Germany, Finland and France (63.1, 48.4 and 46.8 thousand EUR per worker, respectively), followed by United Kingdom and Italy (44.1 and 43.5 thousand EUR per worker, also respectively).

Focusing on the most important EU-27 producers, the available data shows that countries such as France, Italy and specially Sweden are specialised in the production of pleasure and sporting boats, as more than 30% of the added value of the total NACE 35.1 is generated by this sector (see Graph 11). Other countries with a significant presence of the recreational boat sector correspond to The United Kingdom, Finland and The Netherlands.

Graph 11. Market specialisation of a selection of countries (% of the added value generated by the building and repairing of pleasure and sporting boats sector in comparison to the whole building and repairing of ships and boats sector, 2006



Source: Eurostat, Structural Business Statistics (SBS)

It is interesting to notice the relatively importance of the pleasure and sporting boats sector in the Scandinavian countries (Sweden, Finland, etc). This situation is explained by the existing tradition in these countries, so boat ownership per head is almost ten times higher in the Scandinavian countries than in other countries. Similarly, the boat parks in these countries are around a third of the total, which is significant given that the residents of these countries only account for around 4% of the total population in Europe (info taken from ECOTEC, 2006).

Finally, and despite the existence of a large presence of very small enterprises serving domestic markets, the sector as a whole has invested significant efforts in developing the export market. In this respect, available data for 2004 shows that the most important EU producers (i.e. Italy, Germany, The Netherlands, the United Kingdom and France) have the largest trade surpluses in the boating industry, which underlines their competitive position. By way of contrast, Spain, Malta and Greece are the largest importer of recreational boats, suggesting their role as tourist destinations rather than manufacturers (see Table 14).

Table 14. Value of exports and imports, 2004 (thousand EUR)

	Imports	Exports	Balance of trade
Austria	34,505	27,625	-6,880
Belgium	50,595	34,267	-16,328
Cyprus	3,783	2,520	-1,263
Czech Republic	1,096	344	-752
Denmark	30,262	73,839	43,577
Estonia	5,807	6,667	860
Finland	28,245	63,520	35,275
France	395,700	550,000	154,300
Germany	97,404	744,853	647,449
Greece	53,859	3,738	-50,121
Hungary	823	668	-155
Ireland	5,526	1,992	-3,534
Italy	304,000	983,000	679,000
Latvia	1,081	288	-793
Lithuania	1,364	517	-847
Luxembourg	585	0	-585
Malta	67,923	9,445	-58,478
Netherlands	113,703	384,674	270,971
Poland	1,609	n.a.	n.a.
Portugal	16,790	580	-16,210
Slovakia	2,149	40	-2,109
Slovenia	36,261	59,493	23,232
Spain	887,356	603,526	-283,830
Sweden	92,898	137,314	44,416
United Kingdom	291,114	559,034	267,920

n.a: non-available
Source: ECOTEC, 2006 (info obtained from ICOMIA)

3.2.3. Some notes on the repairing sector

From an economic perspective, the European ship and boat repairing sector has got an estimated production value of EUR 5,266 thousand million, where this figure represents approximately a 14% of the total production value of the European building and repairing of ships and boats sector (data obtained from Eurostat PRODCOM)[9]. Approximately, a 20% of the repairing activity corresponds to the pleasure and sporting boats sector, whereas the remaining 80% corresponds to repairing and maintenance activities in ships.

From a national perspective, it is possible to see important differences in the percentage that maintenance and repairing activities represent in the different EU countries (see Table 15). Thus, and focusing on the ships sector, in countries such as Latvia, Estonia, Bulgaria, Portugal or Lithuania, ship repair/maintenance activities account for more than 50% of the national production value (in Latvia this percentage goes up to 84.1%). In the main EU-27 shipbuilding Member States (Germany, France, Italy, United Kingdom and Spain), the repairing/maintenance activities account for percentages ranging between 3.6% in France to 16.4% in Spain, where in Germany, Italy and the United Kingdom it accounts for a 9.9%, 12.5% and 13.3%, respectively). In any case, Poland, Italy, Spain, Germany, The Netherlands and the UK are, in this order, the main repairing countries in total production figures.

[9] This figure is significantly higher than the figure provided by CESA, and estimated in EUR 3,014 thousand. This difference in figures might be explained by the absence of the recreational boat sector and non-affiliated enterprises in CESA.

Table 15. Percentage that represents maintenance and repairing of ships and pleasure boats in comparison to the total subsector production value, selected EU countries, 2005

	NACE 35.11	NACE 35.12
Bulgaria	58.8	45.1
Germany	9.9	---
Estonia	61.2	2.4
Ireland	42.9	56.5
Greece	30.4	---
Spain	16.4	47.6
France	3.6	10.5
Italy	12.5	13.7
Latvia	84.1	0.0
Lithuania	51.5	0.1
Netherlands	15.1	5.9
Poland	34.8	---
Portugal	58.3	1.8
Finland	7.8	4.0
United Kingdom	13.3	6.9

NACE 35.11: Repairing of ships; boats and floating structures (excluding yachts; other pleasure or sports vessels; rowing boats and canoes)
NACE 35.12: Maintenance; repair; reconstruction; fitting out services of pleasure and sporting boats
Source: Eurostat, Structural Business Statistics (SBS) and PRODCOM.

Meanwhile, and in the case of the pleasure boat sector (see also Table 15), the countries with the highest importance of repairing/maintenance activities within their national sectors include Ireland, Spain and Bulgaria (56.5%, 47.6% and 45.1%, respectively). Concerning the main EU manufacturing countries (i.e. Italy, France, United Kingdom, Germany and The Netherlands), these percentages range between 13.7% in the Italian case to 5.9% in the Dutch case). Italy, France and Spain are the largest EU-27 boat repairing Member States in total production figures[10].

Table 16. Brief description of the ship repairing sector

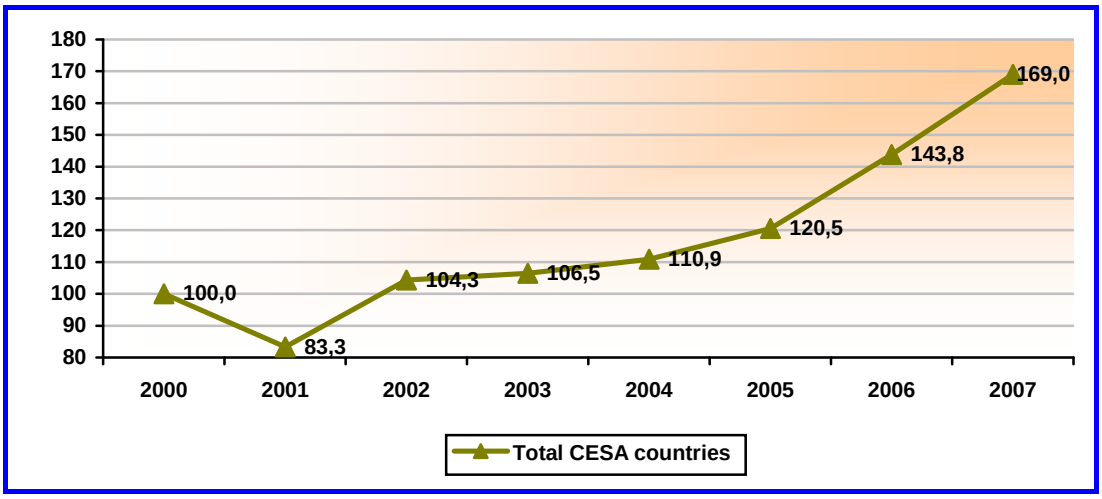
- The ship and boat repairing activity can be defined as a service industry and not a manufacturing sector, and it is characterised as a short-term activity, in the sense that cycles in this industry are shorter and more frequent than in the shipbuilding sector, with irregular workloads that render very difficult to plan activities and result in added time pressures for repairers, although in some market niches (i.e. luxury ship, ferry boats and fishing vessels) seasonal fluctuations of demand are relatively important.
- It is also the case that some shipyards combine new production with repairing/maintenance activities in order to compensate for fluctuations in demand for new constructions by offering repair and maintenance services, although there are some shipyards specialised in these repairing/maintenance activities (according to figures coming from CESA affiliates, approximately a 23% of the CESA shipyards undertake exclusively repair and conversion activities). Interestingly also, repair and maintenance companies usually operate in much more localised markets than shipbuilding companies, which reinforces the cyclical nature of the ship repair industry. It is important to stress that the 'after sales' market is an increasingly important aspect of both ship and boat building.
- The irregular workloads that characterise ship repairing activities require that most yards need to extensively draw on sub-contractors and on temporary labour to give them the flexibility required in what is essentially a short term business. In any case, these shipyards keep some key activities 'in-house' such as the revision of hulls or propellers.
- One of the main concerns in the sector is how to obtain the skilled labour required to perform the work available and, facing the future, how to secure these skills (mostly linked with 'blue collar' activities). Furthermore, yards not only need to ensure the services of skilled trades, but also have to consider the recruitment and retention of the technical and management skills required by all successful businesses. Thus, it is a global market for skills in two senses – firstly, yards are drawing in labour from around the world (multi-national sourcing of skills); and secondly, yards do not simply compete with each other, but with other industry sectors. In order to maintain the required level of technical expertise for both the home and the export market, industry faces increasing pressures for responding to these challenges

Source: CESA, 2008 and Müller, 2007

[10] Data for Germany are not available.

From a time evolution perspective, and according to the information provided by CESA, the repairing activity has experienced an upward trend since 2002 onwards, although during 2003 and 2004, the level of repair activity was lower than normal due to low levels of activity in the offshore oil and gas sector and high freight rates on offer, so many owners were cutting down as far as possible on the work to be done by the repairing/maintenance yards in the interests of getting their ships running. By way of contrast, 2005, 2006 and specially 2007 have experienced an especially positive evolution in the repair/maintenance activities (see Graph 12), due to the current intense use of ships. By way of contrast, prices remain at the lowest levels because of fierce international competition (CESA, 2007).

Graph 12. Evolution of the turnover of maintenance, repair and conversion activities, 2000-2007 (index year for year 2000=100)

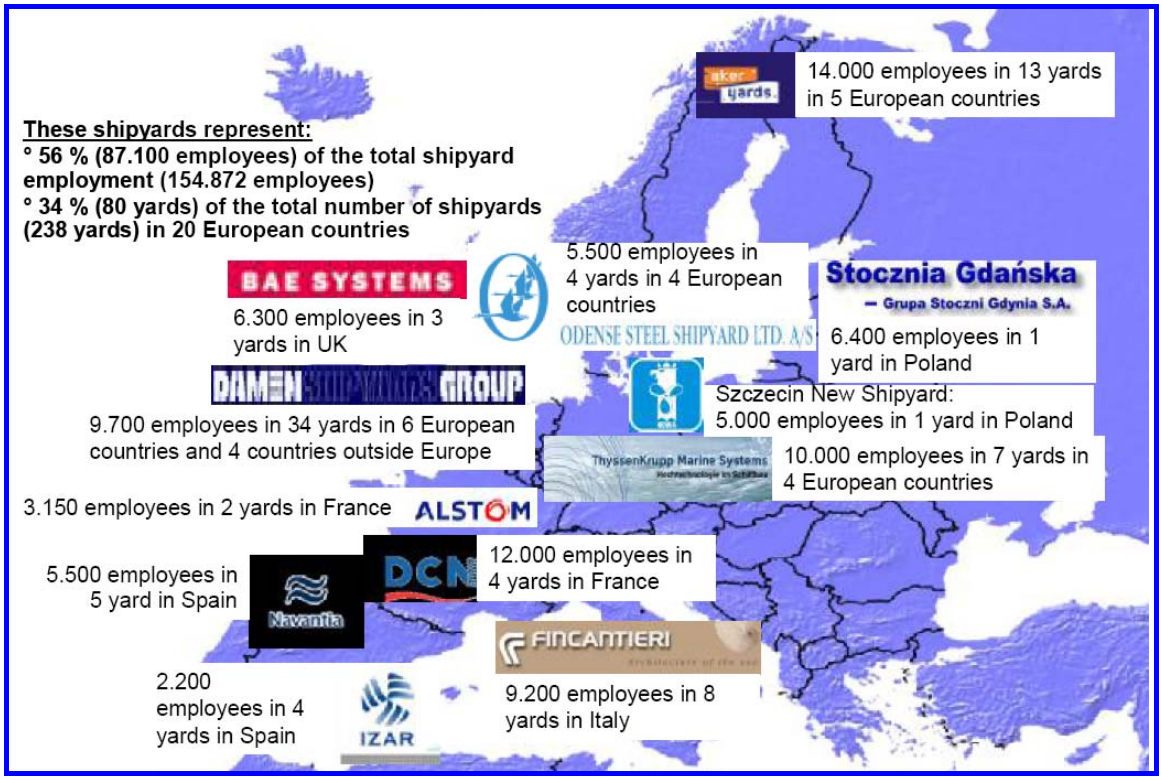


Source: CESA

3.3. MAIN GROUPS AND ENTERPRISES

The available information for the building and repairing of ships sector shows that large shipyard groups dominate the European sector. Thus, 34% of the CESA associated shipyards are shipyard groups, where they represent up to 56% of the total direct shipyard employment (Tholen & Ludwig, 2006), (see Graph 13). This result is explained by a strong process of economic concentration experienced during the last twenty years by the European shipbuilding industry, basically through different mergers and takeovers, as well as the closure of many companies.

Graph 13. Major European Shipyards Groups in Europe in 2004



Source: Tholen & Ludwig, 2006

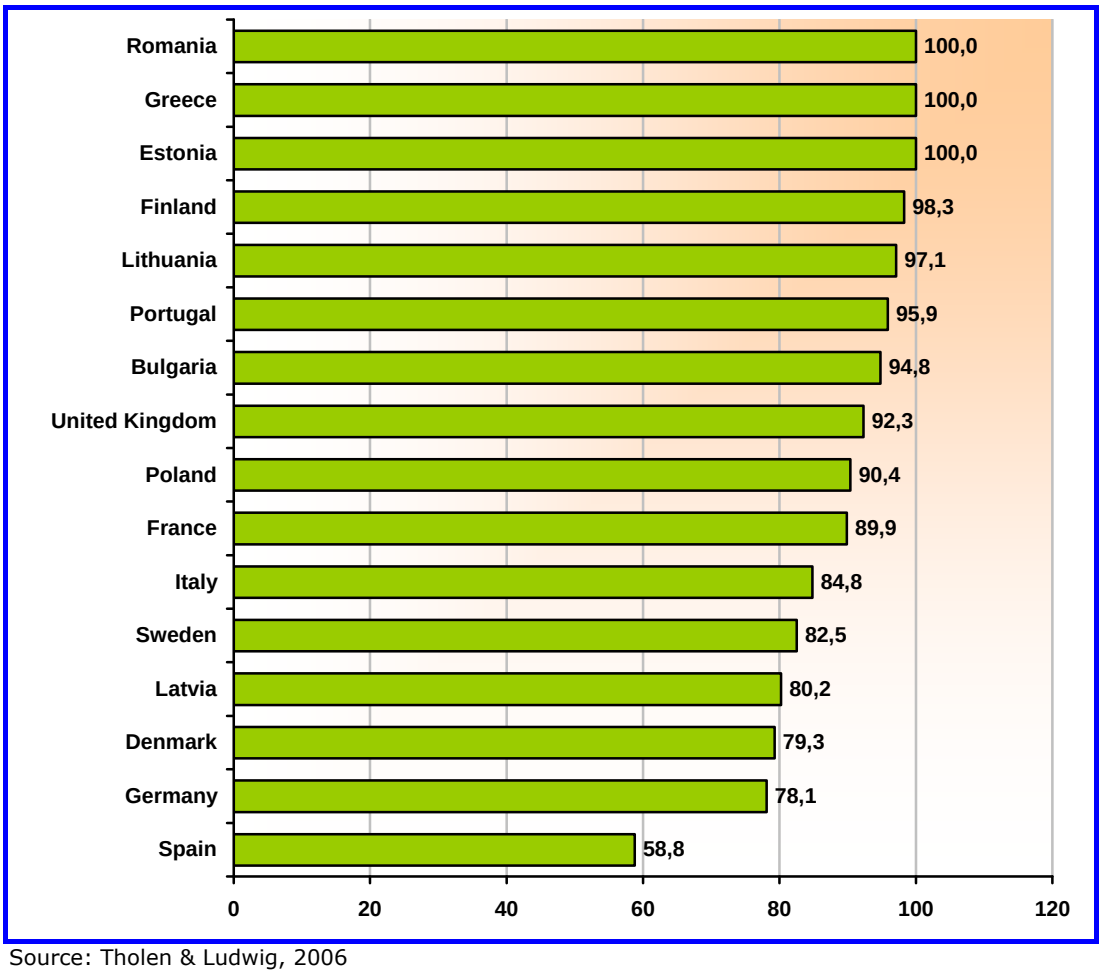
Aker Yards (with nearly 14,000 employees in 13 yards in 5 European countries) is the biggest European shipyard-group, followed by Thyssen Krupp Marine Systems (10,000 employees in 7 yards of 4 European countries), DCN (12,000 employees located in 4 French yards), the Damen Shipyards Group (9,700 employees in 34 yards in 6 European countries and 4 countries outside Europe) and Fincantieri (9,200 employees in 8 yards in Italy). In any case, only four groups (Thyssen Krupp Marine Systems, Aker Yards, Odense Steel Shipyard Group[11] and Damen Shipyards Group) can be named as European shipyardgroups because they have facilities in more than one European country.

These major European shipyard-groups play a crucial role in some of the European shipbuilding countries. Thus, a 82% of the Finish shipyard workforce is employed by three yards of Aker Finnyards, Fincantieri provides 76% of the Italian employment and 50% of the Spanish employment is provided by the Navantia group. Meanwhile, BAE Systems represents a 39% of the UK shipyards' employment and Thyssen Krupp Marine Systems employs approximately one third of the German shipyard workforce. In some countries such as Romania, up to 82% of the shipyard workers are employed by foreign shipyard-groups, basically Aker yards, Daewoo and Damen (Tholen & Ludwig, 2006).

On the other hand, it is worth stressing that the European building and repairing of ships sector is dominated by large-scale shipyards. Thus, and according to CESA sources (Tholen & Ludwig, 2006), this dominance is particularly relevant in some countries such as Romania, Greece, Estonia, Finland or Lithuania, where more than 96% of the shipyards' direct employment is employed in yards with more than 500 employees (see Graph 14). A detailed list of the largest shipyards in a selection of EU countries can be found next (see Table 17).

[11] The group is a member of the A.P. Moller - Maersk Group.

Graph 14. Share of shipyards with more than 500 employees in total employment, by some EU Member States



Source: Tholen & Ludwig, 2006

Table 17. Largest shipyards in selected EU countries

Countries	Main largest shipyards
Germany	• Aker Warnemünde Operations GmbH • Aker MTW Werft GmbH • Blohm + Voss GmbH • J.J. Sietas KG Schiffswerft GmbH & Co. • Nordseewerke GmbH • Howaldtswerke-Deutsche Werft GmbH • HDW-Gaarden GmbH • Meyer Werft GmbH • Volkswerft Stralsund GmbH
Denmark	• Odense Steel Shipyard Ltd.
Spain	• Astillero La Naval (Construcciones Navales del Norte, S.A.) • NAVANTIA S.A. Astillero Fene-Ferrol • NAVANTIA S.A. Astillero Cartagena • NAVANTIA S.A. Astillero San Fernando-Puerto Real
Finland	• Aker Finnyards • Aker Finnyards • Aker Finnyards
France	• Aker Yards France
Greece	• Elefsis Shipyards • Hellenic Shipyards Co.
United Kingdom	• A & P Birkenhead Ltd • BAE - Barrow in Furness • BAE Systems - Yarrow Yard

Countries	Main largest shipyards
Italy	• Fincantieri Cantiere di Marghera • Fincantieri Cantiere di Monfalcone • Fincantieri Cantiere di Riva Trigoso
The Netherlands	• IHC Holland Dredgers B.V. • Schelde Marinebouw B.V.
Poland	• Gdańska Stocznia Remontowa S.A. • Stocznia Gdansk S.A. • Stocznia Północna S.A. • Stocznia Gdynia S.A. • Stocznia Szczecińska Nowa Sp. z o.o. • Szczecińska Stocznia Remontowa Gryfia S.A.
Portugal	• Estaleiros Navais de Viana do Castelo S.A.
Romania	• S.C. Aker Shipyards Braila S.A. • S.C. Damen Shipyards Galati S.A. • S.C. Aker Shipyards Tulcea S.A.

Source: CESA

By way of contrast, geographically concentrated small and medium-sized enterprises tend to play a more important role in the ship repair industry. A detailed list of the shipyards associated to CESA and undertaking exclusively repair and conversion activities can be found in Table 18.

Table 18. Shipyards associated to CESA and undertaking exclusively repair and conversion activities, selected EU countries

Countries	Main largest shipyards
Belgium	• Antwerp Shiprepair N.V.
Germany	• CON-MAR Ingenieurtechnik GmbH & Co. • Handels KG • Elsflether Werft GmbH & Co. KG • Julius Grube KG GmbH & Co • Schiffswerft M. A. Flint GmbH • Schiffswerft von Cölln GmbH & Co. • Blohm + Voss Repair GmbH • Deutsche Industriewerke GmbH • Husumer Dock- und Reparatur GmbH & Co. KG • Kölner Schiffswerft Deutz GmbH & Co. KG • MWB Motorenwerke Bremerhaven AG • Meidericher Schiffswerft GmbH & Co. KG • Turbo-Technik Reparatur-Werft GmbH & Co
Denmark	• Orskov Yard Ltd.
Spain	• Diques Navales Pasaia • Astilleros Canarios (ASTICAN) • NAVANTIA Ferrol S.A. Reparaciones Fene-Ferrol • Astilleros de Mallorca • Astilleros de Santander • NAVANTIA S.A. Reparaciones Cartagena • NAVANTIA S.A. Reparaciones Cádiz-San Fernando • Unión Naval de Barcelona
Finland	• Turku Repair Yard Ltd
France	• SOBRENA • ARNO Dunkerque • Unión Naval Marseille S.A.S.
United Kingdom	• A&P Shipcare - Chatham • A&P Shipcare - Tilbury • A&P Falmouth Limited • A&P Shipcare - Dover • A&P Shipcare - Ramsgate • A&P Southampton Ltd • Dunston (Ship Repairers) Ltd • Fleet Support Limited • Milford Haven Ship Repairers • A&P Tyne Limited • A&P Teeside

Countries	Main largest shipyards
Italy	• Navalimpianti S.p.A. • T. Mariotti Cantiere Navale • Cantiere Navale E. NOE • Naviravenna • Cantiere San Marco S.r.l • Cantiere del Mediterraneo SPA • Palumbo S.r.l.
The Netherlands	• Werf Alblasserdam B.V. • Scheepswerf & Machinefabriek 't Ambacht B.V. • Breko Reparatie B.V. • Damen Shiprepair Van Brink Yard • Scheepswerf Hoogerwaard B.V. • Serdijn Ship Repair B.V. • Keppel Verolme B.V. • Damen Shiprepair Niehuis Yard • Damen Shiprepair Rotterdam United Yard • Nicoverken Holland B.V. • Scheldepoort B.V. Repair & Conversion Yard • Amsterdam Ship Repair B.V. • Oranjewerf Scheepsreparatie B.V. • Scheepswerf Gelria B.V. • Marinebedrijf Divisie Platform
Poland	• StoczniaWisła Sp.zo.o • Stocznia Remontowa Nauta S.A. • Morska Stocznia Remontowa S.A.
Portugal	• LISNAVE, Estaleiros Navais, SA • Naval Rocha • Navalria - Docas; Construções e Reparações Navais, SA

Source: CESA

Meanwhile, and as far as the pleasure and sporting boats subsector is concerned, the available information (see Francesetti, 2006) suggests that the current boat yard sector is mainly composed by a mass of small/medium-sized yards (the average European yard size is of 20 employees), often linked to family businesses and located in seaside areas or rivers/lakes, where they either manufacture boats independently or as subcontractors for the larger yards. Of course, this relatively higher presence of small and medium sized-enterprises reflects a lower bargaining power of enterprises vis-à-vis subcontractors. Meanwhile, there is a limited number of large companies, engaged in high quality medium series production or very specialised products (i.e. superyachts, sports, boats over 20m in length), produced on a customised base. These larger yards, often operating in the international market, have a trend to absorb the smaller yards in a process of concentration and increasing yard size and sustained by the constant expansion of the market (continuously growing demand). Interestingly also, it is possible to identify an increasing presence of US manufacturers in European yards (especially in Poland), where they subcontract the production under US trade mark (basically in order to save transport costs and have better access to the EU-27 market). Finally, some yards are also involved in repair/maintenance and refit activities, very often in combination with production activities. Usually, yards specialised in the manufacturing of new boats are larger than those specialised in repairing/refit activities.

Main European enterprises in the recreational boat market include the French Groupe Beneteau, the Italian Ferreti Group and the Azimut-Benetti Group. European leaders are growing aggressively in the last years. All these groups have engaged in acquisitions and mergers over the past few years, consolidating their market position (see Francesetti, 2006). The world leaders are the US Brunswick Boat Group, Luhrs/Hunter and Genmar, who are firmly placed in Europe.

3.4. PRODUCT SPECIALISATION

Focusing the attention on the building and repairing of ships sector (NACE Rev 1 35.11), it is possible to argue that the European industry is particularly specialised in the production and repair of specialised, complex and high tech vessels, both surface and submarine. As a consequence, EU shipyards are increasingly abandoning several low cost market segments such as bulk carriers and tankers (being taken over by the Asian yards, especially Korean and Chinese ones) and focusing on some high-value vessel types (such as cruise and passenger vessels), very specialised non-cargo ships. For example, almost all cruise ships are developed and built in four European shipyards in Italy, France, Germany and Finland (ECOTEC, 2006).

In this respect, the comparison between the European (CESA) and the world total order book (see Table 19) in 2005 and 2006 shows the European (CESA) shipyards are particularly specialised in the production of container vessels, passenger vessels and other non-cargo vessels (26.0%, 25.4% and 13.8% of the total European order book in CGT in 2006, respectively), followed by products & chemical carriers and ferries (8.3% and 7.7%, also respectively). Comparing to the total world figures, European shipyards seem to be particularly specialised in the production of passenger vessels (25.4% of the European order book in comparison to the world 3.4%), other non-cargo ships (13.8% versus 5.3%, respectively) and ferries (7.7% versus 1.3%, also respectively). By way of contrast, and as already mentioned, some segments seem to have been abandoned by the European manufacturers such as the crude oil tankers or the bulk carriers, which represent less than 0.7% of the total European order book in comparison to approximately the 14% for the world sector.

Table 19. Total Order book on 31.12.2005, 31.12.2006 and 31.12.2007 (in % of CGT)

Vessel Types	Europe (CESA countries)			World	
	2005	2006	2007	2005	2006
Container Vessels	32.3%	26.0%	21.5%	29.3%	24.1%
Passenger Vessels	23.5%	25.4%	27.4%	3.6%	3.4%
Other non-cargo vessels	7.0%	13.8%	17.2%	3.5%	5.3%
Products & Chemical Carriers	9.6%	8.3%	6.2%	15.3%	17.0%
Ferries	7.0%	7.7%	8.0%	1.5%	1.3%
General Cargo Vessels	5.5%	5.7%	6.3%	3.9%	4.4%
Other Dry Cargo Vessels	5.7%	5.5%	0.3%	0.3%	0.2%
Ro-Ro Vessels	4.1%	3.1%	7.6%	0.9%	4.5%
LPG Carriers	1.7%	1.9%	1.4%	2.6%	3.0%
Fishing Vessels	1.2%	0.8%	1.0%	4.6%	0.3%
LNG Carriers	1.1%	0.8%	0.1%	9.9%	8.8%
Crude Oil Tankers	0.7%	0.7%	0.3%	9.6%	13.8%
Bulk Carriers	0.2%	0.2%	2.6%	14.7%	14.0%
Reefers	0.0%	0.0%	0.0%	0.2%	0.1%

Source: CESA

Not surprisingly, the European shipbuilding industry is the global leader in the construction of complex/high technology vessels such as cruise ships, ferries and specialised non-cargo vessels (dredgers, off-shore supply vessels in oil-extracting activities, naval vessels[12], etc). This market for complex ships is characterised by limited demand in numbers of ships, the building of prototypes with very few sister ships, a tailored and knowledge-based production process, a considerable technical expenditure, and a high number of specialised subcontractors (European Commission, 2003b).

From a country perspective (see Table 20), it is possible to identify different product specialisations in the different EU countries. Thus, and whereas countries such as Finland, France and Italy are specialised in the production of Passenger vessels (with a share of

[12] Naval vessels are produced in Germany, Spain, France, Italy and The Netherlands.

more than 65% of the order book for 2006), countries such as Denmark, Germany[13], Poland or Romania are particularly specialised in the production of Full Container vessels[14]. Meanwhile, Spain and specially the United Kingdom are particularly specialised in the production of other non-cargo vessels, as well as The Netherlands (with a strong presence of general cargo ships and full container vessels also in this country). This situation implies that some European countries (i.e. Denmark, Germany, Poland or to some extent Romania, The Netherlands and Spain) are particularly subject to a strong competition from third countries in some of their specialised products such as container vessels and products/chemical carriers.

Table 20. Total Order book by country and shiptype, 2006 (in thousand CGT)

Vessel Types	FIN	F	D	DK	I	NL	POL	RO	E	UK
Crude Oil Tankers (double hull)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.7%	0.0%	0.0%
Product and Chemical Tankers	0.0%	0.0%	2.5%	0.0%	3.5%	11.2%	1.5%	22.6%	15.0%	11.6%
Bulk Carriers (exs. Comb. Carriers	0.0%	0.0%	0.3%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%
Combined carriers	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	4.4%	0.0%	0.0%	0.0%
General cargo ships	0.0%	0.0%	2.3%	0.0%	0.0%	31.3%	1.9%	18.3%	19.2%	0.0%
Reefers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Full Container vessels	1.9%	0.0%	52.1%	97.3%	0.0%	19.8%	47.4%	28.8%	8.3%	0.0%
Ro-Ro vessels	0.0%	0.0%	4.7%	0.0%	0.0%	0.0%	9.1%	0.0%	6.8%	0.0%
Car Carriers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	24.8%	0.0%	0.0%	0.0%
LPG Carriers	0.0%	0.0%	3.0%	0.0%	0.6%	0.0%	4.3%	1.6%	0.0%	0.0%
LNG Carriers	0.0%	7.0%	0.0%	0.0%	0.0%	0.7%	1.0%	0.0%	7.4%	0.0%
Ferries	28.8%	0.4%	4.7%	0.0%	20.1%	0.5%	0.7%	2.4%	7.4%	37.9%
Passenger vessels	69.4%	91.2%	28.0%	0.0%	70.5%	1.4%	0.0%	0.0%	0.0%	0.0%
Fishing vessels	0.0%	0.1%	0.0%	1.6%	0.0%	0.7%	0.0%	0.0%	2.1%	0.0%
Other Non-Cargo vessels	0.0%	1.3%	2.4%	1.1%	5.3%	32.4%	5.1%	20.5%	33.9%	50.4%
Total orderbook (in thousand (CGT)	972.9	1,037.2	4,228.7	1,082.4	2,491.6	2,064.4	1,623.2	898.1	922.5	5.9

Source: CESA

Meanwhile, and referring to the pleasure and sporting boats sector (NACE Rev 1 35.12), the available data from Eurostat shows that the EU-27 is particularly specialised in terms of production value in the manufacturing of motorboats (sea-going and non-sea going), sea-going sailboats and in maintenance/repair services activities (see Table 21)[15]. From a country perspective, and taking into account a selection of the most important EU producers shows that, in most of the selected countries (i.e. Germany, Italy, The Netherlands or the United Kingdom), the manufacturing of sea-going motorboats is the main activity in terms of production value. By way of contrast, in France and Finland the main activity refers to the production of sea-going sailboats for pleasure or sports, whereas in Spain it is the maintenance and repair services activity[16].

[13] This result is partially explained by the strong presence of German container vessels shipowners in Europe, who tend to favour the German production in this domain. Also, shipowners often choose the marine equipment to be included on-board, basically on the basis of confidence on the quality of the product or resale values.

[14] In the case of Germany, and due to the big size of its order book, passenger vessels also have a relatively high importance in the European context.

[15] Take into account that there is no data for the manufacturing of sea-going sailboats for pleasure or sports.

[16] Data has to be taken with great care as not all the information for all sectors in all countries is available due to confidentiality reasons.

Table 21. Production value of the building and repairing of pleasure and sporting boats (NACE Rev 1 35.12), by concrete products, per selected countries (2006), EUR Million

PRODCOM Code	Value EU27	Germany	Spain	France	Italy	The Netherlands	Finland	The United Kingdom
Sea-going sailboats for pleasure or sports	:C (>1,266)	:C	:C	413,59	131,58	84,82	104,44	405,05
Non sea-going sailboats, for pleasure or sports, of a length ? 7.5 m	31,59	0,00	1,17	1,12	8,86	0,00	0,00	:C
Non sea-going sailboats for pleasure or sports, > 100 kg in weight and 7.5 m in length	387,44	:C	:C	242,70	8,38	:C	4,87	:C
Inflatable vessels for pleasure or sports, of a weight ? 100 kg	57,10	:C	:C	22,21	7,37	0,00	0,00	:C
Inflatable vessels for pleasure or sports, of a weight > 100 kg	143,07	0,00	:C	49,32	78,40	0,00	0,00	13,81
Sea-going motorboats for pleasure or sports (excluding outboard motorboats)	2516,65	221,90	99,63	75,06	1074,20	332,61	73,26	607,21
Non sea-going motorboats for pleasure or sports, ? 7.5 m in length (excluding outboard motorboats)	193,47	:C	25,16	0,54	38,77	:C	29,04	:C
Non sea-going motorboats for pleasure or sports, > 7.5 m in length (excluding outboard motorboats)	632,89	:C	53,70	97,95	147,50	50,85	0,00	24,67
Rigid boats < 100 kg in weight (including outboard motorboats, rowing boats and canoes)	79,96	4,22	:C	31,00	14,85	0,00	2,62	14,56
Rigid boats > 100 kg in weight and < 7.5 m in length (including outboard motorboats, rowing boats and canoes)	272,50	:C	5,49	48,60	43,14	:C	93,06	6,10
Rigid boats > 100 kg in weight and 7.5 m in length (including outboard motorboats, rowing boats and canoes)	465,98	147,29	:C	51,80	204,18	:C	0,00	16,22
Maintenance, repair, reconstruction, fitting out services of pleasure and sporting boats	1071,66	58,05	203,15	182,58	488,76	21,36	15,19	78,77

:C Means Confidential
Source: Eurostat (PRODCOM)

3.5. SOME NOTES ON THE MARINE EQUIPMENT SECTOR

One of the key current features of the shipbuilding industry refers to the extended outsourcing and externalisation practices, with an increasing emphasis on product specialisation strategies. Thus, and whereas three decades ago most of the shipbuilding work was carried out by the shipyards, currently around 50-70% of the shipbuilding work (and of course of the added value) comes from external subcontractors, where in complex ships up to 70-80% of their value and of the relevant innovations is developed and implemented by the shipyards together with the suppliers. Not surprisingly, the equipment manufacturers evolve at almost the same rhythm as the shipyards themselves, so they are equally affected by reductions/increases in orders, as the primary market for the marine equipment sector is with vessel newbuildings (info obtained from EMEC[17] web page). It is believed that the trend towards outsourcing will continue to increase (info obtained from ECOTEC. 2006). Therefore, the competitiveness of the European building of ships and boats sector is strongly dependant on the competitiveness of the marine equipment sector.

Just to give some data, shipyards still work with a high number of suppliers and subcontractors directly (ranging between 1,000 to 2,500 names depending on company size and ship types), where this figure sharply contrasts with the automotive and

[17] EMEC stands for The European Marine Equipment Council

aerospace industries, usually working with "platform suppliers" with less than 200-500 first-tier suppliers (BALance Technology Consulting et al, 2000). In any case, there is a growing trend to integrate the number of marine equipment suppliers in order to supply 'integrated solutions' to the clients (bridges, cargo systems, waste management disposal mechanisms, etc). This is bringing with it rationalisations and trends towards mergers, takeovers and alliances (Drewry, 2002).

Meanwhile, and concerning the recreational boat manufacturing sector, it is possible to find an extensive array of manufacturers of accessories or suppliers around the larger yards, or even around the small/medium sized yards, all contributing to the production of a boat, where this situation is particularly important in the case of custom and semi-custom superyacht production (as suppliers are particularly specialised and have specialised skills and high-level expertises) (info obtained from Francesetti, 2006).

In any case, the marine equipment sector can be defined as a very heterogeneous one (see previous section in this report on the definition of the sector), which results in added difficulties for the classification and estimation of the economic importance of the marine equipment sector. In this respect, the world marine equipment market was estimated at EUR 73 billion in 2004, where Europe as a whole is a major provider of marine equipment. Thus, the European market was valued at EUR 26 billion in 2004 (a 35-36% of the world production for marine equipment), with EUR 12 billion related to the export market (a 46% of export share) (info obtained from ECOTEC, 2006). In fact, the sector is very active in the external markets (increasingly export-oriented), with an increasing physical presence of enterprises in Eastern Asian shipbuilding nations such as South Korea or China) (ECOTEC, 2006).

European equipment industries are world leaders in propulsion, cargo handling, communication, automation, environmental and security systems. Significantly, the vast majority of marine equipment and services used for cruise ships is sourced from Europe. The major shares in the EU production value refer to mechanical engineering including engines (26%), electrical engineering/electronics (18%) and steel products (15%) (BALance Technology Consulting et al, 2000). The European industry derives its competitiveness through innovative and reliable high quality products.

The leading country in the European marine equipment sector is Germany with 15% of the world market share. Other important players in the sector are the UK, Italy, The Netherlands, France and Spain, where the countries which are the biggest players in the marine equipment sector increasingly focus their attention on exports (BALance Technology Consulting et al, 2000). Some other lockland countries (i.e. Austria or Czech Republic) also have a relatively important marine equipment industry. Generally speaking, the average size of European marine equipment enterprises is relatively small, where most of existing innovations in the sector come from enterprises ranging from 50 to 200 jobs.

4. THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR FROM AN EMPLOYMENT PERSPECTIVE

4.1. GENERAL OVERVIEW OF THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR FROM AN EMPLOYMENT PERSPECTIVE

According to the estimations provided by Eurostat, the EU-27 building and repairing of ships and boats sector provided in 2006 employment to 296.0 thousand people[18]. A 29% of this employment was involved in the building and repairing of pleasure and sporting boats sector, whereas the largest share was employed in the building and repairing of ships sector. The employment in the building and repairing of ships and boats sector represented a 0.8% of the total European manufacturing employment in 2005 and 2006. Interestingly, total EU27 employment in the sector has experienced an upward trend since year 2001 (see Table 22).

Table 22. Evolution of employment in the EU-27 building and repairing of ships and boats sector, 1996-2006 (estimated values)

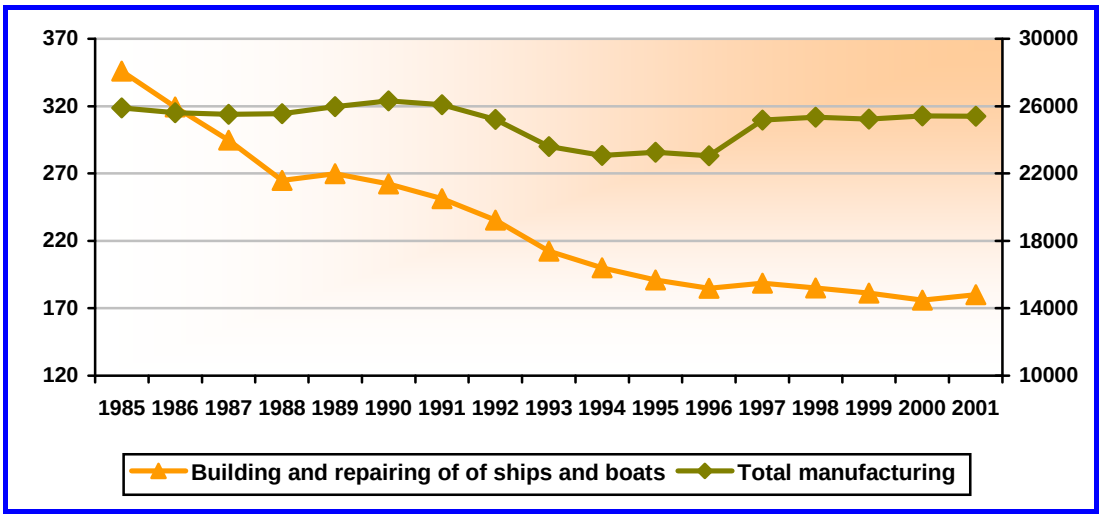
	EU15	NMS	EU27
1996	209,565	n.a.	n.a.
1997	206,261	n.a.	n.a.
1998	203,733	n.a.	n.a.
1999	203,062	n.a.	n.a.
2000	196,168	n.a.	n.a.
2001	204,007	84,113	288,120
2002	204,385	85,910	290,295
2003	211,426	81,600	293,026
2004	210,355	84,422	294,777
2005	207,768	87,030	294,798
2006	208,000	88,000	296,000

Source: Eurostat, Structural Business Statistics (SBS). Own elaboration

However, from a long time dynamic perspective, the sector employment has experienced a dramatic downward trend, well reflecting the severe crisis that has experienced the European building of ships and boats sector in the last 25 years (specially the shipbuilding activity), as well as active outsourcing and subcontracting strategies that have led to higher levels of employment amongst suppliers, so functions previously carried out by the shipyards directly are now being subcontracted to external suppliers as a means of rationalising operations and reducing costs. Thus, the available information for the time period 1985-2001 (data only referred to EU-15 and to enterprises with more than 20 employees) shows that employment in ship and boat building and repair has declined rather dramatically in this time period, especially between 1985 and 1996, so if in 1985 ship and boat building and repair still provided over 1.3% of EU-15 total manufacturing employment, this share was only of 0.7% by 2001 (with a loss of over 166 thousand jobs) (see Graph 15). By way of contrast, total manufacturing employment in the EU-15 has shows a much more stable pattern, recovering from the cyclical downturn that took place in the early- to mid-1990s.

[18] Estimated value

Graph 15. Evolution of employment in the EU-15 building and repairing of ships and boats sector (thousand persons), 1985-2001



Enterprises employing 20 persons or more
Source: Eurostat, Structural Business Statistics (SBS)

From a Member State perspective, employment in the building and repairing of ships and boats sector is particularly concentrated in four countries, that is to say, Italy, France, Poland and the United Kingdom (43,009, 36,526, 34,656 and 32,715 people working in the sector, respectively). Other countries with an important sector employment correspond to Romania, Spain and Germany, as well as The Netherlands (29,384, 27,896, 26,111 and 13,737 persons, also respectively) (see Table 23). All in all, these eight countries account for an 82% of the total EU-27 employment in the sector in 2006, approximately.

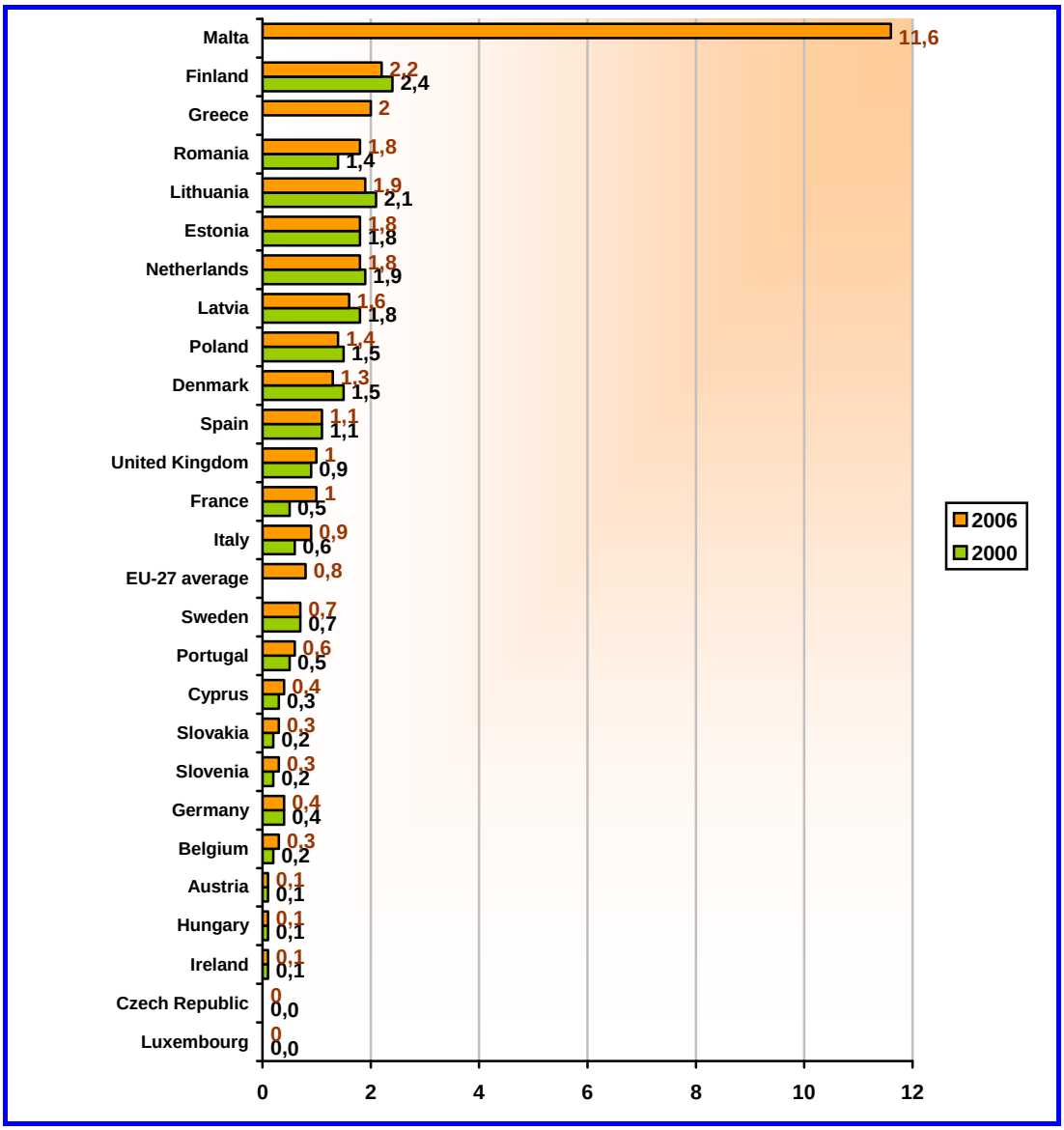
Table 23. Number of persons working in the building and repairing of ships and boats, by Member States and by subsectors, 2006

	Number of persons employed		
	Building and repairing of ships and boats (NACE 35.1)	Building and repairing of ships (NACE 35.11)	Building and repairing of pleasure and sporting boats (NACE 35.12)
Belgium	1,729	1,478	251
Bulgaria	6,350	-	-
Czech Republic	649	598	51
Denmark	5,398	3,581	1,817
Germany	26,111	20,799	5,312
Estonia	2,385	2,095	290
Ireland	285	202	83
Greece	7,904	6,988	916
Spain	27,896	23,594	4,302
France	36,526	23,346	13,180
Italy	43,009	24,882	18,127
Cyprus	146	54	92
Latvia	2,622	2,427	195
Lithuania	5,085	4,844	241
Luxembourg	0	0	0
Hungary	495	184	311
Malta	3,689	3,612	77
Netherlands	13,737	7,562	6,175
Austria	404	111	293
Poland	34,656	30,665	3,991
Portugal	4,613	3,466	1,147
Romania	29,384	29,037	347
Slovenia	729	104	625
Slovakia	1,018	-	-
Finland	9,009	6,152	2,857
Sweden	5,763	2,555	3,208
United Kingdom	32,715	21,997	10,718
TOTAL	**302,307**	**220,333**	**74,606**

All data referred to 2006 with the exceptions of Bulgaria (2005), Estonia (2005), Malta (2002), Netherlands (2005), Poland (2005) and Romania (2005)
Source: Eurostat, Structural Business Statistics (SBS)

In any case, and in relative terms, employment data shows that the building and repairing of ships and boats sector is particularly relevant in some countries such as Malta, Finland or Greece, where more than 2% of the manufacturing total employment is involved in the sector (see Graph 16) for the 2005 year. Other members States with a relatively high relevance of the ship and boat building and repairing activity include Romania, Lithuania, Estonia and The Netherlands, where the sector comprises a 1.8%-1.9% of the total employment in manufacturing activities. The sector also seems to be important in Latvia and Poland (1.4%-1.6% of total national manufacturing employment), whereas in some of the most relevant Member States such as France, Italy, Spain or the United Kingdom, this percentage ranges from 0.9% to 1.1% (all data referred to 2005).

Graph 16. Share of employment in building and repairing of ships and boats/total manufacturing employment, 2000 and 2006



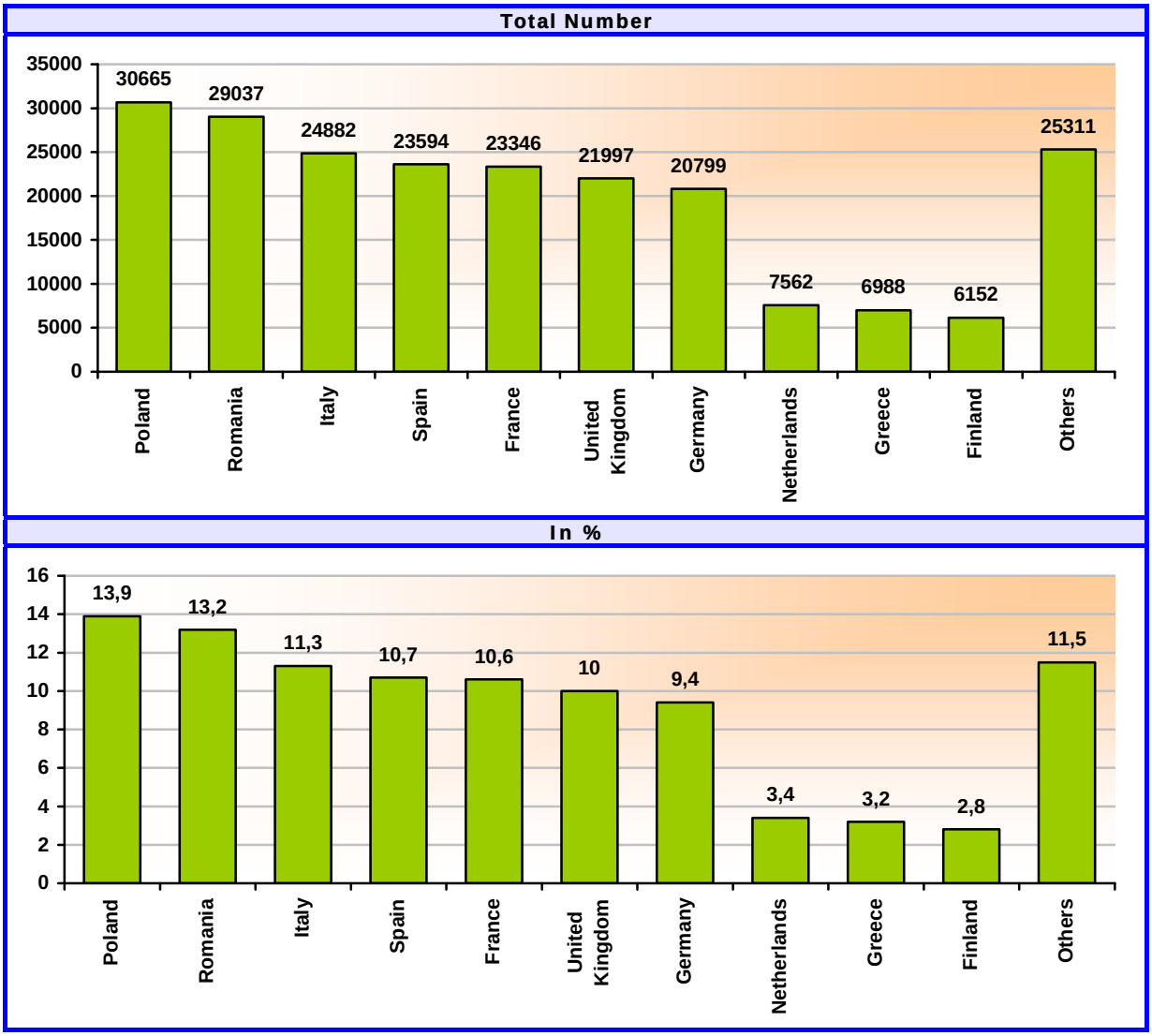
All data referred to 2006 with the exceptions of Estonia (2005), Netherlands (2005), Poland (2005), Romania (2005) and Slovakia (2004)
Source: Eurostat, Structural Business Statistics (SBS)

4.2. GENERAL OVERVIEW OF THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR BY CONCRETE SUBSECTORS

4.2.1. Building and repairing of ships

According to the data provided by Eurostat, the building and repairing of ships sector did provide a total of 220.3 thousand jobs in 2005 in the total EU-27, approximately. According also to the same source, Poland, Romania, Italy and Spain were the largest countries in the EU-27 in terms of employment, each of them between 14% and 11% of the total EU-27 employment in the shipbuilding and repairing activity. These four countries are closely followed by France, United Kingdom and Germany (with respective percentages of 9-10%). These seven countries gathered a 79.1%% of the total shipyard workforce in Europe (see Graph 17 and Table 23).

Graph 17. Number of persons working in the building and repairing of ships, by main Member States, total number and percentage, 2006



All data referred to 2006 with the exceptions of Bulgaria (2005), Estonia (2005), Malta (2002), Netherlands (2005), Poland (2005) and Romania (2005)
Source: Eurostat, Structural Business Statistics (SBS)

However, other information sources (i.e. CESA) provide a complete different picture of the employment situation in EU countries (see Table 24).

Table 24. Employment in the CESA countries, 1975-2006

	1975		2005		2006	
	Total	New Buildings	Total	New Buildings	Total	New Buildings
Belgium	10,245	6,586	-	-	-	-
Croatia	-	,-	11,143	9,647	11,370	9,503
Denmark	18,900	15,300	3,600	3,300	3,700	3,300
Finland	18,000	17,000	4,372	4,290	4,400	4,400
France	40,354	24,938	16,700	3,500	16,600	3,500
Germany	105,988	71,598	20,600	14,600	21,600	16,100
Greece	10,159	2,316	2,784	115	2,496	400
Ireland	1,633	1,427	-	-	-	-
Italy	36,260	21,460	12,063	8,689	11,837	8,666
Netherlands	39,850	20,850	10,000	4,300	11,700	3,750
Norway	29,000	16,500	5,307	5,307	5,000	5,000
Portugal	17,100	7,000	1,880	1,107	1,760	972
Spain	47,000	27,800	8,238	2,222	6,170	2,179
Poland	-	-	18,652	11,818	19,120	14,858
United Kingdom	55,999	48,272	7,000	500	5,000	500
Romania	-	-	17,260	15,960	16,600	15,000
Sweden	31,500	25,000	0	-	0	-
Total	**461,988**	**306,047**	**139,599**	**85,355**	**137,353**	**88,128**

Source: CESA (data obtained from Gerencia del Sector Naval, 2007).

In this sense, the comparison between Eurostat and CESA data provides different results. Just to give an example, CESA suggests that, in a selection of 11 EU Member States (see Table 25), the available employment in 2005 was of 198,488 jobs in the Eurostat database, whereas the CESA figure was much less important (117,283 jobs). Interestingly, these differences can be also appreciated at national level, especially in countries such as United Kingdom, Spain, Greece or Italy. In all cases, and with the only exception of The Netherlands and Germany (where CESA employment is higher than Eurostat data), Eurostat data is much higher than CESA figures. An explanation for these differences can be found in the following footnote[19].

Table 25. Employment data in ship building and repairing activities provided by Eurostat and CESA, 2006

	Eurostat Data	CESA data	Difference (in absolute terms)	Difference (in %)
Poland	30,665	19,120	11,545	60.4
Romania	29,037	16,600	12,437	74.9
Spain	23,594	6,170	17,424	282.4
United Kingdom	21,997	5,000	16,997	339.9
Italy	24,882	11,837	13,045	110.2
France	23,346	16,600	6,746	40.6
Germany	20,799	21,600	-801	-3.7
Netherlands	7,562	11,700	-4,138	-35.4
Greece	6,988	2,496	4,492	180.0
Finland	6,152	4,400	1,752	39.8
Portugal	3,466	1,760	1,706	96.9
Total 11 EU Member States	**198,488**	**117,283**	**81,205**	**69.2**

Source: Eurostat, Structural Business Statistics (SBS) and CESA (data obtained from Gerencia del Sector Naval, 2007)

In any case, and from a time dynamic perspective, both data sources confirm that employment in ship building and repair activities in Europe has experienced a general

[19] These differences are explained by several reasons. On the one hand, CESA members do not include military yards; On the other hand, it is likely that Eurostat data also includes indirect employment in the shipbuilding sector and, employment of people in the marine equipment sector, whereas CESA information only reports on direct employment in CESA associated shipyards.

remarkable downward trend. Thus, and looking into the data provided by CESA, total CESA employment has gone down from 461,988 jobs in 1975 to 137,353 jobs in 2006 (see Table 24), where this situation can be extended to all CESA countries. Meanwhile, data from Eurostat for the time period 1995-2006 shows that, with the surprising exception of France, in all the most important EU Member States ship builders, employment has shown a downward trend, where this trend has been particularly important in Portugal, The Netherlands, Finland or Poland (more than 3.6% of negative annual cumulative growth rate in these four countries between 1995 and 2006) (see Table 26).

Table 26. Evolution of employment in selected EU-27 Member States in the building and repairing of ships, 1995-2006

	1995	2000	2006	Annual Cumulative growth rate 1995-2006
Germany	23,219	22,919	20,799	-1.0%
Spain	28,641	25,839	23,594	-1.7%
France	12,448	11,012	23,346	5.9%
Italy	25,110	21,245	24,882	-0.1%
Netherlands	13,024	17,339	7,562	-4.8%
Poland	45,993	n.a.	30,665	-3.6%
Portugal	9,984	4,550	3,466	-9.2%
Finland	9,404	8,714	6,152	-3.8%
Sweden	3,040	2,870	2,555	-1.6%
United Kingdom	32,420	27,107	21,997	-3.5%

All data referred to 1995 with the exceptions of Germany (1999), France, Portugal and United Kingdom (1996) and Poland (average 1996-1999)
All data referred to 2006 with the exceptions of Poland (2005) and The Netherlands (2005)
Source: Eurostat, Structural Business Statistics (SBS)

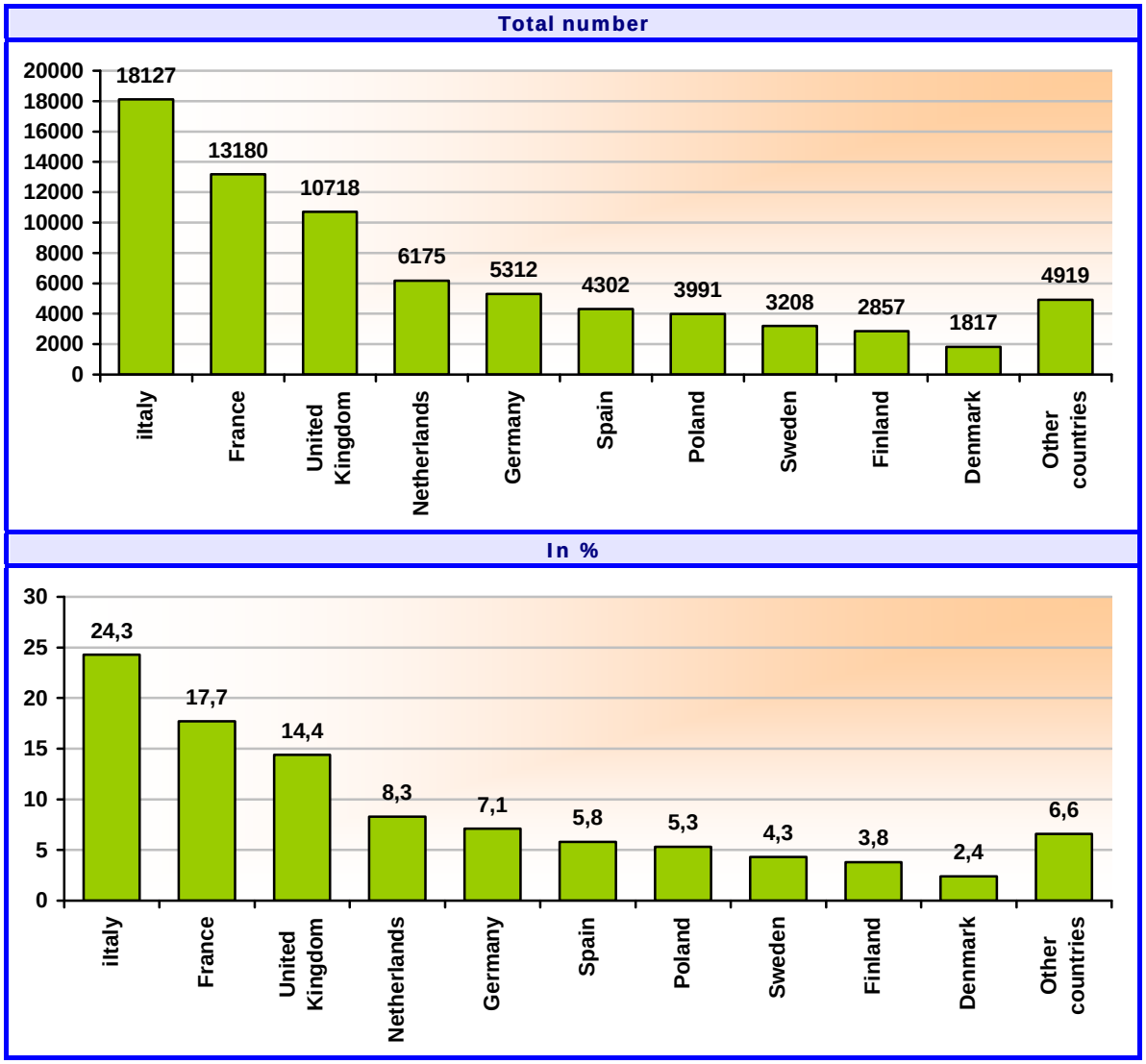
This downward trend can be explained to a number of interrelated factors, such as the strong competition from Asian producers (particularly China and South Korea over the last 20-25 years), well-spread outsourcing practices in the shipbuilding industry or required adjustments to the environmental and social acquis in the case of the shipbuilding industry in the new Member States (European Economic and Social Committee, 2004), all combined with significant uncertainty and overcapacity in the world markets.

In any case, the shipbuilding industry has experienced a radical change during the 20 years, so if in the past the sector has been regarded as a labour intensive industry, shipbuilding can be currently defined as a capital, high technology and knowledge intensive one (CESA, 2007).

4.2.2. Building and repairing of pleasure and sporting boats

According to information provided by Eurostat, in the EU-27 there were approximately 74.6 thousand people involved in the building and repairing of pleasure and sporting boats (in both inland waterways and the sea). From a country perspective, employment is particularly relevant in three countries, this is, Italy, France and United Kingdom (18,127, 13,180 and 10,718 people, respectively). These three countries account up to 56.4% of the total EU-27 sector employment. Meanwhile, other Member States with a relative presence of employment include The Netherlands, Germany, Spain, Poland and Sweden, with employment ranging from 3,000 to 6,200 people (see Graph 18 and Table 23). Generally speaking, this ranking of countries is also presented by other available studies (see ECOTEC, 2006).

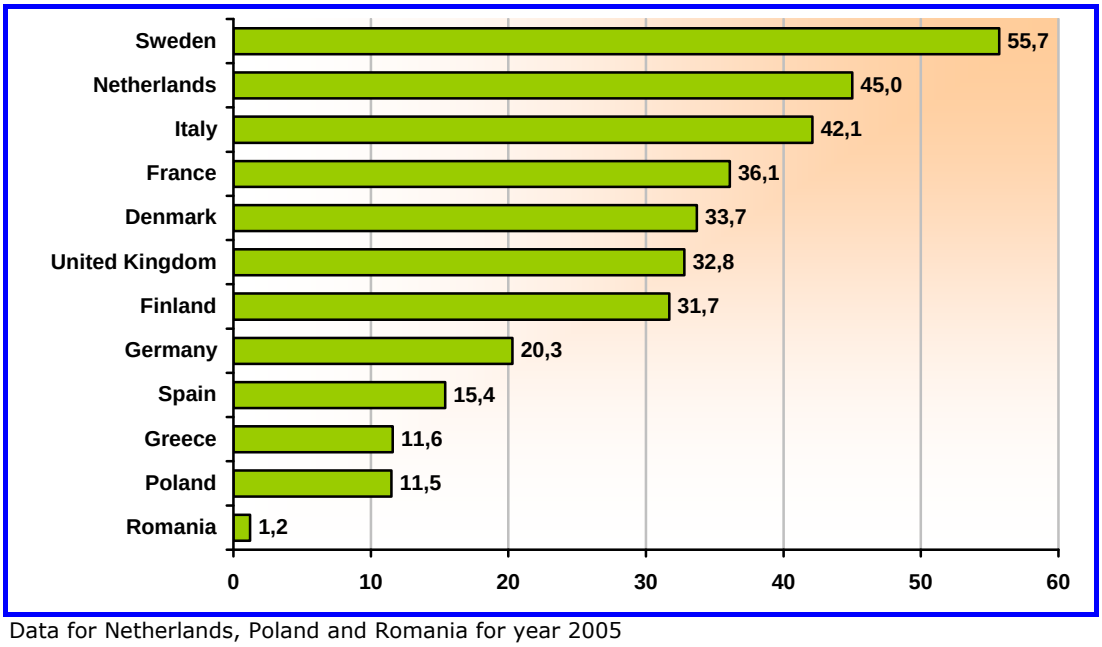
Graph 18. Number of persons working in the building and repairing of pleasure and sporting boats, by main Member States, total number and percentage, 2006



All data referred to 2006 with the exceptions of Bulgaria (2005), Estonia (2005), Malta (2002), Netherlands (2005), Poland (2005) and Romania (2005)
Source: Eurostat, Structural Business Statistics (SBS).

From a market specialisation perspective, and focusing on those EU countries with the largest employment in the building and repairing of ships and recreational boats, the building and repairing of pleasure and sporting boats is a sector particularly relevant in countries such as Sweden, The Netherlands or Italy, where this sector generates more than 40% of the total NACE 35.1 national employment (see Graph 19). Other countries with a significant presence of the sector in terms of employment refer to France, Denmark, United Kingdom or Finland (with percentages ranging from 31 to 36%). Finally, in other employment-related relevant EU Member States such as Spain, Greece, Poland or Romania, this sector contributes with less than 16% to the total NACE 35.1 national employment.

Graph 19. Market specialisation of a selection of countries (% of the employment generated by the building and repairing of pleasure and sporting boats sector in comparison to the whole building and repairing of ships and boats sector, 2006



Data for Netherlands, Poland and Romania for year 2005
Source: Eurostat, Structural Business Statistics.

From a time dynamic perspective, and contrarily to what happens in the building and repairing of ships sector, the building and repairing of pleasure and sporting boats is a sector that has experienced a remarkable increase in employment during the last ten years (see Table 27). Thus, and focusing on a selection of the most important EU Member States in terms of employment, it is possible to identify a positive evolution in the time period 1995-2006, with positive increases in all the selected countries of more than 4% in annual cumulative terms. In this sense, it is particularly relevant the growth rates available in Portugal, Spain, Poland or Italy (18.7%, 14.4%, 13.0% and 10.2%, respectively), probably linked with their relatively low labour costs (especially Poland) (ECOTEC, 2006).

Table 27. Evolution of employment in selected EU-27 Member States in the building and repairing of pleasure and sporting boats, 1995-2006

	1995	2000	2006	Annual Cumulative growth rate 1995-2006
Germany	3,591	3,560	5,312	3.6%
Spain	979	2,357	4,302	14.4%
France	7,335	9,920	13,180	5.5%
Italy	6,233	9,215	18,127	10.2%
Netherlands	3,876	5,763	6,175	4.3%
Poland	1,038	n.a.	3,991	13.0%
Portugal	174	334	1,147	18.7%
Finland	1,068	1,875	2,857	9.4%
Sweden	1,565	2,807	3,208	6.7%
United Kingdom	6,643	8,268	10,718	4.4%

All data referred to 1995 with the exceptions of Germany (1999), France, Portugal and United Kingdom (1996) and Poland (average 1996-1999)
All data referred to 2006 with the exceptions of Netherlands (2005) and Poland (2005).
Source: Eurostat, Structural Business Statistics (SBS)

4.2.3. Some notes on the employment in the marine equipment sector

To conclude, this subsection is interested in providing a very brief estimation on the importance of the European marine equipment sector from an employment perspective. In this sense, it is worth stressing once again the lack of recognition of the sector as such, as well as the heterogeneity of this sector and the fact that most companies are active also in other manufacturing sectors. All these elements result in added difficulties for calculating its main economic figures (including employment).

In this respect, and according to some estimations elaborated by some experts (see ECOTEC, 2006), the marine equipment sector provided approximately 287,000 jobs in 2004/5, with estimations varying between 272,000 and 302,000 jobs. In terms of relative importance, Germany is the biggest player in the marine equipment industry (approximately 25% of the EU-25 employment in the sector), followed by Poland, France, Italy, Denmark and Finland (approximate percentages of 23%, 10%, 8%, 7% and 7% (see Table 28).

Table 28. Employment in the marine equipment sector, 1997-2005

Country	1997	2005 (*)
Austria	-	7,000
Belgium	613	770
Denmark	20,326	20,626
Estonia	-	1,500
Finland	-	19,000
France	18,900	30,000
Germany	58,700	70,000
Greece	-	3,281
Italy	-	24,000
Latvia	1,285	1,435
Netherlands	13,050	13,500
Poland	-	50,000-80,000
Spain	23,041	14,523
United Kingdom	-	16,604

All data referred to 2005 except Belgium (2000), Finland, Germany, Greece, Italy and Spain (2004) and UK (2001)
Source: ECOTEC, 2006

Interestingly also, and from a time dynamic perspective, and taking into account the difficulties in the estimations, it is possible to suggest that most countries have experienced a growth in employment, although in some countries (i.e. Spain) it is possible to notice a decline.

4.3. MAIN EMPLOYMENT PATTERNS IN THE BUILDING AND REPAIRING OF SHIPS AND BOATS

4.3.1. Some introductory remarks

This section is interested in presenting some information on the main employment patterns available in the European Building and Repairing of Ships and Boats sector[20]. From a methodological perspective, this section is based on the information provided by the Eurostat's Labour Force Survey[21], for the whole sector NACE 35.1. Information coming from other information outside Eurostat sources will not be analysed in this section[22].

In addition to this, the information will be desegregated in two main groups of Member States, this is, EU-15 Member States and New Member States (NMS). The reason for this grouping is that "old" Member States' are characterised by current highly efficient and streamlined productive and manpower structures, after severe restructuring experiences in the eighties/nineties. Meanwhile, new Member States (although with some differences amongst them) are currently suffering from important modernisation and restructuring processes (linked with privatisation, changes in production methods, changes in markets and clients, changes in legal and financial guaranteeing frameworks, etc), who obviously have an impact on the existing employment patterns within the sector.

Finally, it is worth mentioning that information will be presented desegregated by some of the main manufacturing Member States (i.e. France, Germany, Italy, Poland, Romania and Spain).

4.3.2. Gender considerations in the building and repairing of ships and boats sector workforce

According to the available data provided by the Eurostat's Labour Force Survey, the European building and repairing of ships and boats sector can be defined as a male-dominated one, at least in comparison with the manufacturing total. Thus, up to 88.9% and 89.0% of the EU-15 and New Member States (NMS) workforce in the sector are men, where these figures sharply contrast with the 71.5% and 59.7% corresponding to the total manufacturing, respectively (see Graph 20). This male-dominated presence can be extended to the main EU ships and boats building Member States, although some slight differences can be appreciated amongst countries (from 93.9% of male presence in Poland to 81.5% in France) (see also Graph 20).

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[20] Unfortunately, information on other relevant variables such as presence of permanent/fixed term contracts is not available.

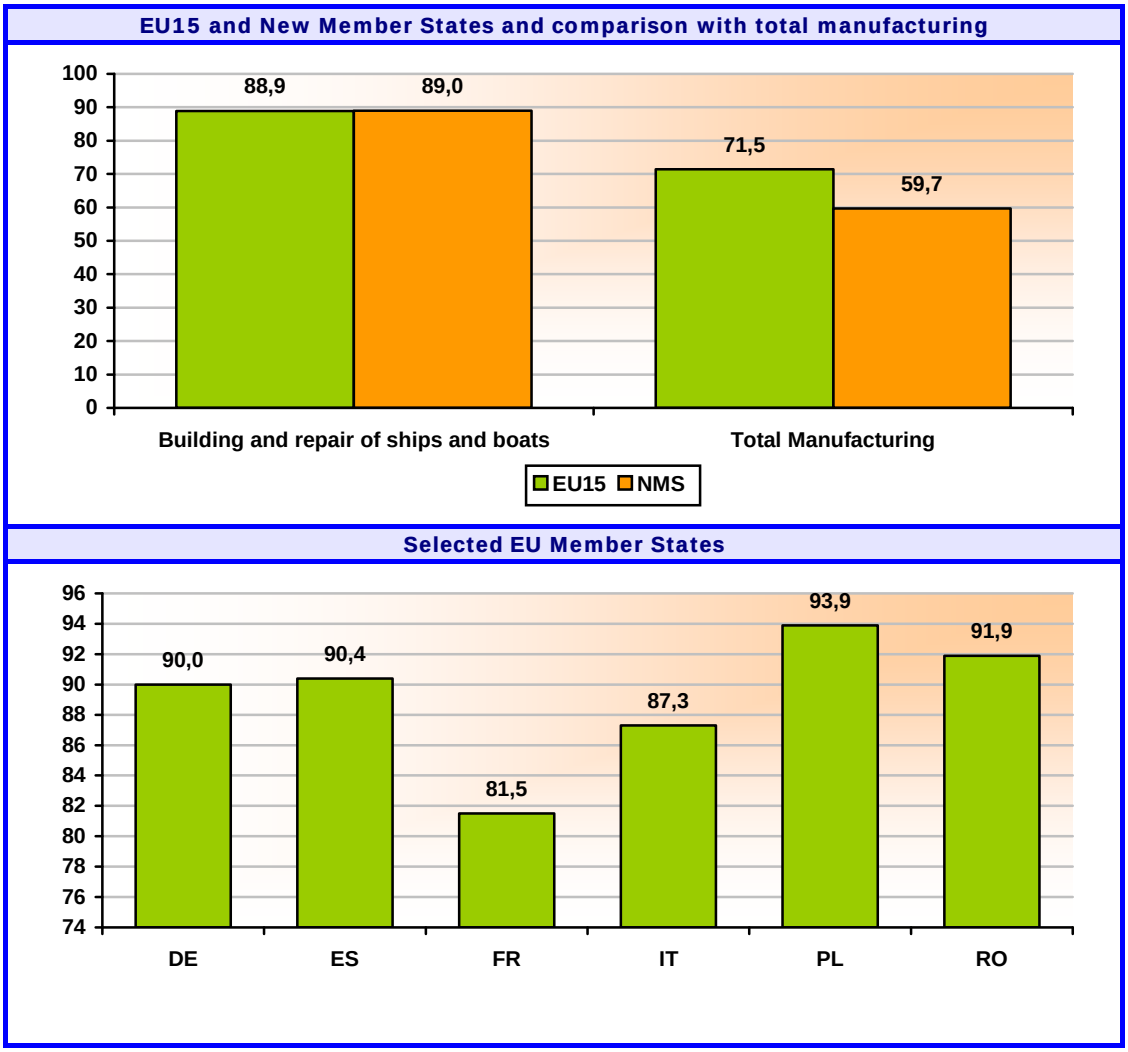
[21] The information obtained from the Labour Force Survey of Eurostat has to be analysed with great care for a number of reasons:

- The info is based on a representative but small sample of households. This means that there is an inevitably a margin of error surrounding the figures reported, specially if the industry being examined itself is relatively small or if job figures are broken down further in terms of their characteristics (sex, age, education)
- Definitions used for occupations may vary according to national conventions, which leave scope for differences between countries
- Disaggregated information for detailed economic sectors is not available for all EU countries (in the case of the building and repairing of ships and boats sector, info is not available for some large producers such as Bulgaria or United Kingdom).

In any case, The Labour Force Survey (LFS) has a number of strong points that deserve their use, such as its up-to-date nature or the possibility to compare on an homogeneous basis all EU countries.

[22] It is worth mentioning that, recently last June 2008, the European Shipbuilding Social Dialogue Committee has produced a report (see 't Hart & Schotte, 2008) that provides a complete description of the shipbuilding sector demographic characteristics in 14 European countries associated to CESA (including Croatia)

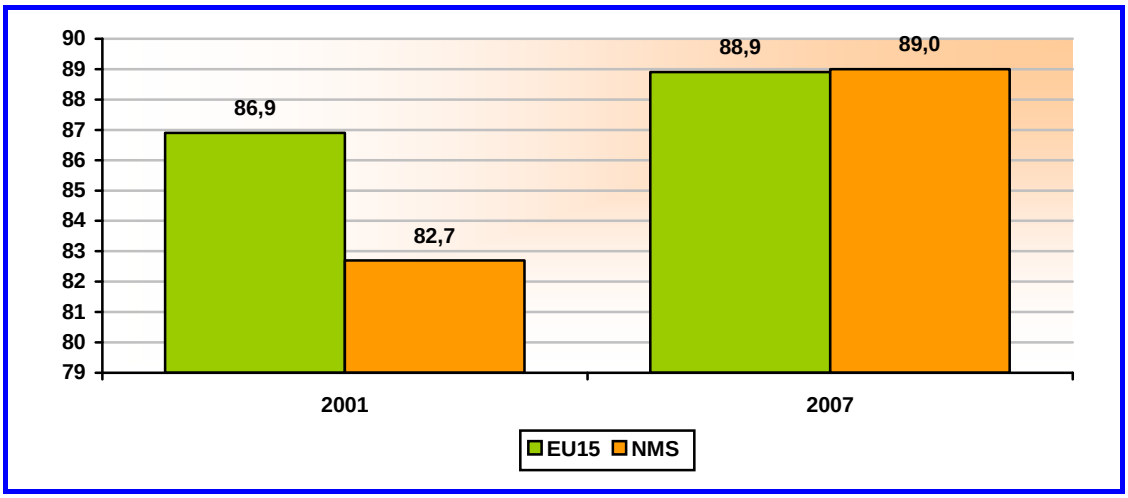
Graph 20. Male employment (%) in the building and repairing of ships and boats sector, EU15, New Member States and selected EU Member States, 2007



Source: Eurostat, European Labour Force Survey

From a time evolution perspective, the available data shows that this male-dominated presence has been even increased during the time period 2001-2006, so if in 2001 86.9% and 82.7% of the EU-15 and NMS sector workforce was male, respectively, these percentages have increased up to 88.9% and 89.0% in 2006, also respectively (see Graph 21).

Graph 21. Evolution of male employment (%) in the building and repairing of ships and boats sector, EU15 and New Member States, 2001-2007

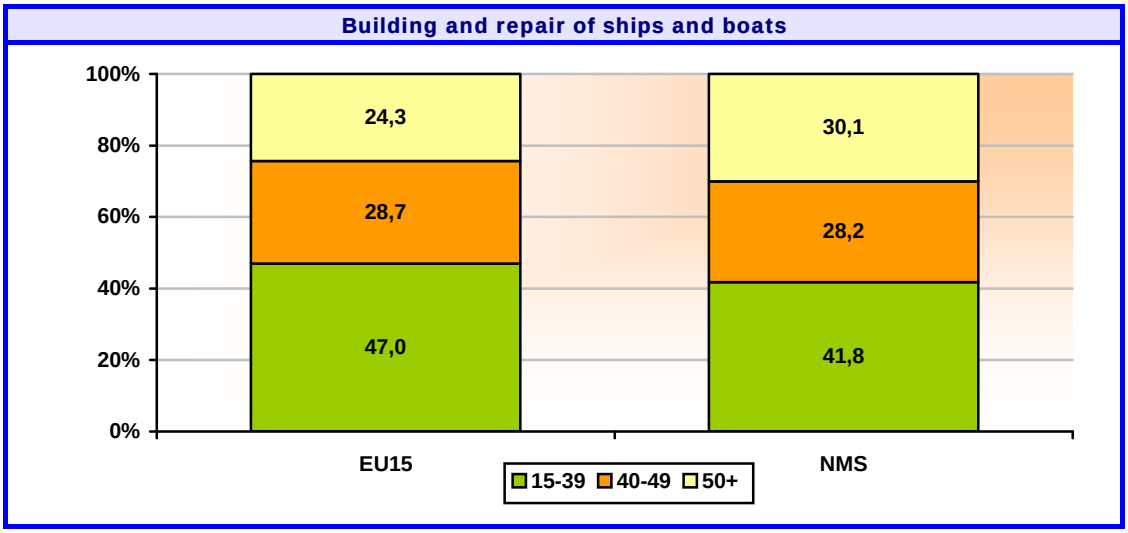


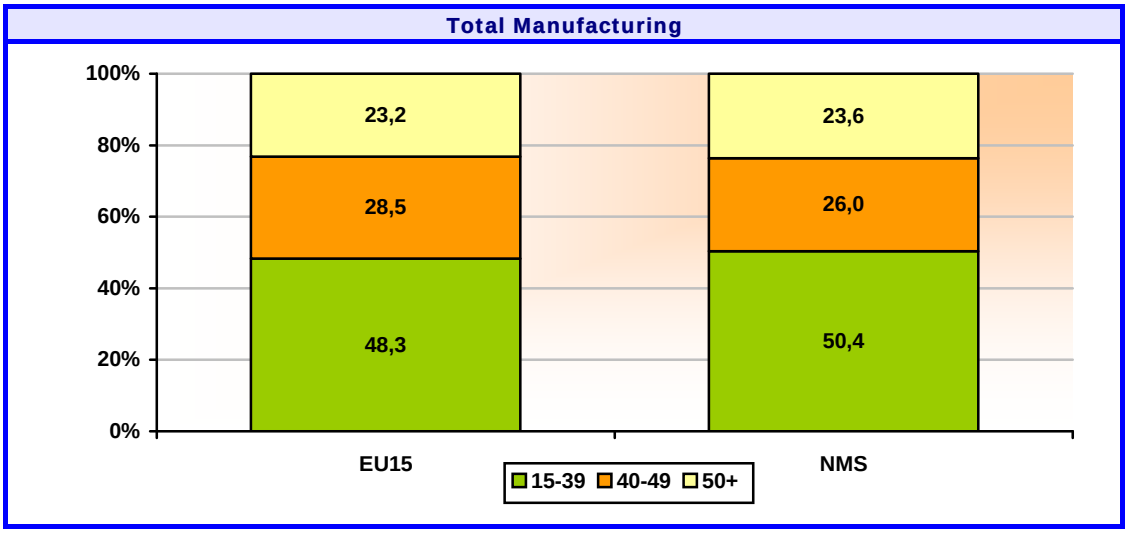
Source: Eurostat, European Labour Force Survey

4.3.3. Age considerations in the building and repairing of ships and boats sector workforce

From an age perspective, it is possible to suggest a relatively large percentage of sector people that is expected to retire in the next 10-20 years. Thus, and according to the available information referred to 2006, up to 53,0% and 58,3% of the EU-15 and NMS sector workforce was older than 40, where approximately a 25% is older than 50 years. Not very significant differences can be appreciated between EU-15 and NMS figures, nor compared to the total manufacturing sector, so this ageing problem is not solely privative of the building and repairing of ships and boats sector (see Graph 22). In any case, the presence of people older than 50 years old is higher in the NMS building and repairing of ships and boats sector workforce in comparison to the total manufacturing.

Graph 22. Employment distribution by age groups in the building and repairing of ships and boats sector and comparison with total manufacturing, EU-15 and New Member States, 2007

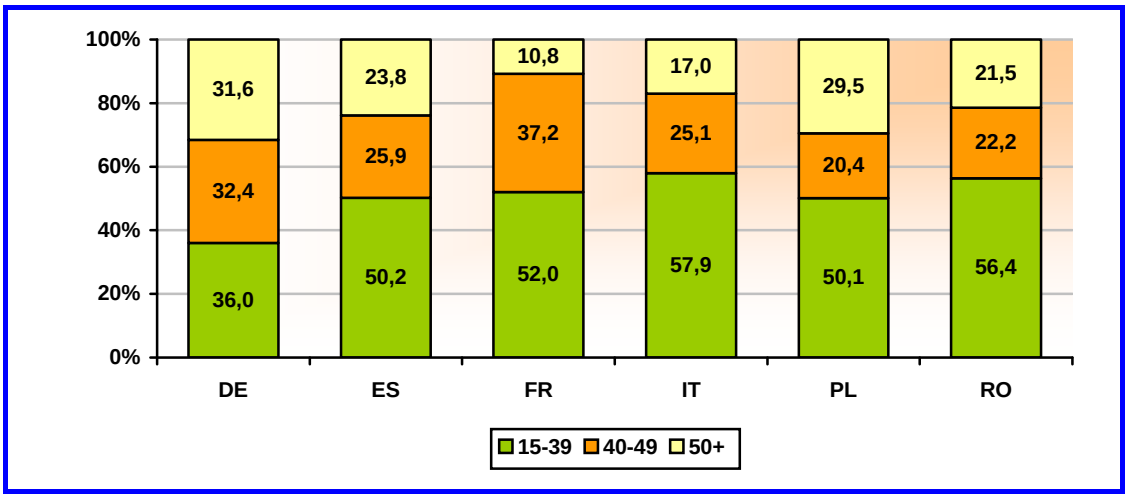




Source: Eurostat, European Labour Force Survey

In any case, the comparison amongst different EU Member States shows important age differences amongst them. Thus, the presence of older age groups is particularly relevant in the German, Polish, Spanish or Romanian cases (up to 31.6%, 29.5%, 23.8% and 21.1% of their workforces are older than 50 years old), whereas in the French and Italian cases this percentage is much smaller (10.8% and 17.0% of their workforces are older than 50 years old) (see Graph 23).

Graph 23. Employment distribution by age groups in the building and repairing of ships and boats sector in some selected EU Member States, 2007



Source: Eurostat, European Labour Force Survey

From a time evolution perspective in the time period 2001-2007, it is possible to identify relatively similar presence of the different age cohorts in the EU-15 and NMS workforces (see Graph 24).

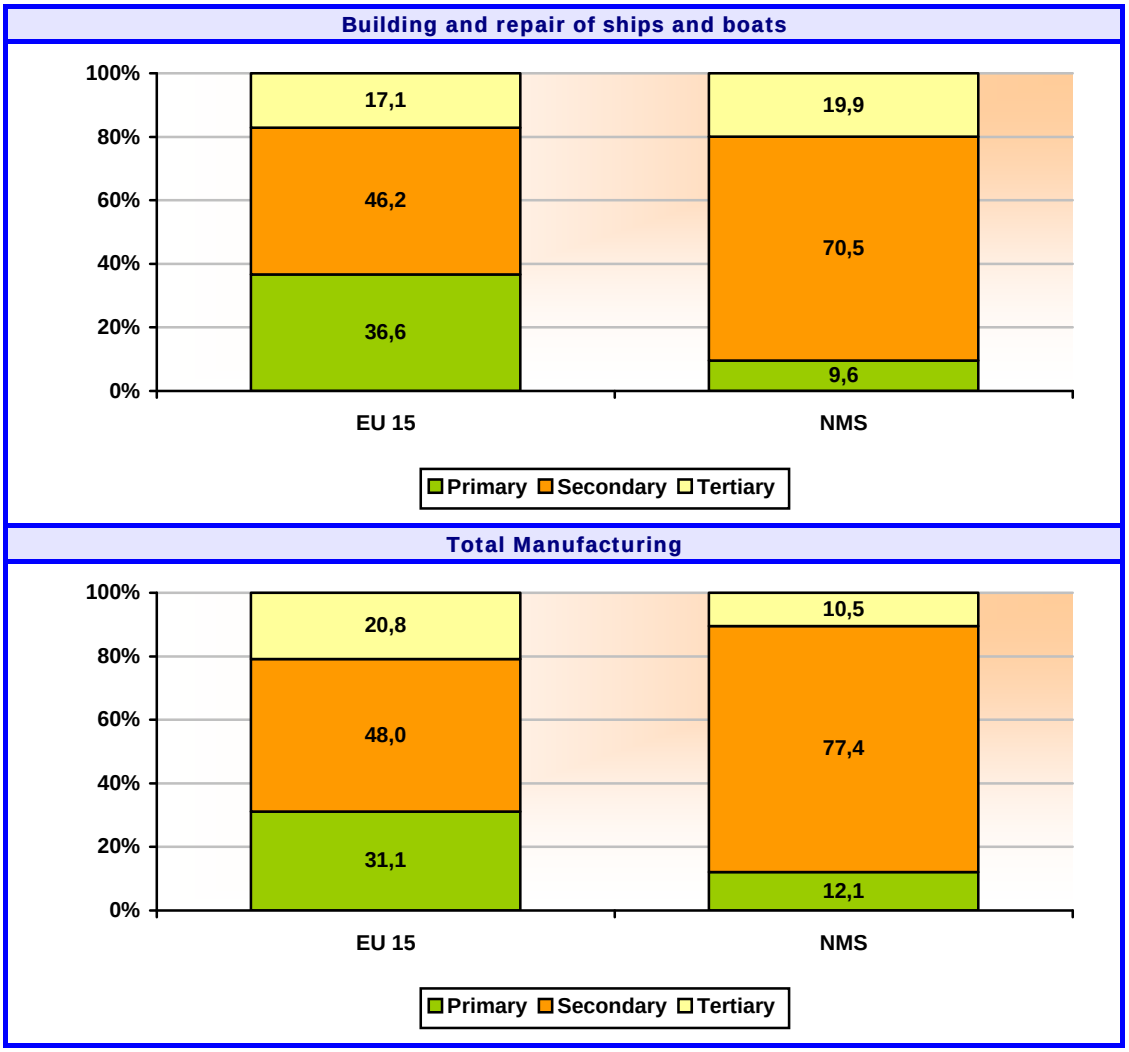
Graph 24. Evolution in the distribution of employment by age groups in the building and repairing of ships and boats sector, EU-15 and New Member States, 2001-2007

Source: Eurostat, European Labour Force Survey

4.3.4. Level of education in the building and repairing of ships and boats sector workforce

Concerning the level of education of the European building and repairing of ships and boats sector workforce, one of the most striking elements refers to the existing differences in the educational level between EU-15 and NMS countries. Thus, and whereas up to 36.6% of the EU-15 sector workforce has got primary educational levels, this percentage is much lower in the NMS countries (9.6%). By way of contrast, the presence of people with tertiary education levels is relatively similar in the EU-15 Member States in comparison to the NMS (17.1% in comparison to 19.9%, respectively) (see Graph 25). Meanwhile, the comparison with the educational level of the total manufacturing workforce does not show very important differences in comparison to the building and repairing of ships and boats sector situation. If any, a lower educational level of the EU-15 workforce in building and repairing of ships and boats (63.3% of the sector workforce has got secondary or tertiary education in comparison to 68.8% in total manufacturing).

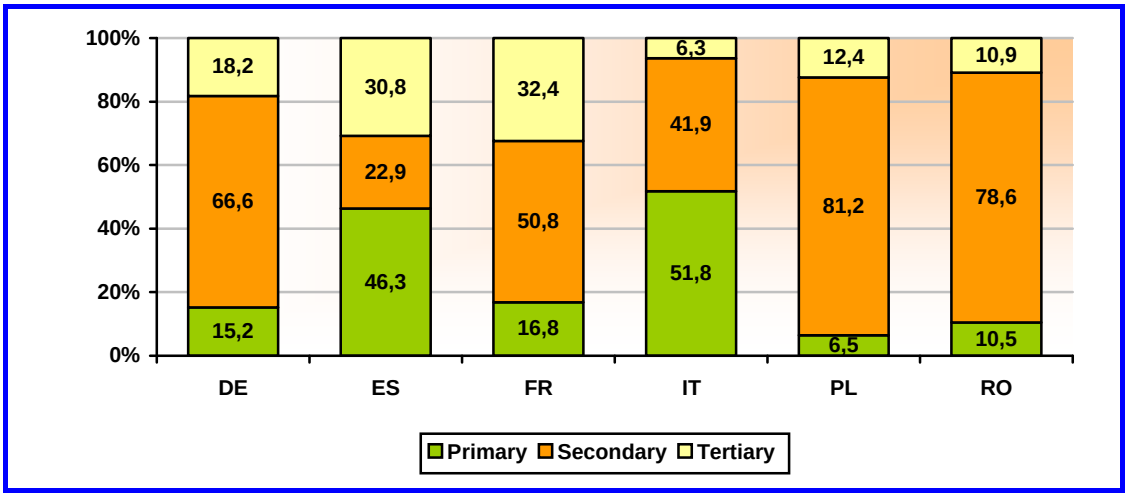
Graph 25. Employment distribution by educational groups in the building and repairing of ships and boats sector and comparison with total manufacturing, EU15 and New Member States, 2007



Source: Eurostat, European Labour Force Survey

Meanwhile, the comparison amongst different EU Member States shows the existence of important differences amongst countries. Thus, and whereas in countries such as France, Spain or Germany the presence of people with tertiary studies is relatively important (32.4%, 30.8% and 18.2%, respectively), these percentages are much smaller in other Member States such as Poland, Romania or specially Italy (12.4%, 10.9% and 6.3%, respectively). Interestingly also, countries such as Italy or Spain show a much higher presence of workers with primary education levels in comparison to other Member States (in these two countries, more than 51.8% and 46.3% of the workforce have primary educational levels, respectively) (see Graph 26).

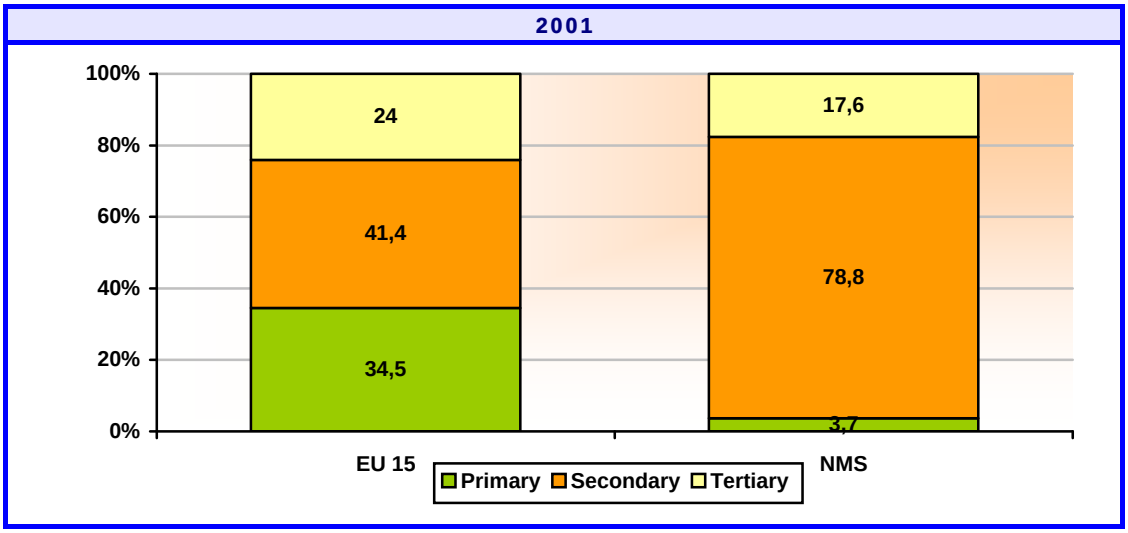
Graph 26. Employment distribution by educational groups in the building and repairing of ships and boats sector in some selected EU Member States, 2007

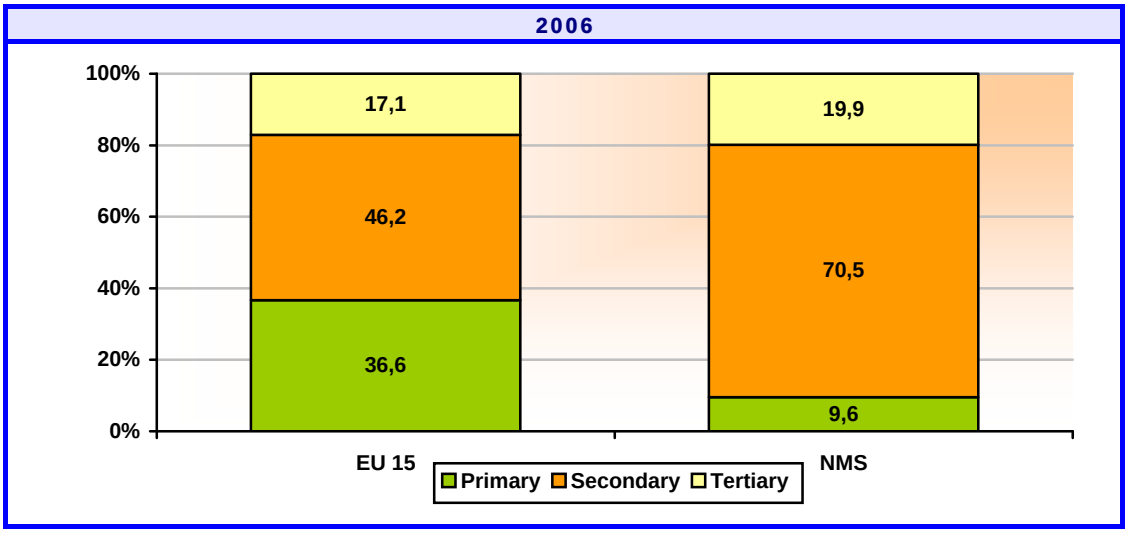


Source: Eurostat, European Labour Force Survey

From a time evolution perspective, it is worth stressing the fact that, according to the available statistical information and contrarily to what it could be initially expected, the presence of tertiary education-level workforce has experienced a relatively reduction in the time period 2001-2006, specially in the EU-15, whereas in the NMS this percentage has experienced a small increase (see Graph 27). By way of contrast, the presence of secondary educational level workforce has increased in the EU-15, whereas in the NMS this presence has been reduced up to 8 percentage points in the analysed time period (see also Graph 27).

Graph 27. Evolution in the distribution of employment by educational groups in the building and repairing of ships and boats sector, EU15 and New Member States, 2001-2007





Source: Eurostat, European Labour Force Survey

4.3.5. Presence of part-time employment

To end with this section, there is some available information on the presence of part-time employment in the European building and repairing of ships and boats sector. As it can be seen (Table 29), there are very marked differences in the presence of part-time working practices amongst the different EU Member States and between subsectors. Thus, and taking the building and repairing of ships and boats sector as a whole, part-time employment is particularly relevant in countries such as France and specially The Netherlands, where more than 10% of the workforce are on a part-time basis. Meanwhile, in countries such as Spain, Romania or Finland, this type of employment is practically non existent, as it only affects less than 0.5% of the workforce.

Table 29. Presence of part-time employment (%) in the building and repairing of ships and boats sector, by countries and subsectors, 2006

	Building and repairing of ships and boats (NACE 35.1)	Building and repairing of ships (NACE 35.11)	Building and repairing of pleasure and sporting boats (NACE 35.12)
Germany	3.7	3.0	6.1
Spain	0.4	0.2	1.1
France	9.8	9.9	9.6
Italy	1.8	1.0	2.7
Netherlands	10.9	9.0	13.2
Romania	0.1	0.1	1.2
Finland	0.3	0.1	0.7
Sweden	4.8	4.9	4.6
United Kingdom	3.6	2.3	6.9

All data referred to 2006 with the exceptions of Netherlands (2005), Romania (2005) and United Kingdom (2005)
Source: Eurostat, Structural Business Statistics (SBS)

In addition to this, the available data also shows that part-time practices are more relevant in the Building and repairing of pleasure and sporting boats (NACE 35.12) in comparison to the Building and repairing of ships sector (NACE 35.11), where this difference is particularly relevant in some countries such as The United Kingdom or Germany (see also Table 29).

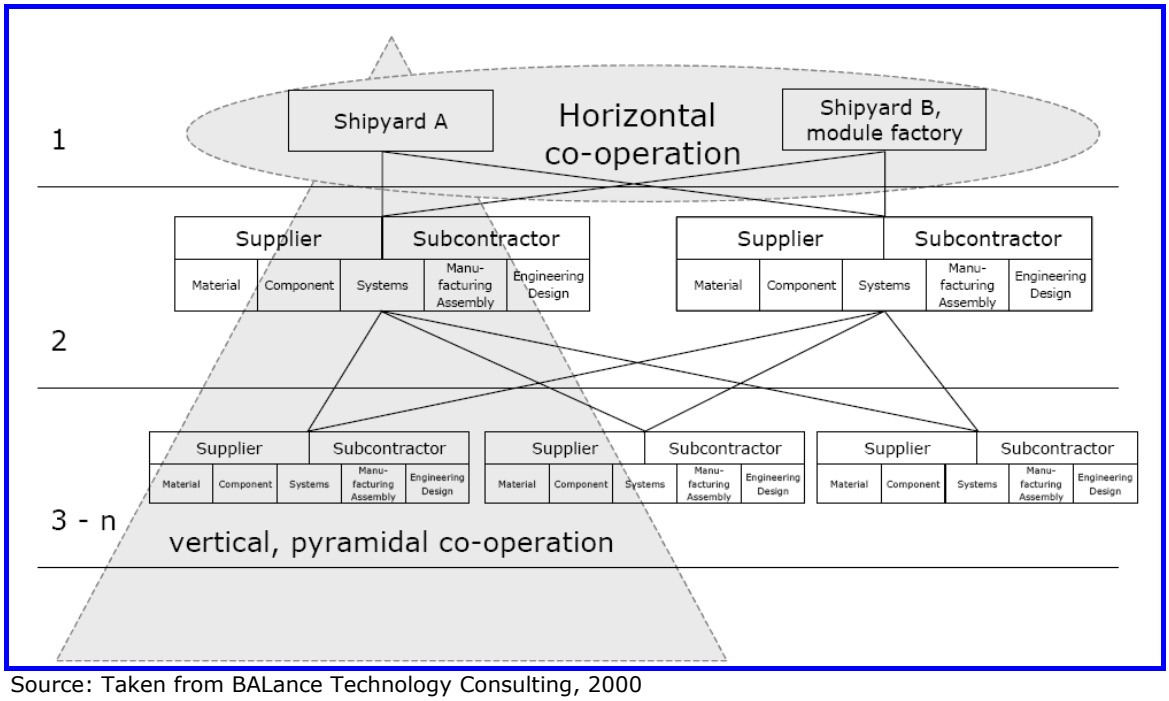
4.4. MAIN OCCUPATIONS IN THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR

4.4.1. Description of main occupations in the building and repairing of ships and boats sector

a) A brief approach to the sector manufacturing processes

The building and repair industry of ships and boats uses and produces a wide variety of manufactured components in addition to basic construction materials. Shipbuilding includes constructing, assembling, installing, cleaning, painting, outfitting, and testing activities. There are multiple types of construction which may include modular construction, traditional construction (from keel up), and fibreglass/composite material mould construction. Meanwhile, ship repair activities include altering, converting, installing, cleaning, painting, and maintaining of existing ships and vessels. New ship construction and ship repairing both apply of essentially the same manufacturing practices, processes, facilities, and support shops, and both require excellent planning, engineering, and interdepartmental communications. Also, both ship repair and new construction work require highly skilled labour because many of the operations (especially in ship repair) have limited potential for automation. In any case, it is worth stressing that, from a manufacturing perspective, shipbuilding is an industry undergoing important changes, since the modern shipyards are increasingly becoming final assembling facilities (and management/sales/logistics co-ordinators), with increasing elements of the "outfitting" (and therefore also of the value added) being contracted out (See Graph 28 for a description of the value chain organisation of the building of ships sector).

Graph 28. Synthetic fiche on the value chain organisation of the building of ships sector



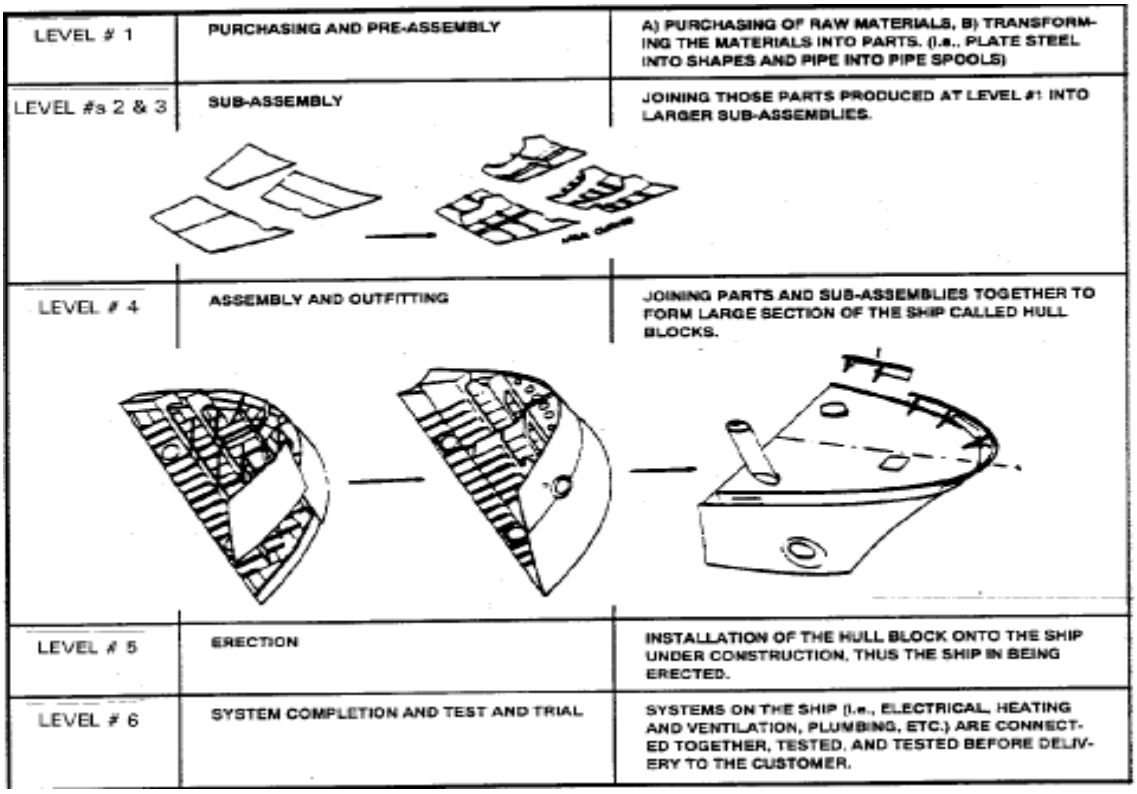
Source: Taken from BALance Technology Consulting, 2000

From a manufacturing perspective, shipbuilding includes a number of processes that are briefly described in Table 30. .

Table 30. Brief description of a typical shipbuilding process

- In order to begin **the design of a ship** a naval architect must meet with the owners of the planned vessel and establish exactly what it is the owner wants his vessel to do. The naval architect is responsible for determining the size (length, breadth, depth), shape (hull form), power requirements, and general arrangement of decks and compartments. To do this he must have a very clear idea of what it is the owner wishes to do with his vessel. He will then produce concept designs based on the owners' needs, ideas from similar ship types that have already been built, and the incorporation of new technology which might make for a better ship.
- Once the owner has selected a basic design he thinks best suits his needs, work starts on refining the basic design, estimating vessel costs and planning for the production of the ship. Naval architects refine the hull design and general arrangement while marine engineers, marine systems designers and production engineers work to design the systems which will turn the naval architects' hull into an operating ship. Engines are selected, propulsion systems designed, fuel, oil, water, electric power production systems, heating, ventilation, air conditioning, cargo handling, anchoring and mooring systems all must be designed or purchased to suit the vessel and its purpose.
- Once a contract has been awarded to a **shipyard to build the new ship**, people in the design office (the naval architects and marine system designers) work to prepare more detailed production drawings. These drawings are used by the production department to plan how they will employ the hundreds of trades people working to turn those drawings into reality. The purchasing department begins "sourcing" equipment required for the ship, purchasing all the materials and equipment needed to fulfil the design requirements. Others work on financing arrangements to pay for the construction of the ship, and all the usual activities required to operate any organization the size of a shipyard.
- The actual construction process consists of **steel fabrication and outfitting**. The first level involves the purchasing and handling of raw materials and fabricating these materials into the most basic parts. Parts fabrication or pre-assembling operations often involve cutting, shaping, bending, machining, blasting, and painting of these materials. Steel must be cut in various shapes which will be welded together to form the hull, bulkheads, and decks of the ship. This is done by computer controlled cutting machines working from data produced at the naval architect's computer.
- Another important aspect of ship construction is **outfitting**. Outfitting involves the fabrication and installation of all the parts of a ship that are not structural in nature, is carried out concurrently with the hull construction. Outfit is comprised of the ship's plumbing, derricks, masts, engines, generators, pumps, ventilation ducts, electrical cable, stairs, doors, ladders, bridge control equipment and everything else that goes into a ship. The basic raw materials include pipes, sheet metal, electrical components, and machinery. A zone-oriented method is typically used to assemble the parts that form major machinery spaces onboard the ship including engine rooms, pump rooms, and auxiliary machinery spaces. Parts or fittings can be assembled onboard the ship during hull erection, on the blocks or sub blocks, or independent of the hull structure in units of similar part.
- Ships are usually built in **"units," or blocks of the ship**, built independently and then welded together to form the final product. By building the ship this way workers will have easier access to the interior of the ship, welding can be more easily carried out, the installation of equipment is simpler, in other words each unit can be "pre-outfitted" more quickly and with less effort than if the hull was completed first. This makes the ship quicker and less costly to produce, a very important consideration in the competitive shipbuilding industry (as it increases the efficiency of the ship construction process). Therefore, blocks are carefully designed to minimize work and to avoid scheduling problems. These blocks are very often produced by external subcontractors.

Typical Manufacturing levels



- The units are welded together to form **sub-assemblies** which are then lowered into a dry dock and welded to other subassemblies until the ship is complete. The size of the sub-assemblies is usually only limited by the capacity of the equipment used to transport them to the dock and lower them into place. Parts fabrication is carried out throughout the shipyard in a number of different shops and work areas depending on the specific raw materials being handled. Parts of the ship are often built at other shipyards and floated on a barge to the lead shipyard for assembly.
- Once all the units are together the **ship is "floated up"** in the dock and tugs will move it to an outfitting pier where the all the remaining work is finished. Hundreds of people are involved in the building of a ship; pipefitters, machinists, electricians, welders, joiners, draughtsmen, sheet metal workers, riggers, painters and others virtually swarm the dockyard when construction is underway. Supplying companies send people to install and "set-to-work" equipment the shipyard has purchased for the ship. Supervisors and quality assurance technicians are kept busy ensuring work proceeds according to the designs produced by the naval architects and engineers, and that the work is up to the required standards.

Source: http://www.mi.mun.ca/mi-net/shiptech/shipbldg.htm and U.S. Environmental Protection Agency, 2007

Meanwhile, ship repairing activities generally include all ship conversions, overhauls, maintenance programs, major damage repairs, and minor equipment repairs (U.S. Environmental Protection Agency, 2007). Although specific repair methods vary from job to job, many of the operations are identical to new ship construction operations. Repair operations, however, are typically on a smaller scale and are performed at a faster pace. Jobs can last anywhere from one day to over a year. Repair jobs often have severe time constraints requiring work to be completed as quickly as possible in order to get the ships back in service. In many cases, piping, ventilation, electrical, and other machinery are prefabricated prior to the ship's arrival. Often, repair jobs are an emergency situation with very little warning, which makes ship repair a fast moving and unpredictable environment. Typical maintenance and repair operations include:

- Blasting and repainting the ship's hull, freeboard, superstructure, and interior tanks and work areas
- Major rebuilding and installation of machinery such as diesel engines, turbines, generators, pump stations, etc.

- Systems overhauls, maintenance, and installation (e.g., piping system flushing, testing, and installation)
- System replacement and new installation of systems such as navigational systems, combat systems, communication systems, updated piping systems, etc.
- Propeller and rudder repairs, modification, and alignment
- Creation of new machinery spaces through cut outs of the existing steel structure and the addition of new walls, stiffeners, vertical, webbing, etc.

In addition, some larger shipyards are capable of large repair and conversion projects that could include cutting a ship in half and installing a new section to lengthen the ship, replacing segments of a ship that has run aground, completing rip-out, structural reconfiguration and outfitting of systems, major remodeling of ships' interiors or exteriors, etc.

b) Main occupations in the building and repairing of ships and boats sector

The previous section has shown that the building and repair industry of ships and boats includes a very wide array of different and complex production processes that require a large number of workers with many different and specialised skills. In this sense, both Table 31 and Table 32 provide information on the main occupations in the building and repairing of ships and boats sector, as well as a brief description of the activities carried out in some of the most relevant occupations in engineering and production activities. Meanwhile, Table 33 provides a classification of technical professions in the European shipbuilding industry by educational levels and three selected functions (sales, design/engineering, production).

Table 31. Main occupations available in the building and repairing of ships and boats sector

Main occupational groups	Main occupations available in the sector
Management Occupations	• General and Operations Managers; Industrial Production Managers; Financial Managers; Purchasing Managers; Sales Managers; Human Resources Managers; Administrative Services Managers
Business and Financial Operations Occupations	• Logisticians; Purchasing Agents; Accountants and Auditors; Financial Analysts; Human Resources and Labour Relations Specialists.
Computer Occupations	• Network and Computer Systems Analysts and Administrators; Computer Support Specialists
Engineering Occupations	• Marine Engineers and Naval Architects; Industrial Engineers and Technicians; Mechanical Engineers, Technicians and Drafters; Electrical and Electronic Engineers, Technicians and Drafters.
Sales and Related Occupations, Office and Administrative Support Occupations	• Sales Representatives; Supervisors of Sales Workers; Office Clerks in general; Stock Clerks and Order Fillers; Bookkeeping, Accounting, and Auditing Clerks; Executive Secretaries, Administrative Assistants and Secretaries; Supervisors of Office and Administrative Support Workers; Customer Service Representatives
Service Workers	• Occupational Health and Safety Specialists and Technicians; Nurses; Emergency Medical Technicians and Paramedics; Security Guards; Fire Fighters; Janitors and Cleaners
Production Occupations	• Fiberglass Laminators and Fabricators; Welders, Cutters, Solderers and Brazers; Carpenters; Plumbers, Pipefitters and Steamfitters; Structural Metal Fabricators and Fitters; Machinists; Electricians; Inspectors, Testers, Sorters, Samplers, and Weighers; Painters, Grinding and Polishing Workers; Different Machine setters; Sewing Machine Operators; Upholsterers; Numerical Tool and Process Control Programmers; Supervisors of Production and Operating Workers; Supervisors of Transportation and Material-Moving activities; Team Assemblers; Sheet Metal, Metal and Plastic Workers; Insulation Workers; Freight, Stock, and Material Movers; Industrial Truck and Tractor Operators and Drivers; Crane and Tower Operators.

Main occupational groups	Main occupations available in the sector
Installation, Maintenance and Repair Occupations	• Electrical and Electronics Installers and Repairers; Maintenance and Repair Workers; Riggers; Motorboat Mechanics; Industrial Machinery Mechanics; Diesel Engine Specialists; Heating, Air Conditioning, and Refrigeration Mechanics and Installers; Control and Valve Installers and Repairers; Supervisors of Mechanics, Installers, and Repairers

Source: US Department of Labor, Bureau of Labor Statistics

Table 32. Description of main occupations involved in engineering and production activities available in the building and repairing of ships and boats sector

Name of the occupation	Brief Description
Marine Engineers and Naval Architects	• Naval architects are specialist engineers involved in designing, building, operating and maintaining all kind of ships and off-shore constructions. Meanwhile, marine engineers are involved in designing, building, operating and maintaining the equipment and machinery used in ships and in subsea and offshore installations.
Industrial Engineers	• Design, develop, test, and evaluate integrated systems for managing industrial production processes including human work factors, quality control, inventory control, logistics and material flow, cost analysis, and production coordination
Mechanical Engineers	• Perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of such equipment as centralized heat, gas, water, and steam systems
Drafters	• They prepare detailed drawings that give exact measurements and specifications for all the ship's parts. These drawings are used by the production department to plan how they will employ the hundreds of trades people working to turn those drawings into reality.
First-Line Supervisors of Production and Operating Workers	• Supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators.
Fiberglass Laminators and Fabricators	• Laminate layers of fiberglass on molds to form boat decks and hulls.
Welders, Cutters, Solderers, and Brazers	• Use hand-welding, flame-cutting, hand soldering, or brazing equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products. Welding is important in shipbuilding because most ships are joined together by welding rather than by riveting.
Carpenters	• Construct, erect, install, or repair structures and fixtures made of wood, such as concrete forms; building frameworks. May also install cabinets, siding, drywall and batt or roll insulation.
Plumbers, Pipefitters, and Steamfitters	• Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems
Structural Metal Fabricators and Fitters	• Fabricate, lay out, position, align, and fit parts of structural metal products.
Machinists	• Set up and operate a variety of machine tools to produce precision parts and instruments. Include precision instrument makers who fabricate, modify, or repair mechanical instruments. May also fabricate and modify parts to make or repair machine tools or maintain industrial machines, applying knowledge of mechanics, shop mathematics, metal properties, layout, and machining procedures.
Electricians	• Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service intercom systems or electrical control systems.
Painters, Transportation Equipment	• Operate or tend painting machines to paint surfaces.
Machine Setters	• Set up, operate, or tend machines or robots that carry out different activities (welding, soldering, painting, grinding, lapping, polishing, etc). Include workers who operate laser cutters or laser-beam machines.
Inspectors, Testers, Sorters, Samplers, and Weighers	• Inspect, test, sort, sample, or weigh raw materials or processed, machined, fabricated, or assembled parts or products for defects, wear, and deviations from specifications. May use precision measuring instruments and complex test equipment.
Crane and Tower Operators	• Operate mechanical boom and cable or tower and cable equipment to lift and move materials, machines, or products in many directions.

Name of the occupation	Brief Description
Sheet Metal Workers	• Fabricate, assemble, install, and repair sheet metal products and equipment, such as ducts, control boxes, drainpipes, and furnace casings. Work may involve any of the following: setting up and operating fabricating machines to cut, bend, and straighten sheet metal; shaping metal over anvils, blocks, or forms using hammer; operating soldering and welding equipment to join sheet metal parts; inspecting, assembling, and smoothing seams and joints of burred surfaces. Include sheet metal duct installers who install prefabricated sheet metal ducts used for heating, air conditioning, or other purposes.
Team Assemblers	• Work as part of a team having responsibility for assembling an entire product or component of a product. Team assemblers can perform all tasks conducted by the team in the assembly process and rotate through all or most of them rather than being assigned to a specific task on a permanent basis. May participate in making management decisions affecting the work. Team leaders who work as part of the team should be included.

Source: US Department of Labor, Bureau of Labor Statistics

Table 33. Major professions in the European shipbuilding and ship repair industry by level of education and selected functions

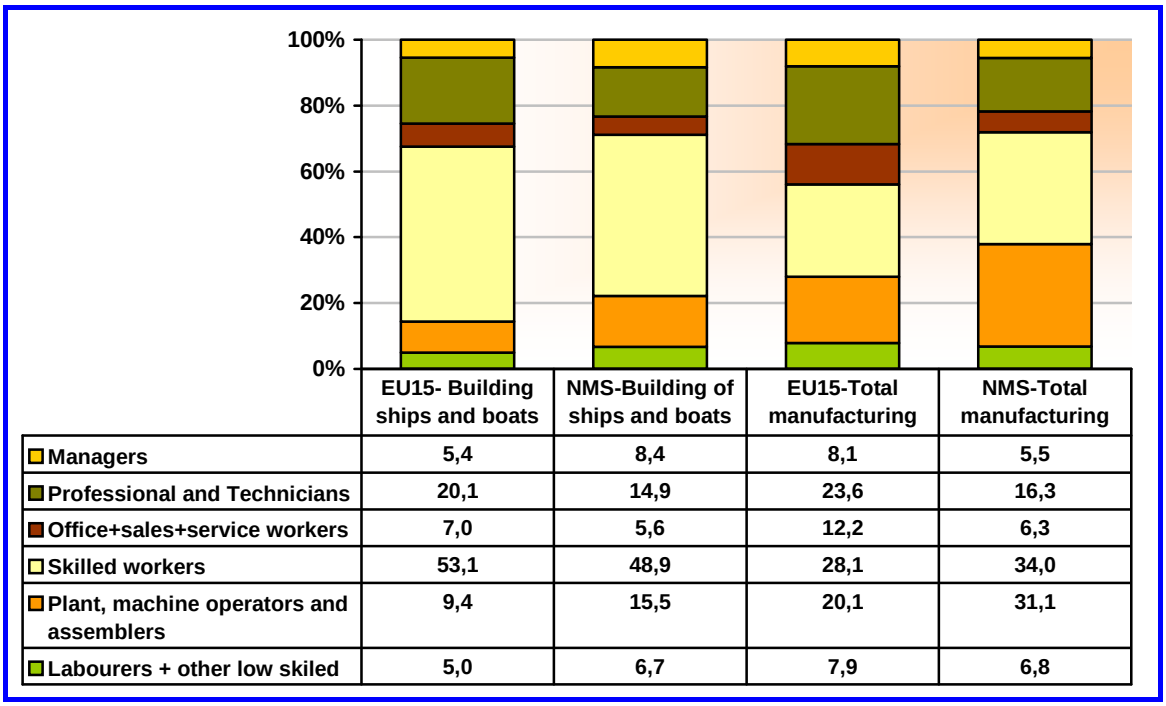
Education system	Average age of starting education	Degree	Level	Technical professions		
				Technical sales / after sales	Design / engineering	Work preparation / production
University or College	18+	University (MSc) or College (BSc) Degree	High	• Sales department managers • Technical sales managers • Proposal engineers • Estimators • After sales managers • Account managers • Customer relation managers	• Design department managers • Engineering department managers • Design managers • Engineering managers • Naval architects • Designers • Structural engineers • Lead engineers	• Work preparation department managers • Production department managers • Work preparation managers • Production manager • General planners/Logistic managers • Project managers • Production coordinators • Repair/Maintenance managers • Dockmasters • HSE managers
Vocational Technical training	16+	Vocational Certificate (below BSc)	Medium	• Technical sales assistants • Assistant estimators • After sales assistants • Account assistants • Customer relation assistants	• Shipbuilding engineers • Mechanical engineers • Electrical engineers • Draughtsmen (CAD) • Engineering planners	• Production assistants • Work preparation assistants • Production planner/Logistic assistants • Foremen • Shipwrights/Master shipbuilders • Master craftsmen • Repair/Maintenance assistants • Assistant dockmasters
Basic technical training		No Vocational Certificate	Low	•	• Shipbuilding draughtsmen • Mechanical draughtsmen • Electrical draughtsmen	• Metalworkers/Steel frame workers • Assembling operators/Steel shapers • Welders • Cutting mechanics • Fitters/Pipefitters/Plumbers • Electricians • Carpenters • Maintenance technicians • Service technicians • Docking assistants

Source: 't Hart P. And Dick Schotte, 2008.

4.4.2. Distribution of occupations in the building and repairing of ships and boats sector: Main figures

According to the available information provided by the Eurostat's European Labour Force Survey, Skilled workers represent the bulk of the workforce in the European building and repairing of ships and boats sector. Thus, up to 53.1% and 48.9% of the EU-15 and New Member States (NMS) sector employment corresponds to this category, well above the second group in importance, this is, Professional and technicians in the EU-15 (they represent a 20.1% of the sector employment) and Plant, machine operators and assemblers in the NMS, 15.5% of employment). Interestingly also, it is worth stressing the higher presence of Skilled workers in the building and repairing of ships and boats sector in comparison to the total manufacturing sector, whereas the analysed sector shows a relatively lower presence of semi-skilled (Plant, machine operators and assemblers) and Low skilled personnel (see Graph 29).

Graph 29. Distribution of employment by main occupational categories, building and repairing of ships and boats sector and total manufacturing, 2007



	EU15- Building ships and boats	NMS-Building of ships and boats	EU15-Total manufacturing	NMS-Total manufacturing
Managers	5,4	8,4	8,1	5,5
Professional and Technicians	20,1	14,9	23,6	16,3
Office+sales+service workers	7,0	5,6	12,2	6,3
Skilled workers	53,1	48,9	28,1	34,0
Plant, machine operators and assemblers	9,4	15,5	20,1	31,1
Labourers + other low skiled	5,0	6,7	7,9	6,8

Source: Eurostat, European Labour Force Survey

Meanwhile, the comparison amongst EU Member States of the presence of occupational categories (see Table 34) shows that, generally speaking, this high presence of Skilled workers can be extended to all the analysed Member States, but specially in Romania and Spain (70.1% and 66.1%, respectively). The only exception to this is given by France (a 26.7% of the French sector workforce belongs to this group), and it is partially explained by the relatively important presence of the group Professional and technicians (in fact, up to 34.7% of the French sector workforce belongs to this group, well above the occupational distribution in other countries). Within this group, in France there is a particularly relevant presence of engineers (31.1% of the total sector French employment), well above the situation in Germany (the second country with higher presence of engineers in relative terms, 14.1%). This high presence clearly contrasts with the situation in Spain or Italy, where only a 8% approximately of the sector workers are engineers. Interestingly also, France also shows a relatively higher presence of managerial personnel (9.6% of the total workforce), where this percentage is much higher than in other analysed Member States.

Table 34. Distribution of employment by occupational categories, building and repairing of ships and boats sector, 2007

Occupational groups	DE	ES	FR	IT	PL	RO	EU15	NMS
Managers	**2,6**	**4,1**	**9,6**	**3,8**	**2,1**	**1,5**	**5,4**	**8,4**
Professional and Technicians	**20,2**	**14,6**	**34,7**	**20,2**	**14,6**	**14,9**	**20,1**	**14,9**
• Computer specialists	1,1	0,2	1,2	0,2	0,0	0,2	0,5	0,0
• Engineers	14,1	7,7	31,1	8,1	10,3	12,9	12,4	8,1
• Business, finance, sales	1,7	0,7	0,0	2,1	1,9	0,0	1,3	1,9
• Other professionals	3,4	6,0	2,4	9,8	2,3	1,7	5,9	4,8
Office+sales+service workers	**7,1**	**8,3**	**10,3**	**5,8**	**7,1**	**2,3**	**7,0**	**5,6**
• Office clerks and secretaries	6,3	7,7	7,5	5,0	5,3	1,3	5,9	5,5
• Service workers	0,8	0,6	2,8	0,8	1,8	1,0	1,1	0,1
Skilled workers	**61,4**	**66,1**	**26,7**	**51,6**	**64,3**	**70,1**	**53,1**	**48,9**
• Skilled workers 1 (1)	15,0	13,4	3,2	11,3	14,2	7,3	12,6	14,8
• Skilled workers 2 (2)	44,3	52,7	23,5	34,2	49,9	62,2	37,7	29,8
• Other skilled workers	2,1	0,0	0,0	6,1	0,2	0,6	2,8	4,4
Plant, machine operators and assemblers	**6,0**	**2,5**	**15,1**	**10,2**	**10,7**	**4,7**	**9,4**	**15,5**
Labourers+ other low skilled	**2,8**	**4,4**	**3,7**	**8,5**	**1,2**	**6,5**	**5,0**	**6,7**
Total	**100.0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

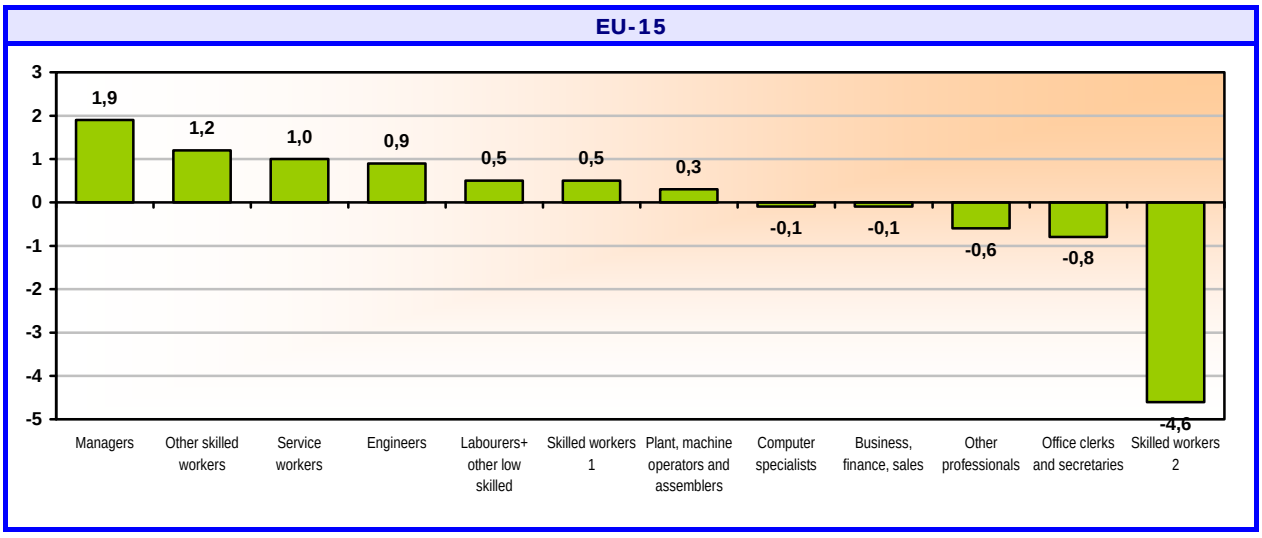
(1) This category includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers

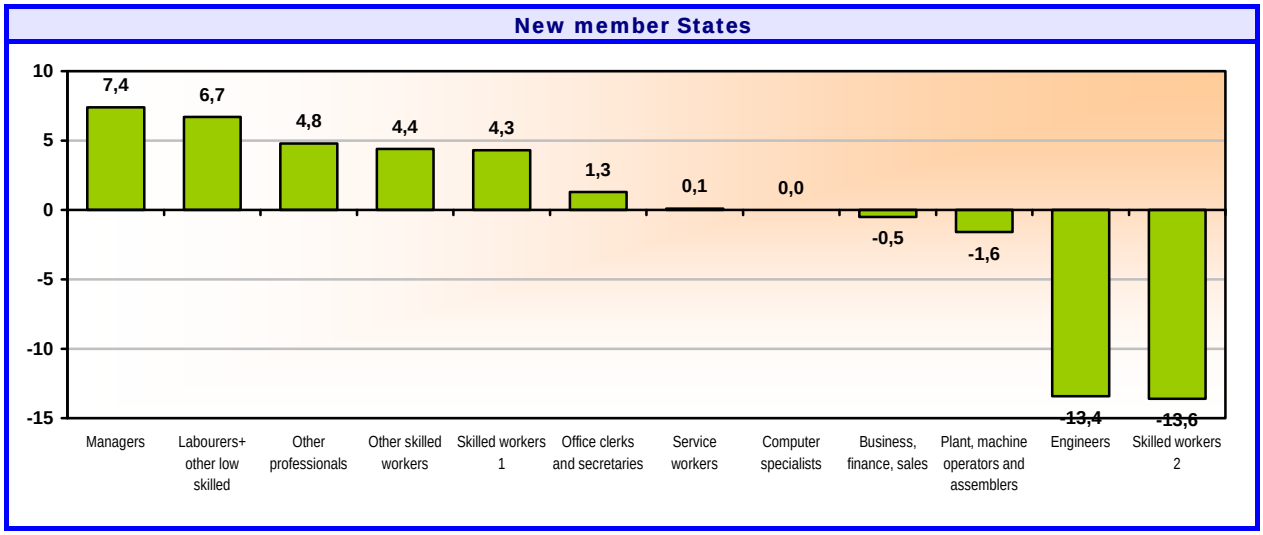
(2) This category includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters

Source: Eurostat, European Labour Force Survey

From a time evolution perspective, it is interesting to notice that, generally speaking, there is a general tendency to increase the relative number of managers, engineers and some skilled workers in the EU-15, whereas in the NMS its is precisely the group of engineers and skilled workers the one that has experienced the most significant reduction in contrast with the increase in the presence of managers and other skilled workers (see Graph 30). In general terms, it is possible to say that the sector is currently experiencing a shift from blue-collar to white-collar employment, basically due to the growing demand for better educated personnel, enhanced competences and the development of a multi-skilled workforce as a result of the existing specialisation on high-tech products.

Graph 30. Percentage point change in the distribution of occupations, EU-15 and New Member States, 2001-2007





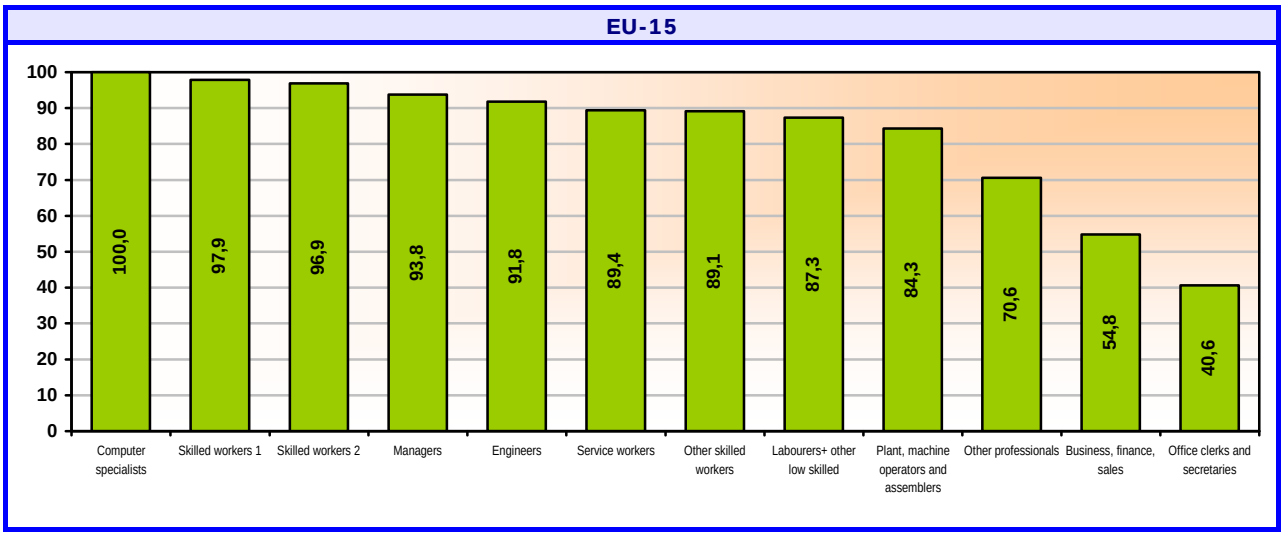
Skilled workers 1 includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers
Skill workers 2 includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters
Source: Eurostat, European Labour Force Survey

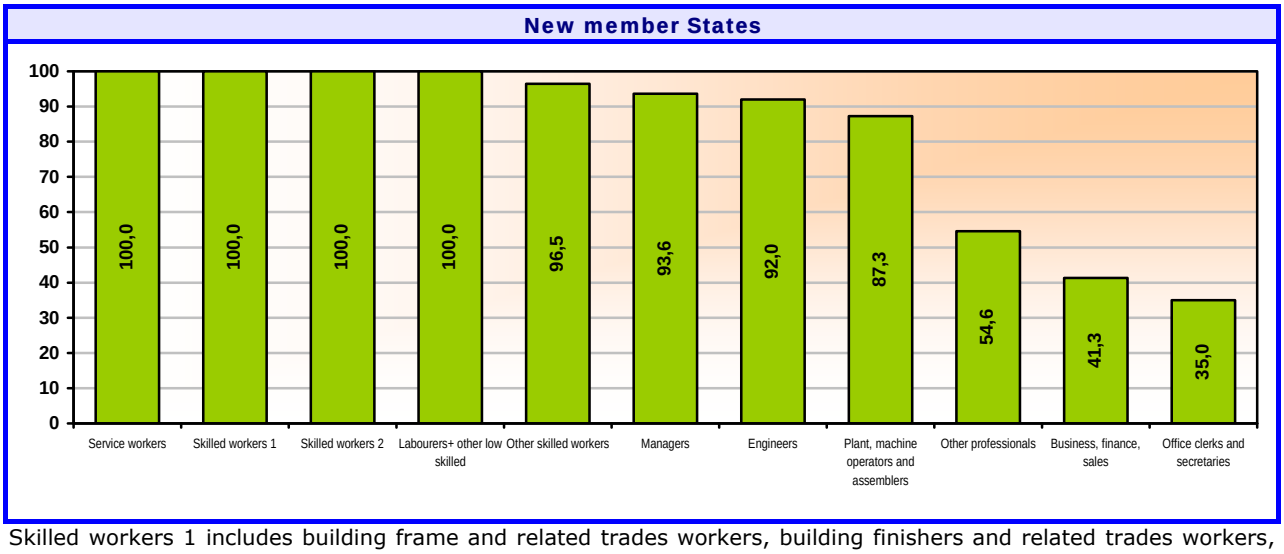
4.4.3. Distribution of occupations in the building and repairing of ships and boats sector by selected variables (gender, age and educational level)

a) Gender distribution

This section is interested in providing information on existing occupational groups in the European building and repairing of ships and boats sector by some selected employment variables, such as gender, age and educational level considerations. In this respect, and as far as gender considerations are concerned, the already suggested male-predominance in the sector can be extended to all the occupations, with the only exceptions of Office clerks and secretaries as well as those professionals involved in business, finance and sales activities (see Graph 31). Just to give some data, up to 65.0% and 59.4% of the Office clerks and secretaries in the NMS and the EU-15 are women, respectively, where these figures sharply contrast with the overall presence of men in the remaining occupations.

Graph 31. Male employment in the different occupations, 2007

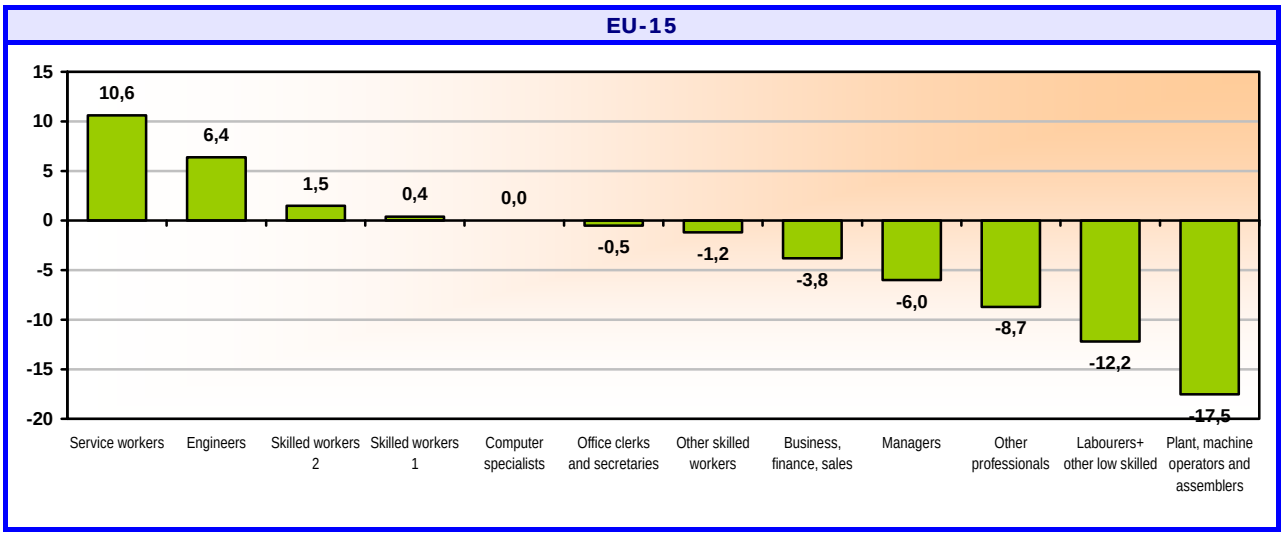


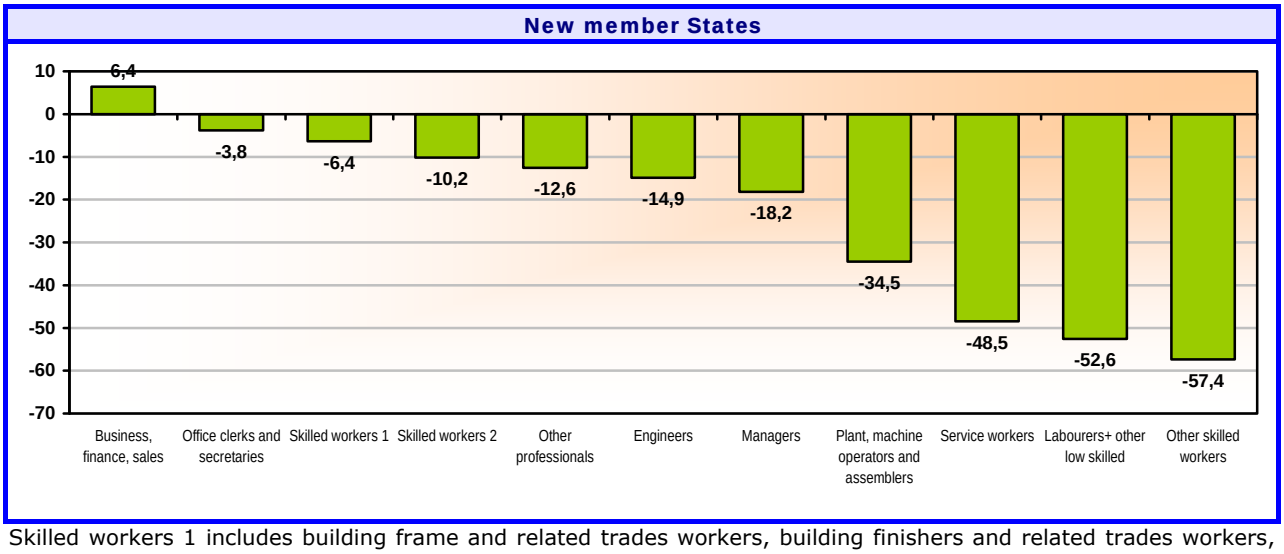


Skilled workers 1 includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers
Skill workers 2 includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters
Source: Eurostat, European Labour Force Survey

In any case, and from a time dynamic perspective (2001-2006), women are becoming more present in some concrete occupations, especially as far as service workers, engineers and skilled workers are concerned in the EU-15 and professionals involved in business, finance and sales activities in the NMS (Graph 32). In any case, and as already suggested, the male predominance within the sector workforce is still a clear fact that will require a large time span to be changed.

Graph 32. Percentage point change in female employment by occupations, EU-15 and New Member States, 2001-2007





Skilled workers 1 includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers
Skill workers 2 includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters
Source: Eurostat, European Labour Force Survey

b) Age distribution

As far as age considerations are concerned, the available data from Eurostat shows that there are a number of occupational groups within the sector particularly affected by ageing problems. In this sense, and focusing on some aggregated data, the groups more affected by this ageing process are the managerial group in the EU-15 as well as the engineers, service workers, skilled workers type 2 and labourers in the NMS, as 33.2%, 32.0%, 28.1%, 26.1%, 28.5% and 26.6% of these groups are expected to be retired in the next 10-15 years (see Table 35).

Table 35. Percentage of employment over 50 years old and older, selected EU Member States and total EU-15 and NMS, 2007

	DE	ES	FR	IT	PL	RO	EU15	NMS
Managers	34.0	35.2	29.4	40.9	33.0	31.1	33.2	32.0
Computer specialists	17.5	11.8	17.0	8.0	14.0	11.0	14.4	10.2
Engineers	25.3	15.2	21.1	18.0	24.1	31.8	22.5	28.1
Business, finance, sales	23.5	25.3	18.5	17.3	15.0	15.5	21.5	18.1
Other professionals	27.1	18.8	17.4	17.7	23.5	15.8	21.7	22.1
Office clerks and secretaries	25.3	18.3	25.3	16.9	17.0	16.6	22.8	23.1
Service workers	25.7	21.5	14.3	15.5	20.8	16.5	21.0	26.1
Skilled workers 1 (1)	25.9	16.4	26.8	17.1	15.7	20.8	22.8	20.3
Skilled workers 2 (2)	22.2	22.9	22.6	20.3	26.1	24.0	23.0	28.5
Other skilled workers	22.9	23.2	20.8	21.3	10.8	13.6	22.3	20.8
Plant, machine operators and assemblers	25.7	20.8	22.3	16.0	14.6	13.6	22.1	21.2
Labourers + other low skilled	27.8	14.5	20.6	18.5	19.7	13.0	23.8	26.6

(1) This category includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers
(2) This category includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters
In red those categories in selected Member States where more than 1/4 of the employment is 50 years old or older
Source: Eurostat, European Labour Force Survey

From a national perspective, this ageing problem seems to be particularly acute in some occupational groups within concrete Member Sates. Thus, and in addition to the managerial occupations (affected by the ageing problem in all Member States), other groups also particularly affected include the Romanian engineers (31.8%) or the German labourers and other professionals (27.8% and 27.1%, respectively).

c) Educational level

Concerning the educational levels of existing occupational groups, the available information shows that, generally speaking, it is possible to identify a clear and direct relationship between the higher hierarchical position of the occupational groups and the presence of people with tertiary (University) educational levels. Thus, tertiary educational levels are particularly present in some occupational categories such as managers, engineers and other professionals in business, finance and sales activities. By way of contrast, the presence of university degree personnel amongst skilled workers, machine operators/assemblers or labourers is much less important (see Table 36).

Table 36. Percentage of employment with tertiary educational levels by occupational groups, in selected Member States and total EU-15 and New Member States, 2007

Occupational groups	DE	ES	FR	IT	PL	RO	EU15	NMS
Managers	61.7	54.8	91.9	9.5	100.0	100.0	46.0	50.7
Computer specialists	29.6	0.0	47.4	0.0	0.0	100.0	34.5	0.0
Engineers	67.4	100.0	46.4	28.8	63.6	65.8	54.5	64.6
Business, finance, sales	31.9	48.8	0.0	91.6	68.4	0.0	62.2	73.9
Other professionals	42.5	73.5	32.9	9.7	17.8	41.3	28.8	43.8
Office clerks and secretaries	21.0	31.5	49.5	0.0	21.1	0.0	21.2	43.3
Service workers	43.7	46.4	0.0	30.4	0.0	0.0	17.1	0.0
Skilled workers 1 (1)	11.2	18.3	15.5	0.0	6.1	0.0	7.4	9.7
Skilled workers 2 (2)	2.8	18.6	10.0	0.0	0.0	0.0	5.9	4.7
Other skilled workers	11.4	0.0	0.0	4.8	0.0	0.0	6.2	0.0
Plant, machine operators and assemblers	0.0	3.5	8.6	0.0	0.0	0.0	1.9	10.8
Labourers + other low skilled	0.0	25.0	0.0	2.6	0.0	0.0	5.0	0.0

Skilled workers 1 includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers

Skill workers 2 includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters

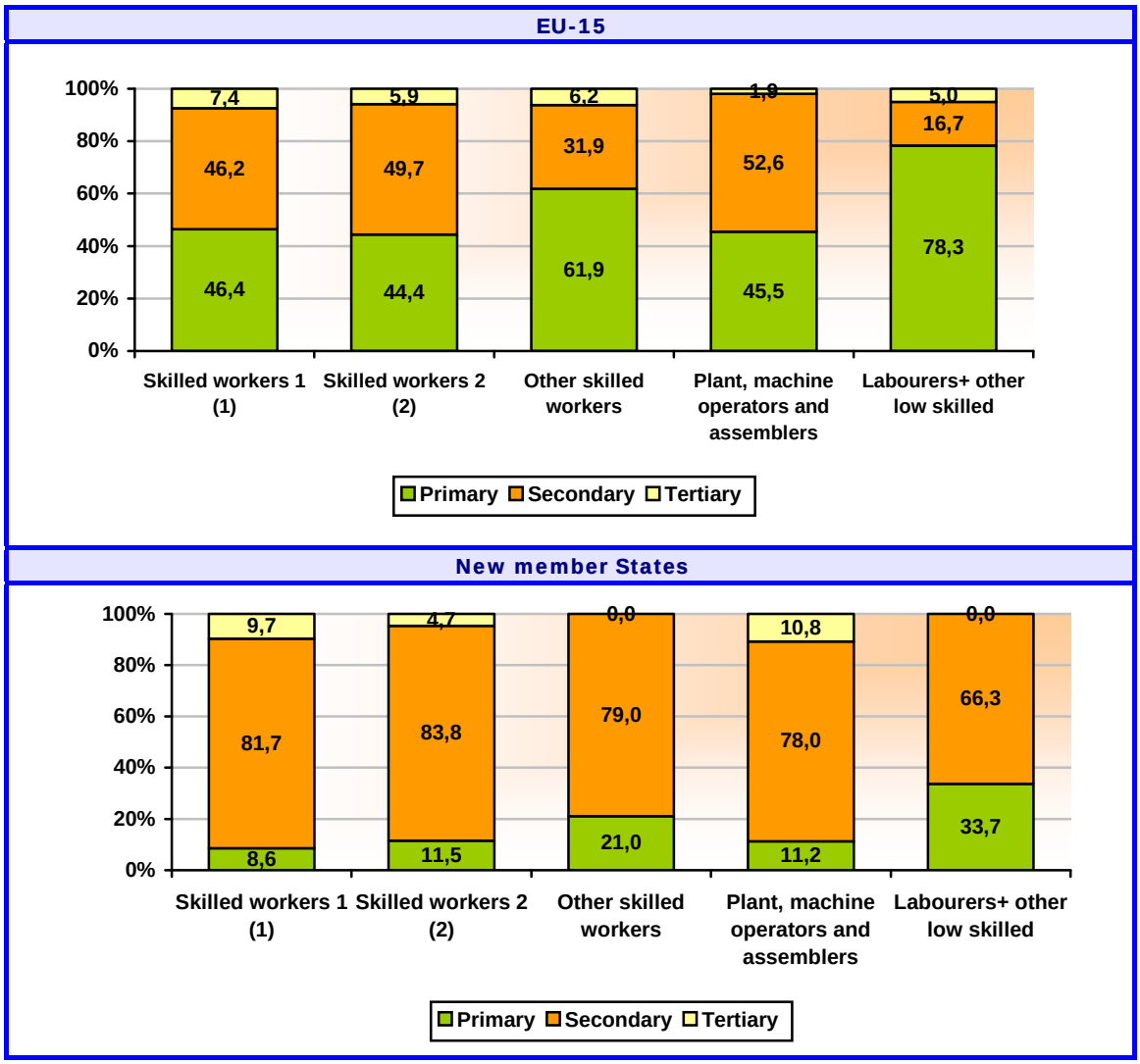
Source: Eurostat, European Labour Force Survey

In any case, the available data shows important differences in the educational attainment of some occupational groups between countries. Thus, and whereas in Italy only 9.5% of managers have a tertiary educational level, this percentage increases to 54.8% in Spain and above 60% in the remaining analysed countries. Also, and as far as the engineers occupational group is concerned, the two opposite situations can be found in Italy and Spain, so if only 28.8% of the Italian engineers have a tertiary educational level, this percentage increases to 100.0% in the case of Spain (see also Table 36).

Focusing on the occupational groups in the lower hierarchical positions (skilled workers, machine operators and labourers), it is possible to observe that the largest percentage of skilled workers type 1 and 2 and the group of machine operators/assemblers have secondary educational levels (most probably linked with vocational training qualifications), whereas the group of labourers and other skilled workers are more dominated by people with low educational levels (compulsory education). These results can be extended to the EU-15 and the NMS, although the available data shows that the educational attainment of the skilled and low skilled NMS workers is higher than their EU-15 counterparts, as the

percentage of people with medium educational levels is higher in all the NMS occupational groups (see Graph 33).

Graph 33. Distribution of employment in some selected occupational categories by level of education, 2007



(1) This category includes building frame and related trades workers, building finishers and related trades workers, painters, building structure cleaners and related trades workers

(2) This category includes metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers; Blacksmiths, tool-makers and related trades workers; machinery mechanics and fitters; electrical and electronic equipment mechanics and fitters

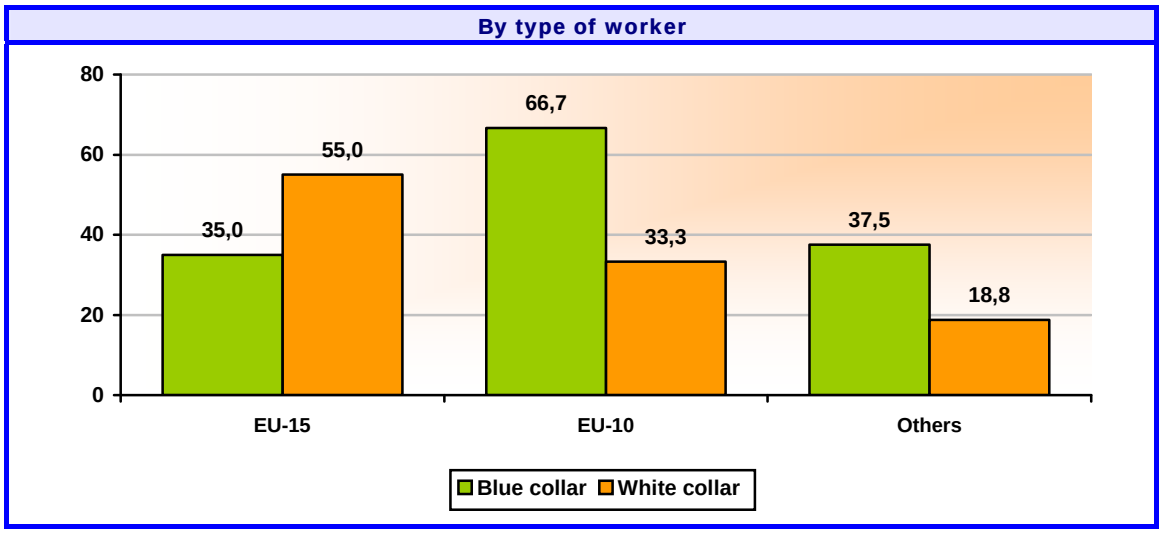
Source: Eurostat, European Labour Force Survey

4.5. CURRENT CHALLENGES EXPERIENCED BY THE BUILDING AND REPAIRING OF SHIPS AND BOATS SECTOR IN THE EMPLOYMENT DOMAIN

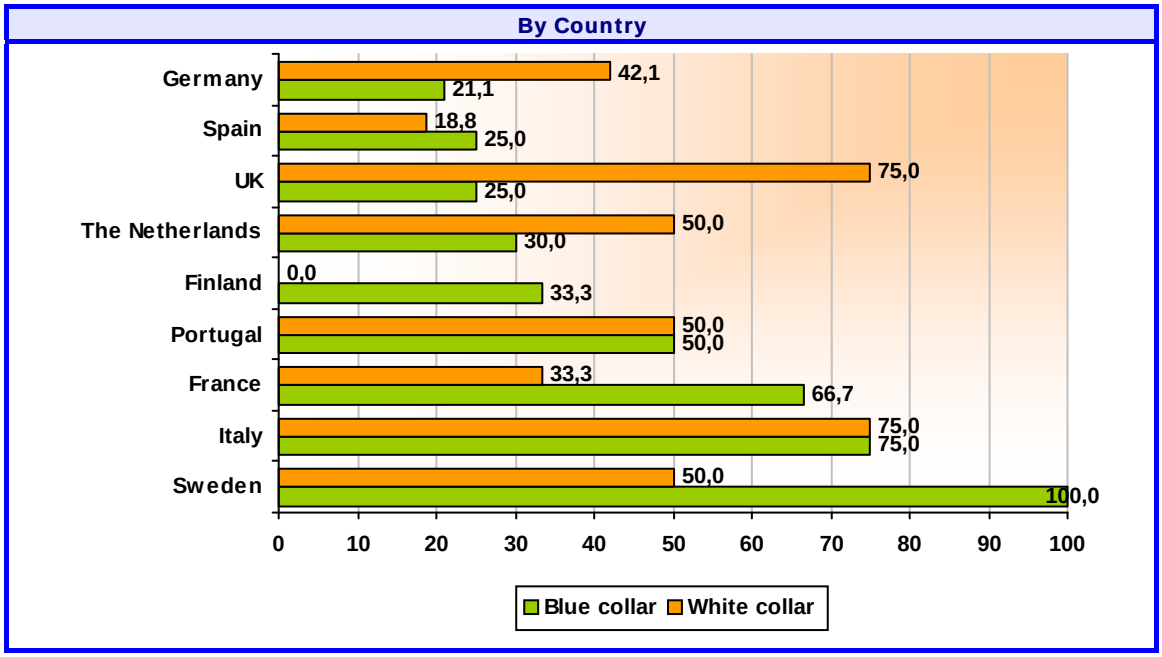
The European building and repairing of ships and boats sector currently faces a number of challenges in relation to the employment issue. These challenges include the cyclical nature of the sector work, difficulties in retaining and recruiting new people into the sector (especially young people) and, finally, changes in skill profiles. These challenges, which most of them are inter-linked with each other, can be summarised as follows (ECOTEC, 2006):

- Cyclical nature of the shipbuilding industry. The fact that the industry is sensitive to economic and contract-driven fluctuations (specially in the ship repair industry) explain the fact that the sector often relies on flexible work organisation methods often linked to poor job security conditions (i.e. short-term contracts and temporary labour practices). This insecurity has also redounded in early retirement practices (which has resulted in a deskilling process for the sector), poor image of the sector amongst potential new recruits[23] and interest of individuals to shift to other more stable sectors. However, these cyclical employment practices do not go well in hand with the increasingly high technology content of the industry.
- Difficulties in retaining and recruiting new people into the shipbuilding sector, especially as far as the attraction of young people is concerned. In this sense, and according to a recent survey conducted in Europe (Tholen and Ludwig, 2006), up to 55% and 35% of the EU-15 shipyards suggest to be affected by problems in recruiting white and blue collar workers, respectively, where these recruitment problems seem to be higher in the merchant ship sector and in countries such as Italy, Sweden or the United Kingdom (see Graph 34). The main reasons underpinning this situation include the lack of an appealing image of the sector (often linked to a 'steel and dirt', 'industry in decline' image as a result of past large scale redundancies and despite the fact that wages are often higher than the national average) or the cyclical nature of employment relationships (due to the cyclical nature of the sector). In this sense, the sector is currently characterised by important labour skill shortages in a number of blue collar fields such as metal workers (especially welders) and pipe workers, as well as in university graduates such as engineers and naval architects, where this skill shortage problem has been aggravated by the substantial employment cuts and the strategies of outsourcing and subcontracting experienced by the sector in the last twenty years, as well as by a low number of qualified university graduates and school leavers suitable for the shipbuilding industry (see Graph 35.). These skill and labour shortages can have a negative influence on the capacity of the European shipbuilding industry to take advantage of the increased demand for new specialised ships.

Graph 34. Recruitment difficulties in the shipbuilding and repair industry, 2006

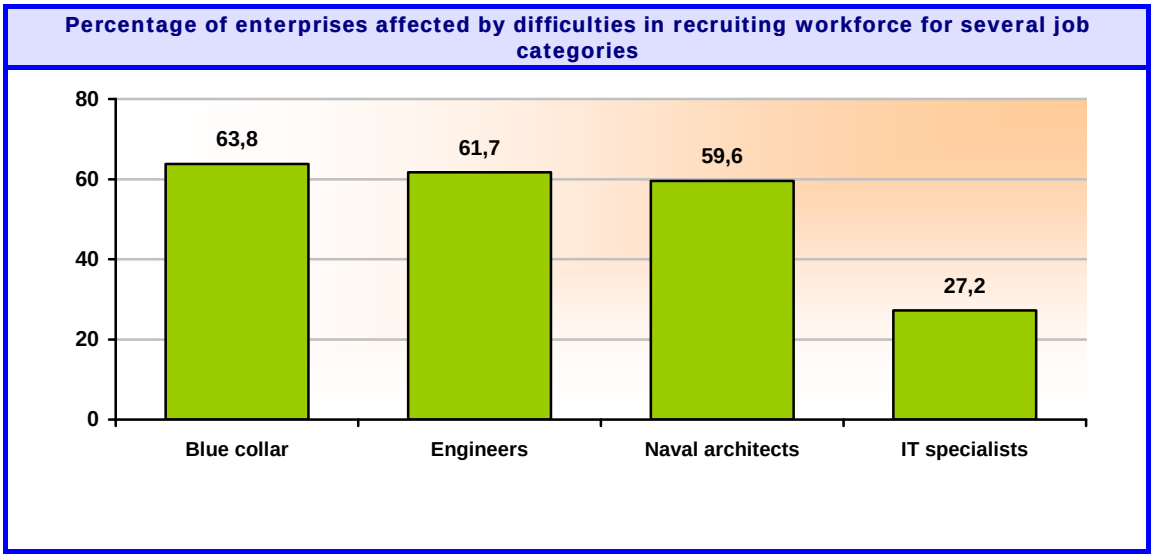


[23] Although the sector reckons that this poor image is improving in the last years

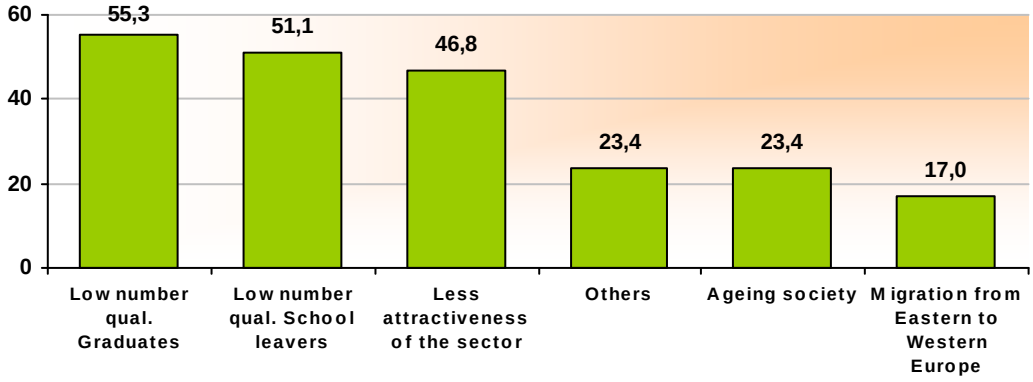


Source: Tholen and Ludwig, 2006.

Graph 35. Recruitment difficulties in the shipbuilding and repair industry, 2008



Reasons for the difficulties in recruiting skilled workforce



Source: Tholen, Ludwig and Smets, 2008.

- Meanwhile, and as far as the building and repair of recreational boat sector is concerned, this sector also faces important challenges in recruiting, training and retaining skilled workers, partially due to the highly specialised skills (i.e. working with materials such glass fibre, etc) needed and also partially due to the labour intensive nature of the sector. In this sense, labour shortages have been identified concerning engineering and technical staff (especially electricians, mechanists, laminators and carpenters) due to the highly specialised skills needed in the industry, as well as a need for staff with specific administrative and management knowledge[24] (ECOTEC, 2006). Also, some problems with retaining staff have been identified in the Southern and Eastern European recreational boating industry. The fact that most of the training is proving in-house via apprenticeship practices obviously complicates the situation for the sector, as in many cases enterprises lack the required resources (in terms of people, premises or money) for training in new skills/competences[25].
- An ageing workforce. A previous section in this report has shown that some occupational groups in some European countries are experiencing an important ageing problem, as a large percentage of some groups are going to retire in the near future and their skills and competences with them. Of course, this problem is also aggravated by the existing difficulties in attracting young workers to the sector, as it was mentioned before.
- Changes in skill profiles. In addition to the difficulties in recruitment already analysed before, the shipbuilding sector is currently experiencing a change in the requested skill profiles. In any case, this section will be discussed in further detail in a subsequent chapter on emergent competences in the building and repairing of ships and boats sector

[24] Administrative expertise is particularly important given the substantial and complicated administrative requirements (regulations) in the sector.

[25] Some national associations (i.e. the Italian and British ones) are currently involved in the management and provision of training activities for associates intended to compensate for existing skill deficits in the sector.

5. INDUSTRIAL OUTLOOK FOR THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOAT SECTOR

5.1. MAIN STRENGTHS AND WEAKNESSES OF THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOAT SECTOR

5.1.1. Strengths of the European Building and Repairing of Ships and Boat Sector

The main strengths of the European Building and Repairing of Ships and Boat Sector can be summarised as follows[26]:

- **Strong historical tradition of the sector as a whole in Europe**. This strong tradition redounds in a robust and solid knowledge base in Europe, well reflected in the existence of a large network of agents in the sector including producers, suppliers, public authorities and academic and training agents. Of course, this solid knowledge base positively contributes to the production and specialisation in high-tech products (see next paragraph).
- **European specialisation in the production of high tech vessels and boats**. On the one hand, and as far as shipbuilding is concerned, Europe can be defined as a world leader in the production of several high tech market segments, both surface and submarine. Thus, European shipyards are increasingly specialising in the production and repairing of high-value, complex, know-how dominated high-tech market segments and niches (i.e. cruise ships, fast ferries, non-standardised container vessels, dredgers, off-shore support vessels, naval vessels such as conventional submarines and fast patrol boats, research vessels and other specialised vessels) that, in most cases, require custom-made one –off products with limited opportunities for series production. At the same time, some low-value market segments (i.e. bulk carriers and crude oil tankers) are increasingly being abandoned by European producers and taken over by Asian yards (specially Korean and Chinese ones). In any case, it is worth stressing the existence of important differences amongst the European countries in terms of product specialisation, especially when comparing the former EU-15 specialisation with the new EU Member States' specialisation, much more involved in the production of standardised vessels with a low R&D content level[27]. On the other hand, and concerning the pleasure and sporting boats sector, a similar picture can be identified, so the European sector is currently world leader in some highly specialised subsectors such as the production of exclusive super yachts or sailboats (see section 3.4 for more information on this).
- **High levels of R&D investment in the European Building and Repairing of Ships and Boat Sector.** In this respect, the European building and repairing of ships and boat sector is very active in the R&D domain (see Graph 9), where this high investment in R&D enable the sector to produce high quality and customised vessels and the development of innovative solutions for new products and processes. This focus on R&D activities is particularly relevant for the marine equipment sector.
- **Presence of a highly consolidated network of suppliers, mostly of them SMEs.** In this sense, the European builders of ships and boats (specially the first ones) have been involved in the last 20 years in very active outsourcing strategies, which have generated a very developed and advanced European supply industry. Thus, and according to some EMEC estimations, a range between 50-70% of the total production

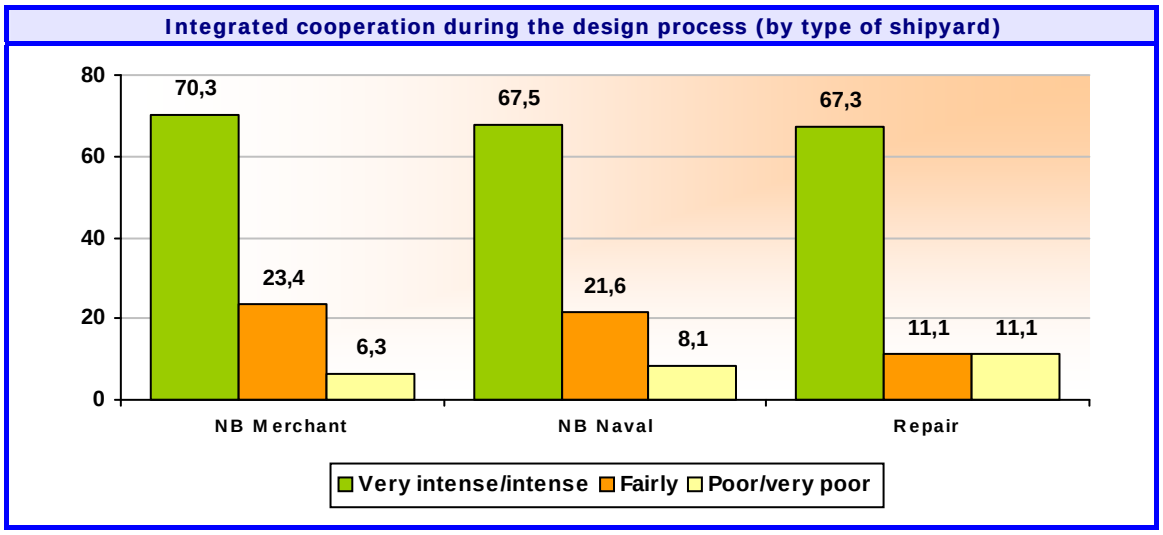
[26] These strengths are presented in a Pan-European perspective. Of course, these strengths can have a different importance amongst European countries due to differences in country-specific conditions such as the structure of the industry in terms of the degree of concentration or the product markets in which companies operate.

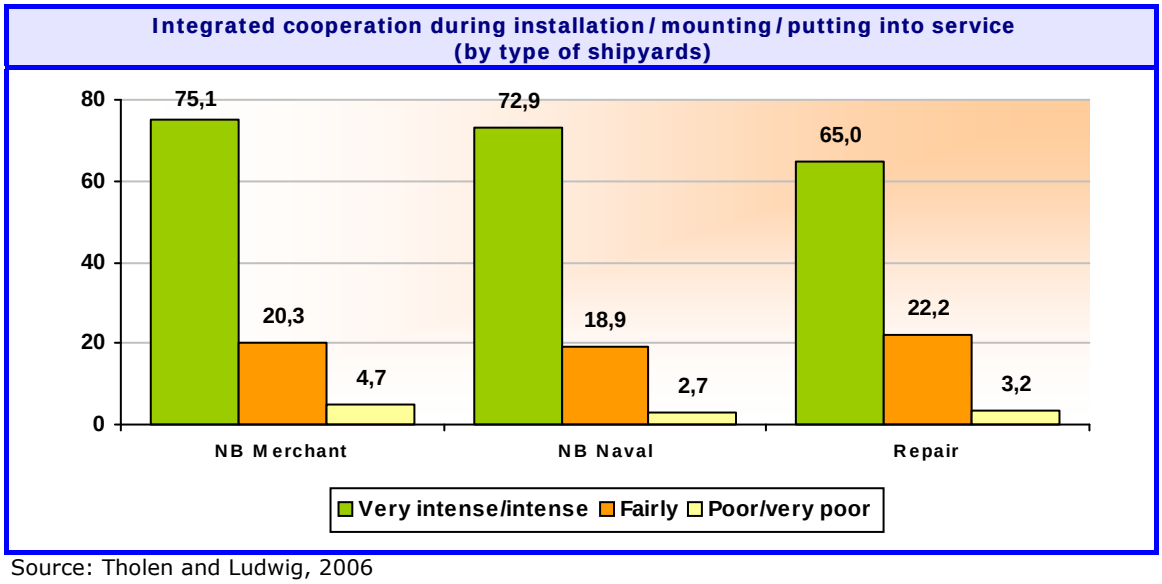
[27] In any case, the sector representative association (CESA) suggests that the presence of a large mix of product portfolio in the European industry is good for the sector as a whole, as it is not dependant on a very limited number of demand sectors.

is sourced across a European network of more than 9,000 mostly small and medium sized supply companies, where in complex ships such as those produced in Europe this percentage can be of up to 70-80%. Therefore, the competitiveness of the European shipbuilding industry is strongly dependant on the quality of the European supply industry, not only as far as equipment and raw material suppliers, but also as far as suppliers of sub-assembled blocks or parts of the ship are concerned. It is also worth mentioning that the presence of a high number of SMEs and a good balance with large enterprises also implies a high degree of flexibility for the sector, which obviously may have positive effects for the sector as a whole.

- **Strong co-operation and integration with suppliers.** Vertical cooperation and integration with suppliers is currently viewed as an essential competitiveness factor, specially having in mind that the move towards outsourcing and greater specialisation is requiring skills that are not necessarily held in-house and are often at the hands of the supplier. This co-operation, helped by existing ICT applications, enable suppliers to be an integral part not only in the design phase but also in the installation, mounting and putting into service phases, helping final producers to find specialised and innovative solutions for special problems. Not surprisingly, an average of 70% of all types of European shipyards state that their cooperation during the design process and the installation/mounting/putting into service phases is very intensive, although this level of cooperation is much higher in the EU-15 than in the new Member State countries (Tholen and Ludwig, 2006) (see Graph 36). Meanwhile, the same study shows that joint working groups from both the yards' and the suppliers' sides (an increased form of co-operation with suppliers) can be found in a high percentage of cases, where there is a positive correlation between the existence of joint working groups and the complexity of the ships built by the yard. Joint working groups can be found in approximately 50% of the repair yards and 58% and 62% of the merchant and naval yards, where all yards involved in building passenger ships (ferries, cruisers) affirm the existence of these joint working groups (see Graph 37).

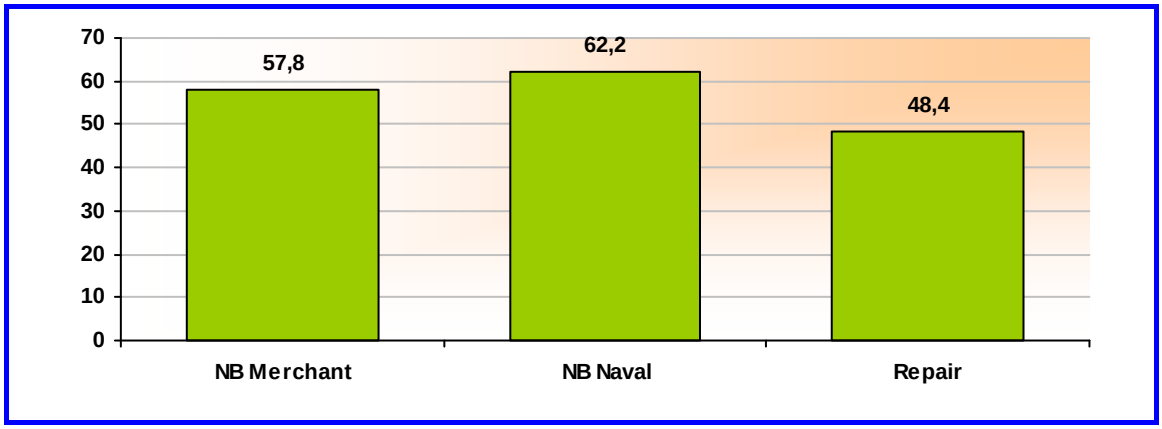
Graph 36. Vertical co-operation between yards and their suppliers during design process and installation, by type of shipyard, 2006





Source: Tholen and Ludwig, 2006

Graph 37. Existence of joint working groups from both yards' and suppliers' side to develop projects / products, 2006



Source: Tholen and Ludwig, 2006

ρ **Strong collaboration between public and private agents in favour of the shipbuilding sector.** In this respect, the European building and repairing of ships sector representative organisations have always had clear that the future of the sector is strongly subject, amongst other issues, to a significant public support (either at national or European level) in a number of fields. In this respect, one of the most important recent examples of this public-private collaboration is given by the LeaderShip 2015 Strategy, presented to the European Commission in October 2002 and intended to outline a robust strategy aimed at providing answers to the key challenges facing the European shipbuilding industry by 2015.

Table 37. Brief description of the Leadership 2015 initiative

- The LeaderSHIP 2015 initiative goes back to the Council conclusions of 14 May 2001 where the Council called upon "the EU shipbuilding industry to continue improving its competitiveness". In March 2002 the industry presented the idea of such an initiative to the President of the Commission, Romano Prodi, who responded positively and requested the Commissioner responsible for enterprise, Erki Liikanen, to set up a working structure based on a detailed work plan. Against this backdrop, the High Level Advisory Group for LeaderSHIP 2015 was set up in January 2003 (see IP/03/120), and in October 2003 presented 30 specific recommendations in eight key areas for the competitiveness of the European shipbuilding and repair industry.
- LeaderSHIP 2015 embodies the main elements of the Lisbon Strategy and puts into practice the new comprehensive and coherent approach to the shipbuilding and repair industry[28]. It represents the culmination of the joint efforts of all the relevant players – the shipbuilding industry (CESA), the trade unions (EMF) and the EU – to ensure the future and competitiveness of this European industrial sector which is of strategic significance in a dynamic growth sector, but which is faced with a series of problems and distortions.
- The Commission's communication analyses and assesses the main issues addressed by the High Level Advisory Group, while policy actions are identified. These relate in particular to the key issues of an integrated approach to industrial and transport policies, increased knowledge-intensity, highly-qualified human resources, structural/organisational changes, technological and non-technological innovation and intellectual property rights protection.
- With its communication, the Commission translates the conclusions of the LeaderSHIP 2015 High Level Advisory Group into official EU policy, confirming that a horizontal policy must be supported by specific sectoral approaches. The recommendations of the High Level Advisory Group's report are integrated into the eight key areas/chapters with corresponding Commission positions/actions as follows:
- Establishing a level playing field in world shipbuilding
- Improving research, development and innovation investment
- Developing advanced financing and guarantee schemes
- Promoting safer and more environment-friendly ships
- A European approach to naval shipbuilding needs
- Protection of intellectual property rights
- Securing the access to a skilled workforce
- Building a sustainable industry structure.

Source: European Commission, 2003b

- **Increasing levels of productivity in the European Building and Repairing of Ships and Boat Sector.** In this respect, this specialisation of European ship and boat yards in high tech market segments is accompanied by a strong focus by large shipyards on increased efficiency and productivity, whereas following both a comparatively conservative approach with respect to pure capacity expansion and a strong emphasis on subcontracting activities. Not surprisingly, productivity levels have experienced a remarkable upward trend in the time period 1985-2000 (see Graph 6), resulting in an increasing value added per person employed. Of course, important differences can be appreciated amongst Member States, especially between the "old" and the "new" Member States.
- **Presence of a highly skilled workforce.** Despite existing difficulties, the European ship and boat building industry benefits from a highly skilled workforce that is at the heart of the specialisation of the European industry on capital-intensive and know-how dominated high-tech market segments. In this respect, a highly-skilled workforce is a key factor in turning knowledge into wealth and ensuring productivity, innovation and competitiveness in the European technologically advanced shipbuilding industry. Of course, this also requires that ship and boat yards need to recruit, retain and retrain quality workers to maintain their skills base and know-how and secure their long-term success.
- **Fluent Social dialogue in the sector, especially as far as human resources and skills issues are concerned.** In this respect, and specifically for the European Shipbuilding sector, the Community of European Shipyards Associations (CESA) and the European Metalworkers Federation (EMF) established back in September 2003 a formal Social Dialogue Committee for the shipbuilding and ship-repair sectors, which

[28] Similar to the G10 Medicines initiative for the pharmaceutical industry and the STAR 21 initiative for the aerospace industry.

was the first of its kind in the metal trades in the EU[29]. So far, this Committee has created three working groups on the image of the sector, worker training and qualifications and cyclical activities and restructuring issues, and has developed a number of initiatives that are summarised in next Table 38. .

Table 38. Main recent activities carried out by the European Social Dialogue Committee for the shipbuilding and ship-repair sectors

- The Committee has delivered practical initiatives like the European "Shipyard Week", developed several years. The prime objective of the "Shipyard Week" is to reinforce and spread the message of LeaderSHIP 2015, improve the attractiveness of shipyards as a workplace for young graduates and highly-skilled professionals and promote a positive image for the sector. In October 2005, an experts' workshop to exchange best practice related to training & skill retention was held.
- Planning is already underway for a similar exercise in 2008. But the problem of the image of shipbuilding which is often portrayed as an old industry with an uncertain future remains and must continue to be addressed. Young graduates and highly skilled workers are not always aware of the opportunities available as a result of the dynamic evolution of shipyards in recent years. Meanwhile, the MIF also called for a European Maritime Day in its recommendations at the last plenary session in Oslo (Norway) in October 2006.
- Going forward, the Social Dialogue committee is currently preparing a new project to develop an aggregate age and qualification profile that could be used to identify future training and recruitment requirements. This also envisages analysing and addressing the problem of an ageing workforce that is particularly acute in some Member States and could complement any future Commission initiatives in the field of maritime skills.

Source: European Commission, 2007

ρ **Presence of a large network of training and education providers related to the sector.** In fact, one of the main strengths of the European sector refers to the existence of a wide network of good training and education providers related to the sector (vocational training centres, universities), etc. However, these providers also suffer from several weaknesses that are commented later on.

5.1.2. Weaknesses of the European Building and Repairing of Ships and Boat Sector

The main weaknesses of the European Building and Repairing of Ships and Boat Sector can be summarised as follows[30]:

ρ **Insufficient collaboration in the RDI domain.** It is a well recognised weakness of the sector that many companies in the sector do not yet sufficiently co-operate between them and with universities in the RDI domain, where these later ones are also often criticised by the fact that they are not sufficiently market-oriented. This situation results in problems for developing new products and processes within the industry from available innovations developed elsewhere. Not surprisingly, one of the targets of the WATERBORNE Vision 2020 is to strengthen the cooperation between the universities and the industry and allow for a better transfer of know how and technology amongst enterprises themselves and from other sectors (Waterborne, 2007).

ρ **Difficulties in financing and guaranteeing schemes.** The shipbuilding sector is characterised by important financing needs, as shipowners require loans up to 80% of the contract price in order to successfully conclude a newbuilding or a major conversion contract. In fact, the value added by the yard's own activities amounts to the smaller part of the total contract sum, while it has to assume full liability for the entire project, so most shipowners require bank guarantees for any down payment made during the

[29] In any case, it is also worth mentioning that in some countries, this social dialogue is not as fluent as at Pan-European level.

[30] These weaknesses are presented in a Pan-European perspective. Of course, these weaknesses can have a different importance amongst European countries due to differences in country-specific conditions such as the structure of the industry in terms of the degree of concentration or the product markets in which companies operate.

construction of the vessel. This situation is currently aggravated by the current financial 'crunch' plus the fact that a number of commercial banks are reducing their interest in shipbuilding and hence their commitment to the industry (with important differences by Member States). All these factors lead to growing difficulties for the arrangement of the ship financing, both during construction (the pre-delivery financing) as well as after the ship is delivered to its owner (the post-delivery financing).

- EU enlargement is creating additional needs for **industrial restructuring and modernisation of shipyards in some Eastern European countries**. Equally to what already happened in the EU 15 Member States, shipyards in the new Member States in Central and Eastern Europe are currently suffering from important modernisation and restructuring processes, linked with privatisation, changes in production methods (increased input of RDI, use of subcontractors, etc), changes in markets and clients (i.e. former Latvian shipyards were focused on ship construction and repair from the former USSR under COMECON), changes in the supply of raw materials, changes in legal and financial guaranteeing frameworks and, very often, reduction in staff numbers. This situation is expected to continue in the near future (specially if new countries join the EU, such as Croatia), due to still existing differences in productivity between the "old" and the "new" Member States and the specialisation of some of these "new" Member States on market segments specially affected by the fierce competition from third non-European countries. In any case, it is worth stressing that some large EU-15 manufacturing groups are investing in Polish and Romanian shipyards.
- **Lack of a European-wide Naval shipbuilding sector.** In this sense, and compared to other defence sector (i.e. aviation), the European naval shipbuilding is dominated by national companies poorly integrated amongst each other (the naval sector is present in Germany, France, Italy, Spain, The Netherlands and The United Kingdom). This situation is explained by several factors, such as the existence of diverging operational requirements coming from the national navies, different procurement cycles differ between countries, the existence of non-harmonised export rules in the Member States, based on different traditions and diverging geo-political objectives and, finally, the absence of a truly common market for naval defence equipment (see Table 39).

Table 39. Brief description of the European Naval shipbuilding sector

- Naval shipbuilding represents a significant share of the European Shipbuilding sector in terms of turnover, applied technology and employment. Its products are worldwide recognised, both in terms of quality and price. Due to structural decreases in defence spending on naval hardware, export is becoming more and more important to maintain critical mass and to provide the necessary continuity for the sector. The main companies leading the European Naval Defence Industry are: Thyssen Krupp Marine Systems (TKMS) (Germany), DCNS (Direction de Construction Navale) (France), Fincantieri (Italy), BAe Systems and VT Group (UK), Damen Shipyards Group (The Netherlands) and Navantia (Spain).
- For the majority of the naval shipyards, the home market is still the prime source of income. National solutions and selective cooperation prevail in this sector. Europe has to contend with the existence of a series of companies of different nationality, subject to different rules and with ties in certain cases to different governments. However, the naval sector is undergoing significant technological changes as well as more and more complex and expensive technologies, which requires in turn collaborative solutions amongst European shipbuilders in order to successfully cope with existing defence demands specially in comparison to other competitors (USA, Japan, China, etc). However, European-wide solutions (similar to Airbus or EADS) are not yet on the agenda, neither there is a development of transnational programmes involving more than two or three countries (i.e. Fremm, CVF/PA2 and others).

Source: own elaboration based on CESA, 2008 and BIPE, 2008

- **Relatively high presence of SMEs in some concrete subsectors.** This report has already suggested that some subsectors (i.e. the marine equipment sector or the building and repairing of recreational boats sector) are particularly characterised by a very high presence of SMEs. This situation may have negative consequences, in terms of lack of corporate structures for getting involved in RDI activities or in accessing to external markets, weak financial structures or higher presence of precarious forms of

employment. In this respect, horizontal networking between companies, in addition to vertical co-operation with other industries, can assist to overcome this weakness as SMEs may benefit from external spill-overs, suppliers and distributors. This situation may give rise to technological and organisational modernisation that will eventually lead to further increase in labour productivity, innovation and economic growth.

- **Difficulties both in retaining the existing workforce and in recruiting new personnel.** A previous section in this report has shown that the European building and repairing of ships and boats sector is currently experiencing difficulties in both retaining and attracting new workforce to the sector. This situation is explained by a number of intertwined factors, such as the lack of an appealing image by the sector (linked to the 'steel and dirt' bad image of the sector)[31], the cyclical (contract-driven) nature of the industry (so the sector is seen to provide insufficient job security, better job opportunities in other sectors or countries (i.e. Eastern European workers) and, finally, changes in the profile of the required skills and failure of the existing training supply to satisfy these new skill profiles. Of course, these factors are currently aggravated by a decreasing and an ageing European workforce. Of course, this situation is negatively affecting the capacity of the European ship and boat building industry to effectively compete and to take advantage of the increased demand for new ships and boats, and poses an important question mark on the future competitiveness of the European sector, specially having in mind is specialisation in high-tech, high value market segments.
- **Existing gap between existing training supply and companies' skill needs.** According to some qualitative information collected from interviews, it is possible to suggest a relevant problem related with a lack of correspondence between enterprises' skill needs and the skills/qualifications provided by training suppliers (either at the university or at the vocational training domain), which demands from enterprises additional efforts in terms of re-skilling and continuing vocational training activities for new employees. This situation is also aggravated by the predominance in some countries of theoretical training approaches that do often lack much empirical and practical information/knowledge needed to perform a profession/job.

5.2. MAIN FACTORS OF CHANGE (OPPORTUNITIES AND THREATS) FOR THE EUROPEAN BUILDING AND REPAIRING OF SHIPS AND BOAT SECTOR

5.2.1. Opportunities for the European Building and Repairing of Ships and Boat Sector

The main opportunities for the future growth and competitiveness of the European Building and Repairing of Ships and Boat Sector can be summarised as follows[32]:

- **Expected booming demand for maritime transport.** It is expected that the growing seaborne trade experienced in last years may continue in the future, fostered amongst other factors by continued growth in the world economy, increased external trade of some countries (i.e China or India) and growing globalisation of markets, where all these elements are expected to positively influence the demand for new merchant cargo and container ships in the future[33] (current order-books for European

[31] Several experts suggest that this 'bad image' is not the case anymore, as the sector is booming and is becoming a source of interesting job opportunities for people. In any case, these experts also suggest that the image of the sector is still far from being as attractive as other more 'sexy' sectors (i.e. aircraft sector).

[32] These opportunities are presented in a Pan-European perspective. Of course, these opportunities can have a different impact amongst European countries due to differences in country-specific conditions such as the structure of the industry in terms of the degree of concentration, the product markets in which companies operate or other elements (i.e. state restructuring processes in the Eastern European Member States).

[33] Approximately, a 90% of the total world trade is transported by ships.

producers are full for the next 2-4 years, on average). Thus, the CESA Working Group on Market and Forecast has prepared a forecast on the requirement for new merchant ships covering the time period 2004-2020. According to this forecast (see results in Table 40), there is a big demand for new shipbuilding activity, where this demand is particularly explained by the continued growth in international seaborne trade, whereas other factors such as the need for replacement of ships in the fleet due to age will contribute relatively less to the newbuilding requirement in the coming years. Of course, an upsurge in the volume of ship freight has a positive effect on the repairing sector as well in the medium-long terms, although in the short run the effect can be the contrary (Müller, 2007).

Table 40. Key figures of the CESA shipbuilding forecast, 2004-2020

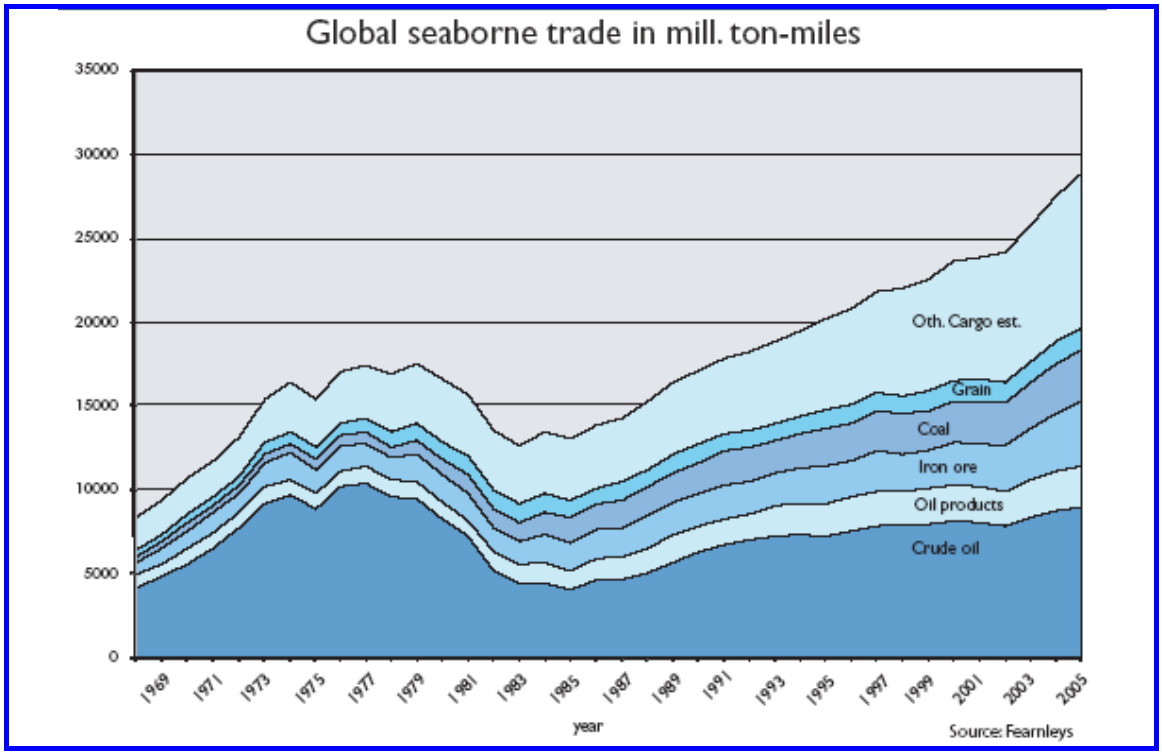
	Unit	2004	2010	2015	2020
Fleet	mill. dwt	839.2	958.6	1062.4	1154.6
	Unit	2004-10	2010-15	2015-20	2004-20
Economic growth	GDP p.a. based on constant prices	3.0	2.8	2.7	2.8
	GDP in PPP p.a.	3.6	3.5	3.4	3.5
Tonnage to be deleted (seagoing ships of 100 gt or more)	mill. dwt.	192.0	132.9	115.2	440.0
	mill. dwt p.a.	29.5	26.6	23.0	26.7
Tonnage to be completed (seagoing ships of 100 gt or more)	mill. dwt	318.3	236.6	207.4	762.3
	mill. gt	222.9	170.4	157.8	550.9
	mill. cgt	160.3	122.4	116.7	399.4
	mill. dwt p.a.	49.0	47.3	41.5	46.2
	mill. gt p.a.	34.3	34.1	31.6	33.4
	mill. cgt p.a.	24.7	24.5	23.3	24.2

Source: CESA, 2006

ρ **Increased use of ocean and short sea shipping for the movement of cargo.** Linked to the previous point, the growth in seaborne trade is also expected to be increased due to an increasing willingness to shift from a congested land transportation system to a more environmentally sustainable waterborne traffic system[34], either internationally or short-sea shipping. This element, well reflected in some recent EU initiatives such as Marco Polo and Motorways of the Sea are introducing new, intermodal maritime-based transport logistics chains in Europe to shift freight from the road to the sea, and are expected to continue in time. This shift is expected to result in the successful delivering of appropriate, innovative and flexible new ships. However, the sector is still critical about these EU initiatives as resources devoted are still limited (in comparison, for instance, to the European activities in the development of high-speed railway tracks).

[34] It should not be forgotten that waterborne freight transport is already more fuel efficient than other transport modes.

Graph 38. Global seaborne trade in million ton-miles, 1969-2005



Source: CESA, 2006

Table 41. Climate Change and employment in the shipbuilding: Support modal shift by investing in European transport infrastructure

• Investments are imperative for restoring balance on a sustainable basis to different modes of transport, reducing the use of passenger cars and the road transport of freight and stepping up the use of public transport, rail (for freight and passengers) and navigable waterways. Such a transfer will create large numbers of new jobs, both for exploitation and infrastructure works. The European Union must give impetus to trans-European infrastructure works in railway, piggyback transport, navigable waterways and the installation of hydrogen refuelling infrastructures ('hydrogen motorways').

Source: ETUC, 2007

- **Increased demand for highly specialised vessels.** It is possible to identify that, in addition to positive prospects for the merchant shipbuilding activity, there are important future opportunities for the sector derived from a growing global demand for new ships, and derived from several activities such as tourism and recreation (i.e. passenger vessels and cruise ships), advanced exploitation of all kind of marine resources including energy production (specialised vessels, offshore oil and gas exploration[35]), defence and security (naval vessels) and aquaculture and fisheries activities (i.e. fishing vessels, other specialised vessels). Just to give some data, the cruise industry has been during the last decade the tourism niche that has experienced the most rapid growth of all, where the market has grown at 7.9%, and expectations are very high as this niche is still further to be developed in the future (World Tourism Organisation, 2003).
- **Expected increase in the demand of recreational boats.** According to some estimations elaborated by EURMIG (European Union Recreational Marine Industry

[35] In this sense, several interviewed experts suggest that the increase in oil prices is having a positive effect on the sector: On the one hand, this increase is fostering offshore oil and gas exploration in further and more difficult places, which in turn also fosters the need for more specialised and complex auxiliary boats serving these exploration activities. On the other hand, an increase in fuel prices is obliging ships to run at more economically-efficient (lower) speeds, which in turn demands more ships to transport the same amount of cargo.

Group) and collected by ECOTEC, the EU recreational boating is expected to grow by 5-6% annually in the next ten years. This projected growth can be attributed to three main reasons, this is, the "baby boomer" generation is reaching retirement age, there is increasing wealth among people in their middle age and, finally, there is huge growth potential in the Eastern European and other emerging economies (ECOTEC, 2006).

- **Positive effects derived from new regulatory framework**. Thus, some public decisions are expected to positively influence in the near future the demand for new ships. Examples of these new framework conditions include the support for the development of seaborne motorways (already mentioned before) or the introduction of new safety and environmental regulations. For instance, the "Prestige" incident and the consequent development of a package of legislative measures on maritime safety in the European Union (see European Commission, 2005b) has increased the pressure on tanker owners to invest heavily in new double hulled vessels and phasing out the remainder of the tankers built during the 1970s investment bubble. Also, and as recently as April 2008, the International Maritime Organization (a United Nations body) has proposed reducing the sulphur content of marine fuels starting in 2010 on all ships. It has also proposed steps reducing nitrogen oxide (NO_2) emissions from engines on new ships from 2011, and it is working on separate measures to deal with the more difficult issue of carbon dioxide emissions (CO_2)[36]. Meanwhile, and as far as the recreational boat building sector is concerned, the European Commission has developed several specific initiatives to ensure the free movement of Recreational Craft and their components on the European internal market (see Recreational Craft Directive 94/25/EC and the amending Directive 2003/44/EC) and to facilitate their export to the United States of America and Canada though Mutual Recognition Agreements (MRAs).
- **Opportunities derived from the introduction of new innovations in the sector.** In this respect, innovations and investments in Research, Development and Innovation (RDI) activities are the main factors underpinning the future competitiveness of the European sector due to the increasing demand for specialised vessels and specialised solutions for the sector as a whole. In fact, European shipbuilders compete internationally through advanced technological solutions, not through low costs, so RDI investment is therefore key. It is worth stressing that in May 2006 it was presented the WATERBORNE Strategic Research Agenda (WSRA) to the European Commission. This agenda, elaborated by representatives from all the stakeholders of the maritime community (Associations, National Authorities and the European Commission), is intended to identify relevant RDI topics that are expected to be crucial for the future development of the European shipbuilding sector according to the Vision 2020 targets and challenges (see Table 42). In this sense, it identifies priorities and provides an idea of the scope in time and the necessary funds as well as the possibilities of clustering in the form of Large Project Initiatives (see Table 43). As it can be seen, promising R&D and innovation segments include environmental technologies and systems (low emissions, eco-energy efficient shipbuilding, etc), security-related solutions (such as better monitoring and onboard security, computer navigation, etc), or new generation production processes (flexible production processes and designs, capability to full process control over distributed production locations, automatisation in production processes, etc).

[36] The European Commission has said that if the International Maritime Organization fails to make concrete proposals on carbon dioxide by the end of the year, it would consider regulating the matter itself, perhaps by including shipping in the European carbon trading system. That could oblige ship owners to buy pollution permits from other sectors, becoming therefore an incentive to build new more environmentally efficient ships.

Table 42. Vision 2020 Medium and long term vision of the WATERBORNE European technology Platform at horizon 2020

The Exploitation Outcomes	Description of the expected exploitation outcomes
The Low Risk Ship	• An in depth understanding of the design and operation of ships from a risk based perspective allows for development and approval of low risk ships. Better risk control options for example, new structural solutions/designs providing improved collision and grounding resistance and damage stability control are available. The standardised approval processes for ships developed using risk based design and operation has reduced costs and improved risk management. A modernised regulatory framework has been approved at IMO based on the safety-level approach together with appropriate acceptance criteria
The Low Energy, Low Emissions Ship	• New efficient propulsion technology is integrated into innovative hull forms to dramatically reduce power requirements. Diverse power supplies are derived from ultra low emissions prime movers, fuel cells and renewable sources. Hybrid drives and intelligent power networks maximise the efficient use of energy
The Autonomous Ship	• Next generation modular control systems and communications technology will enable wireless monitoring and control functions both on and off board. These will include advanced decision support systems to provide a capability to operate ships remotely under semi or fully autonomous control
The Sustainable Recreational Craft	• By 2020, recreational craft will offer better performance and be safer than current vessels, with lower through life costs and less total environmental impact. They will be more comfortable and easier to operate in crowded and difficult waters, all of which will ensure a greater market share for EU builders
The Future Ship Designs For Short Sea Operations	• Dedicated Short Sea Ships will be essential links in environmentally friendly, integrated transport chains in and around Europe. Fast, highly automated ship/shore interfaces enable the most effective use of transport routes and port infrastructures. Sophisticated links to shore-based and inland waterway transport modes will provide the most efficient and cost effective transport system to meet the challenges of growth
The European Cruise Ship	• The Cruise Ship built in European Yards will maintain its world leading position by providing the best passenger recreation facilities, matched with the highest safety and security standards, while achieving the lowest per passenger emissions
Energy Transport in Extreme Conditions	• New highly specialised vessel types will be produced by the European shipbuilding and offshore industries to meet the challenge of extreme conditions. The economic transport of energy to Europe from harsh climates and "hitherto unnavigable" waters will be possible
Seven Day Ship Design	• By 2020 European yards will have developed a design environment enabling them to provide detailed designs in world leading minimum times, enabling the combination of ultimately tailor-made designs with minimal technical and commercial risk
Leading Shipbuilding	• By 2020 European shipyards will have perfected the flexible production process and the capability for full process control over distributed production locations. Retooling for new designs will be minimised, as will be time to market. European shipbuilders will be world leaders in energy efficient shipbuilding
Intelligent Integrated Transport Network	• A secure Web-based system of vessel and cargo tracking will be accessible to all operators and users, with unified rules for the transport of goods within the EU-27. Integrated ICT (Information and Communication Technologies) and ITS (Intelligent Transport Solutions) will enable efficient planning, booking, simulation, routing and control of cargo across different transport modes
Intermodal Waterways	• The shipbuilding industry will provide collision proof ship designs with optimal hydrodynamic properties for maximum size transport units, with reduced risk and increased efficiency for new fleets of inland waterway vessels. New designs for integrated logistic concepts for Containers, Tankers, RoRo, Bulk and General Cargo enable cost effective transhipment between transport modes. Increased transport of goods on the inland waterways relieves congestion on road and rail, fostering incentives for international industrial investment
Accelerated Sustainable Port Development	• A streamlined open planning process enabling efficient and timely infrastructure development. The impacts of natural causes and events, as well as by human intervention – construction, operations, etc – have been benchmarked for judgment and comparison

Source: Waterborne, 2007

Table 43. Research priorities included in the Waterborne research Agenda

Research Priorities	Research Topics	Detailed Research Topics Description
Safe, Sustainable and Efficient Waterborne Operations	Implementing Goal Based / Risk Based Frameworks for Cost Efficient Safety	• Goal Based Regulations and Approval • Risk Based Ship and Ship System Design
	The "Zero Accidents" Target	• Accident and Incident Data Reporting and Analysis • Systems Integration for Safety and Security • Survivability of Smaller Vessels in Extreme Weather Conditions • Operation in Ice Infested Waters
	The "Crashworthy" Vessel	• Research with Respect to Collision and Grounding • Failure Mechanism Research and Modelling
	"Low Emission" Vessels and Waterborne Activities	• Marine Fuel Cell - Fuel Operation Test Facility • Fuel Supply and Fuel Systems • Eco-Ship Systems • Minimising Wash, Noise and Vibration • The Future Sustainable Recreational Craft
	Enhanced Waterborne Security	• Environmental and Economical Maritime Security
A Competitive European Maritime Industry	Innovative Vessels and Floating Structures	• Future Ship Designs for Short Sea • BESST: Breakthrough in European Shipping and Shipbuilding Technology for Cruise and RoPax • Future Advanced Hull Structures • Life Cycle Philosophy
	Innovative Marine Equipment and Systems	• More Efficient Propulsion • Prime Mover Development • Next Generation Power and Propulsion Concepts
	Tools for Accelerated Innovation	• State of the Art Design and Analysis Tools • Technology Base
	Next Generation Production Processes	• Leading Edge Integrated Shipbuilding Production • Human Factors in the Shipbuilding Process • Electric Power & Propulsion Component Design • Electrical Power Networks • Modular Control, Navigation & Communication Systems • Innovative Materials and Systems
	Effective Waterborne Operations	• Automated Ship Operations and Life Cycle Cost Reductions
	Technologies for New and Extended Marine Operations	• Transport Operations in Cold Northern Waters • Offshore Deep Sea Operations & Floating Equipment
Manage & Facilitate Growth and Changing Trade Patterns	Accelerated Development of New Port and Infrastructure Facilities	• Planning Tools for Optimal Logistics Chains and Hinterland Connections • Advanced Field Measurement Techniques • Non Intrusive Measurement • Effects of Climate Change on Waterborne Transport
	Interoperability between Modes	• High Quality and Efficient Inter-Modal Services
	More Effective Ports and Infrastructure	• Ship/ shore Systems Integration & Fast Cargo Handling • Vessel Shore Energy Systems • New Generation Inland Navigation
	Intelligent Transportation Technologies and Integrated ICT solutions	• Ports network and Data Exchange • Cargo Logistic Management
	Understand Environmental Impact of Infrastructure Building and Dredging	• Determination of Real Baseline Conditions against which the Effect of Infrastructure Development may be Measured • Improved Understanding of the Potential Impact of Development • Refinement of Environmental Regulation to Remove Inconsistency, Conflict & Duplication • Marina & Leisure Facility Development

Source: Waterborne, 2007

- **Increased collaboration with other non-maritime sectors and universities/research centres in the R&D domain.** Linked to the previous point, enterprises in the sector and other shipbuilding-related sectors (i.e. the marine equipment sector) can benefit technological developments in other non-maritime fields (i.e. automotive, rail and aerospace, capital intensive construction, etc) and apply them

also to the sector. Also, the shipbuilding sector can benefit from further co-operation with universities and research centres that may allow for a better transfer of know how and technology from these research centres as well as from other sectors. Indeed, one of the targets of the WATERBORNE Vision 2020 is to strengthen the cooperation between the universities and the shipbuilding industry.

- **Increased cooperation between the sector and other related stakeholders.** Finally, the full development and competitiveness of the European building and repairing of ships and boats sector requires the full collaboration between the sector and other sector-related stakeholders such as public authorities, training centres and universities, public and private research centres, etc. In this sense, it is worth mentioning some successful experiences in Europe of these sector partnerships for innovation, skills and jobs, such as the French "Maritime Competitiveness Centres" in France (see Table 44) or the Finish maritime cluster (see Table 45).

Table 44. French maritime Competitiveness clusters

- In France it is possible to identify two maritime competitiveness clusters ("pôles de compétitivité" in French, this is, Pôle Mer Bretagne (Brittany Maritime Cluster) and Pôle Mer PACA (Provence-Alpes-Côte d'Azur Maritime Cluster).
  - Pôle Mer Bretagne brings together 267 members, including 32 industrial groups, 146 SMEs, 48 research centres and higher education institutions, as well as 41 professional bodies and economic-development organisations. Pôle Mer Bretagne focuses on the Atlantic seaboard of France
  - Pôle Mer PACA brings together 230 members, including 54 industrial groups, 103 SMEs, and 79 research and educational organisations. Pôle Mer PACA concentrates on the Mediterranean coast
- These clusters are internationally oriented French competitiveness clusters ("pôles de compétitivité") recognised by the French government. They bring together large companies, SMEs and research centres working in the maritime sector, with the objective of developing and supporting security and sustainable development projects. The clusters have established links with other maritime clusters in Europe with a view to developing innovative projects, some of which could be accepted for European Union financing as part of the EU's 7th Framework Programme for Research and Technological Development. The two clusters also work in close partnership between them, bringing together various stakeholders from the worlds of industry and research, with the aim of increasing business competitiveness through innovation and the improvement of their respective regions' attractiveness, but also through the creation of jobs and the opening-up of the local economy to export markets.

Source: Ministère de la Recherche, de l'Industrie et de l'Environnement

Table 45. The Finland's maritime cluster

- Thirteen clusters have been created in Finland within the framework of the "Centres for Expertise Programme" implemented by the Council of State for the period 2007-2013.
- The aim of the Finish maritime cluster is to give impetus to and bring together the development of activities, training and research in sectors such as shipbuilding, off shore projects and maritime logistics. The areas that will benefit are processing materials and technologies, the internationalisation of the sector, safety and environmental issues and business development.
- Bringing together industrialists and researchers at the highest level, five centres of expertise are actively involved in this cluster, which is coordinated by Koneteknologiakeskus Turku Oy. The centres are in south-east Finland, south-west Finland, western Finland and Satakunta, as well as the centre for expertise in metallurgy of Bothnia.
- The cluster strategy aims to foster the creation of innovative activities, products and services; to improve productivity and networking; to increase the supply of qualified labour. This involves attempting to encourage investment in research and development and improving the skill levels of companies, the exchange and centralisation of information, the organisation of specific measures, the internationalisation of and cooperation between SMEs

Source: Inforegio Panorama, September 2007

5.2.2. Threats for the European Building and Repairing of Ships and Boat Sector

The main opportunities for the future growth and competitiveness of the European Building and Repairing of Ships and Boat Sector can be summarised as follows[37]:

- **Increased fierce competition from third countries.** This report has shown in previous pages an increased competition from Asian countries, so the share of the East Asian shipbuilders in the total world production has grown up approximately ten percentage points since 2001. In this respect, China shows firmly resolution to become the number one shipbuilding country in the world. It is usually suggested European producers are highly specialised in the production of high value added ships. However, it should not be forgotten that this current European competitive advantage might be challenged as the Asian competitors are also likely to develop their expertise as well in the coming years[38], especially if the assisting European infrastructure (training providers, suppliers, marine equipment producers) shift their location to the new emerging markets. In any case, and in the short run, some European countries (i.e. Germany, Poland or to some extent Romania, The Netherlands and Spain) are particularly subject to a strong competition from third countries in some of their specialised products such as container vessels and products/chemical carriers. Similarly, the European recreational boat industry is confronted with an increasing competition from emerging economies[39].
- **Unfair competition practices from some Asian countries.** The increased competition from some Asian countries is further aggravated by the presence of unfair pricing practices and subsidisation in several Asian countries that help to maintain unsustainable capacity and fosters shipyards to accept loss-making orders to fill production facilities (i.e. different forms of direct and indirect subsidies and other support measures, unfair pricing practices in form of dumping, grey areas regarding shipbuilding financing, reservation of the domestic market for local shipyards, import restrictions, loans and loan guarantees to ship-owners below normal market conditions, etc). This situation deeply contrasts with the existing EU strong state aid discipline, and it is fully aggravated by existing difficulties in applying existing multilateral trade rules in shipbuilding (i.e. today, shipbuilding is not subject to any anti-dumping discipline or custom duties). In addition to this, it is worth mentioning that this unfair trade practice also applies to the existing employment and working conditions terms, so the European social acquis is much higher than the existing terms in other Asian competitors. Not surprisingly, the European sector, together with EU authorities, is actively struggling for achieving an internationally applicable agreement which would guarantee a level playing field in the global shipbuilding sector. Also, some countries (for instance the USA) requests that all short-sea shipping activities have to be served by US ships, whereas this practice is not present in Europe.
- **World shipbuilding suffers from a persisting imbalance between supply and demand.** According to the CESA Working Group on Market and Forecast, the available shipbuilding capacity is expected to substantially increase over the next years, going from 26.8 million CGT in 2005 to 31.2 million CGT in 2010 and basically due to expected increases in production facilities in China and other Asian countries.

[37] These threats are presented in a Pan-European perspective. Of course, these opportunities can have a different impact amongst European countries due to differences in country-specific conditions such as the structure of the industry in terms of the degree of concentration, the product markets in which companies operate or other elements (i.e. state restructuring processes in the Eastern European Member States).

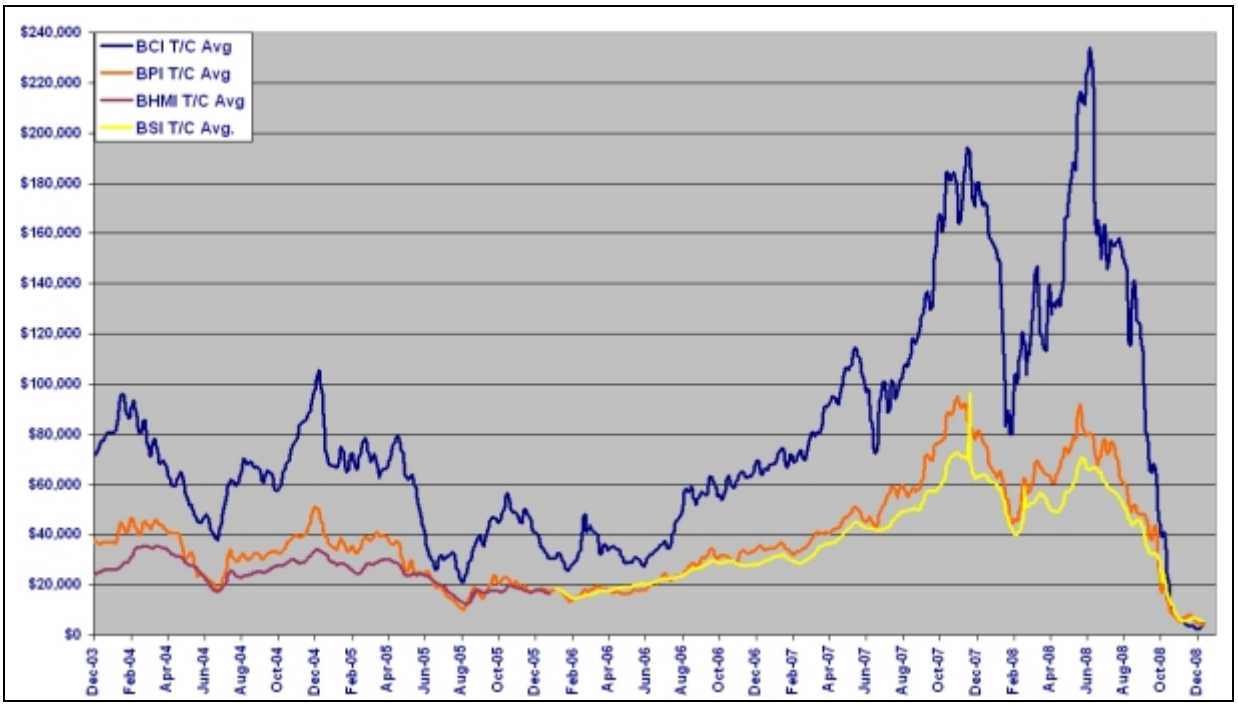
[38] For instance, Korean investors have taken a significant share in one of the main European cruise shipbuilders' capital (Aker yards), which may imply a transfer of knowledge and expertise to Korean shipbuilders in a medium-term perspective.

[39] An additional threat element identified by the boat building industry is referred to the possibility to introduce non-European boats without the CE mark by particulars, which in turn represents an unfair practice in comparison to European products (By affixing the CE marking, the manufacturer, its authorized representative, or person placing the product on the market or putting it into service asserts that the item meets all the essential requirements of the relevant European Directive(s)). Therefore, more market surveillance activities are required to be conducted on this issue.

Conversely, and according also to CESA estimations, this future shipbuilding capacity is expected to be much larger than the newbuilding activity (CESA, 2005). Therefore, a market with substantial oversupply of shipbuilding capacity is likely to develop within a few years, leading to a paradoxical situation in which there is a high demand for ships but the prices are decreasing (with subsequent negative effects for the shipbuilding companies).

ρ **Negative economic prospects for the coming years.** It is a well-known fact that the current economic cycle is subject to important levels of uncertainty that may affect the future positive evolution of the main economic variables. In this sense, the possibility to have a persistent downward trend in the world and European economy in the coming years is getting more and more robust in the coming months, where this situation is expected to negatively affect the European building of ships and boats industry in the medium-term (see for instance the recent evolution of the Baltic Dry Index[40]) (Graph 39). This situation may not only affect freight-related ships but also some of the specialised high quality vessels and boats built in Europe, as they are directly linked to strong economic cycles. This is the case for instance of the recreational boat industry or the cruise sector as a result of its dependence on consumer's discretionary expenditure. This situation can be aggravated if current negative exchange rates in the US$/Euro relation are maintained in the future, where these exchange rate developments are creating increasing concerns with regard to offered prices, specially amongst the European exporters in the sector.

Graph 39. Evolution of the Baltic Dry Index (December 2003-December 2008)



Source: Baltic Exchange

ρ **High volatility of prices related to shipbuilding materials.** Current prices in some of the raw materials used by the shipbuilding materials (i.e. steel, copper, etc) are imposing a heavy external burden on the European industry, as they have grown to historical record levels in the past years although, more importantly, they are currently affected by high volatility levels that make very difficult proper planning activities for

[40] The Baltic Dry Index provides an assessment of the price of moving the major raw materials by sea. This index provides a good assessment of the current and expected situation of the volume of global trade. For more information see http://en.wikipedia.org/wiki/Baltic_Dry_Index

shipbuilding yards. In addition to this, there are significant price differences in the steel market between Europe and Asia (in 2006, European steel was 63% more expensive than Asian, according to CESA estimations), which act as an additional burden for some ship yards specialised in steel-intensive vessels (i.e. cargo vessels), and especially in a context of current full order books. Meanwhile, and as far as the European recreational boating industry is concerned, it is particularly sensitive to increases in the some raw materials prices (i.e. oil prices, affecting not only fuel costs but industry raw materials too). High labour costs are also imposing an added burden in the EU, at least in the EU-15, especially in comparison to other competitors.

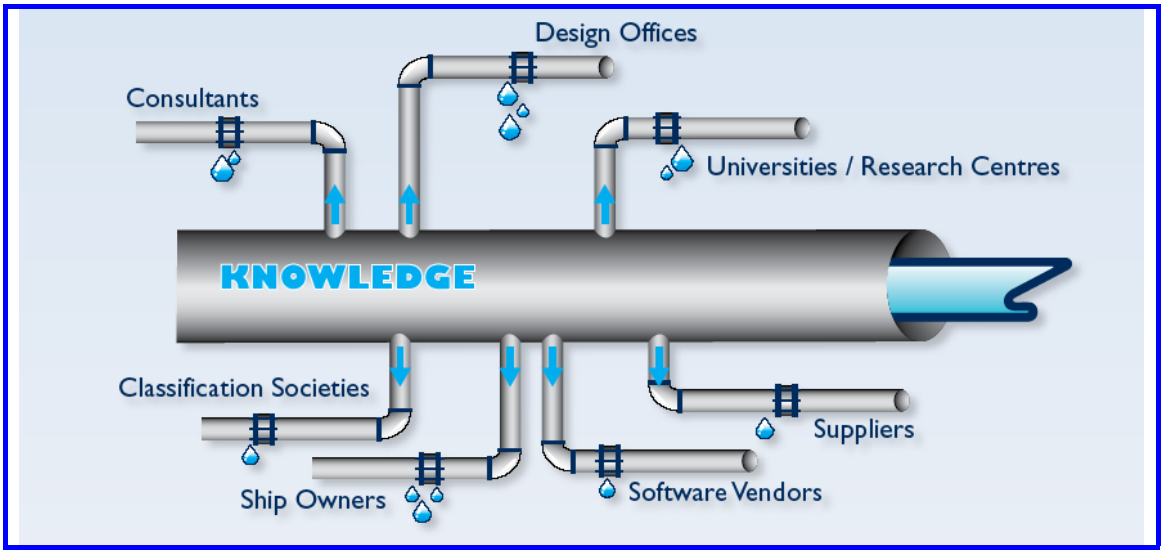
- **Negative effects derived from some public regulations.** For some sectors (i.e. the recreational boat building sector), some EU regulations may have a negative influence on the development of the boat industry. For instance, the Habitats and Birds Directives (European Council, 1979 and 1992) have rendered very difficult the development of yacht harbours and berths in large areas along the EU's coastlines, which has a direct impact on the sector development[41], particularly in some countries such as Sweden or the United Kingdom). In addition to this, the existing administrative regulations (red tape, taxes, security inspections, etc) impose a disproportionate burden on SMEs, which currently dominate the European recreational boating industry. Also, the boat building industry is facing significant pressures from environmental legislation, although the requirement to reduce engine exhaust emissions is being currently implemented by the industry.
- **Relocation of production to third countries.** From an employment perspective, one of the major threats for the European employment refers to the trend towards the relocation of production to other non-EU countries, especially new emerging economies such as China or any other emerging economy, where labour costs are significantly lower. If fact, it is interesting to underline that some marine equipment suppliers are moving facilities to the Chinese market, so they can better serve this emerging market while, at the same time, benefit from lower personnel costs (specially as far as the less specialised/less highly skilled workers are concerned). This situation, which can be positive for companies as they are allowed to increase their future competitiveness, may have very negative effects from an employment perspective, especially if some of the manufacturing facilities are de-located from Europe.
- **Loss of key sector knowledge.** The fact that European producers are more dependent on technological leadership than their competitors (due to their specialisation in complex, high-valued vessels) requires a further attention to the issue of intellectual property rights protection (copyrights, registered designs, trademarks, patents of new materials/manufacturing processes, non-disclosure and specific collaboration agreements). Unfortunately enough, the industry has not sufficiently established a culture for the protection of intellectual property rights, which redounds in leakages of knowledge (see Graph 40) that are positively used by competitors (especially Asian ones)[42]. This situation also calls for a better enforcement of legislative frameworks that protect intellectual property rights[43].

[41] According to estimations provided by EURMIG, in Europe-15 there are 1.75 million berths and approximately 6 million boats, resulting in a desperate need for additional parking places.

[42] In any case, interviewed experts suggest that the sector has taken very serious this issue of reducing the leakages of knowledge since early 2000s onwards, where some important measures are being taken on-board. One good example of this is the "Shipbuilding Intellectual Property Handbook", developed within the framework of GuardSHIP (initiative of the European shipbuilding industry), and intended to provide shipbuilding specific and practical intellectual property protection guidelines for the industry.

[43] In this sense, the European Commission's "proposal for a directive of the European Parliament and of the Council on common rules and standards for ship inspections and survey organisations nd for the relevant activities of maritime administrations", COM (2005) 587 final is regarded as a key legislative element that, when finally passed, will help manufacturers to protect their sensitive information and to preserve their know-how.

Graph 40. Main Leakages of knowledge for the shipbuilding sector



Source: CESA

- **Decreasing and ageing European workforce**. The ageing process of the European workforce is currently one of the main threats affecting the European building and repairing of ships and boats sector. Thus, available data suggests that a significant share of European workers in the sector are nearly to retire but it is difficult to replace them with younger workers. Of course, the lack of attractiveness of the sector, as well as the existence of job opportunities in other sectors or the concrete geographical location of shipyards also imply added difficulties for this ageing process.
- **Need for a highly qualified, skilled, trained and educated workforce.** From an employment perspective, the fully realisation of the opportunities opened up by new technologies, innovations and existing high tech processes is directly dependant on the presence of a highly qualified, skilled, trained and educated workforce. This situation imposes a number of challenges to the sector in recruiting, training and retaining a quality skilled workforce for the industry, such as the need to streamline the existing education and training supply with the current and future new skills' challenges and needs (skill demands) of the sector, the need to attract young people to the sector or, finally, the need to train in new skills demands identified by the sector.

Table 46. SWOT Matrix

STRENGHTS	WEAKNESSES
• Strong historical tradition of the sector as a whole in Europe • Specialisation in high tech vessels and boats • High levels of R&D investment • Presence of a highly consolidated network of suppliers, mostly of them SMEs. • Strong co-operation and integration with suppliers • Strong collaboration between public and private agents • Increasing levels of productivity • Presence of a highly skilled workforce • Fluent Social dialogue, especially as far as human resources and skills issues are concerned • Large network of training and education providers related to the sector	• Insufficient collaboration in the RDI domain • Difficulties in financing and guaranteeing schemes • Additional needs for restructuring of shipyards in some Eastern European countries • Lack of a European-wide Naval shipbuilding sector • Relatively high presence of SMEs in some concrete subsectors • Difficulties both in retaining the existing workforce and in recruiting new personnel • Existing gap between existing training supply and companies' skill needs
OPPORTUNITIES	**THREATS**
• Expected booming demand for maritime transport • Increased use of ocean and short sea shipping for the movement of cargo (sea motorways) • Increased demand for highly specialised vessels • Expected increase in the demand of recreational boats • Positive effects derived from new regulatory framework (safety, environment) • Opportunities derived from the introduction of new innovations in the sector • Increased R&D collaboration with other non-maritime sectors and universities/research centres • Increased cooperation between the sector and other related stakeholders	• Increased fierce competition from third countries • Unfair competition practices from some Asian countries • Persisting imbalance between supply and demand at world level • Negative economic prospects for the coming years • High volatility of prices related to shipbuilding materials • Negative effects derived from some EU regulations • Relocation of production to third countries • Loss of key sector knowledge • Decreasing and ageing European workforce • Need for a highly qualified, skilled, trained and educated workforce

6. DRIVERS OF CHANGE

6.1. RECAPITULATION OF DRIVERS OF CHANGE

According to the analyses conducted in the previous section, there are a number of drivers affecting the European Shipbuilding Sector, which can be summarised on the following Table 47.

Table 47. Main drivers of change

Economic Demand	Economic Supply	Technology Processes	Technology Products and services	Organisation Conceptual	Organisation executive	Others
• Influence of the economic cycle (short run, orderbooks full) • Increase in world trade, but deteriorating perspectives • Increased use of sea transport, both long and short distances	• Competence from third countries (China) • Large multinational groups • Specialised suppliers	• Short time design/ shipbuilding processes • Increased RDI investments • ICTs • Flexible production processes	• Multimodal transport functionalities • ICTs and autonomous ships • Environmental friendly and energy efficient ships/boats • Specialised high-tech, customised vessels and boats	• Increased and more complex international/ national outsourcing, both materials/equipment and modules • Emphasis on basic and development engineering, project management	• Growing demand of qualified personnel • Shortages of skilled personnel • Outsourcing practices, collaborative approaches with suppliers • Internationalisation of suppliers	• Growth of fuel and other raw materials costs • Increasing safety and Environmental concerns • Regulation on sea transports • Strong public-private cooperation

Regarding economic factors, the **evolution of world trade and sea transport** has a crucial importance on shipbuilding demand. To this respect, there is a general trend towards world trade increase, even though an unfavourable evolution can be detected during last years (+8.5% in 2006 to +5.5% in 2007) and perspectives are not improving (+4.5% 2008 forecast). In this sense, even if it is estimated that the order-book guarantees activity for next 4 years, the mid-term impact on demand from the current **economic and financial crisis** seems difficult to evaluate. It must be kept in mind that shipbuilding is a sector with high and complex financial needs and thus particularly exposed to the current financial constraints.

As regards to the growth of cost of fuel, this might have ambivalent effects. On the negative side, freight costs would increase, discouraging some demand. On the other hand, it would induce the merchant fleet to slow down to "economy speed", meaning that for the same volume of cargo, an increased number of ships would be needed in order to keep constant the overall ratio of cargo/distance/time unit. Additionally, a high price of petrol is making increasingly attractive (in economic terms) the exploration of new deposits, giving way to new demand for prospection ships, sea-platforms, etc.

In brief, depending on the impact of the economic and financial crisis, an increased use of sea transport can be expected, both for long distance, intercontinental commerce and for short sea (sea motorways), as a growing alternative to land transport severely affected by congestion problems.

To a great extent, demand for European specialised high-tech ships should go parallel to general demand for standard cargo ships, and the same can be said with respect to passenger ships (cruises, ferries, etc.), always directly subject to the evolution of economic cycle in the months to come.

Also on the demand side, the **strong influence of regulatory framework** can be underlined. Particularly, increasing **environmental rules** and requirements influence the type of ships needed with a positive impact on demand for the type of ships produced by the European industry. A reinforced EU Public private cooperation (i.e. LeaderShip initiative) and a fluent social dialogue will undoubtedly help to exploit the potential benefits of the regulatory framework.

Looking on the supply side, the panorama is marked by the **competence from third countries (particularly China and Korea)**, with an increasing installed production capacity (public sector support) and lower production costs, both materials (steel,…) and labour (wages and social costs), all of it allowing lower prices, often with unfair competition practices. This situation implies a medium term risk of overcapacity at world level, with falling prices, even in spite of growing demand.

In any case, the technological development in these countries (especially Korea) can be regarded as a major threat for the European industry, the term depending on the speed of the process. This question seems crucial, as **technology can be regarded as the main European competitive advantage**. The EU industry is specialised in high-tech ships with a number of traits that make it difficult for the Asian countries to produce:

- Energy efficient, low emissions and environmental friendly ships
- Low risk design and safety equipment
- Communication technologies (autonomous ship)
- Short sea operations and multimodal transport functionalities
- Short time design, flexible shipbuilding processes

This implies a need for increased RDI investments in order to maintain this technological advantage, which in turn calls for an improvement in cooperative policies and on intellectual and property rights safeguard in order to reduce possible knowledge leakages in the sector and keeping the know-how in Europe (as stated on the Waterborne programme).

The organisation of production and sectoral value chain is characterised by the presence of **large multinational shipyard groups** and **increased outsourcing**, both of materials and equipment as of subcontracting of modules. Shipyards tend to keep only core activities, basic and development engineering, and project management, which implies the need of collaborative approaches and strategies to integrate and upgrade ancillary industry.

Last but not least, the **shortage of skilled human resources** must be mentioned. The sector is thriving to improve its image, but nevertheless difficulties remain to attract and retain qualified personnel, in a context of ageing labour force. In addition, currently there is a strong demand of qualified personnel, all of which entails a need for specific recruiting and training strategies.

6.2. CLASSIFICATION, RANKING AND SELECTION OF KEY DRIVERS

The following Table 48 presents these drivers classified according to different characteristics:

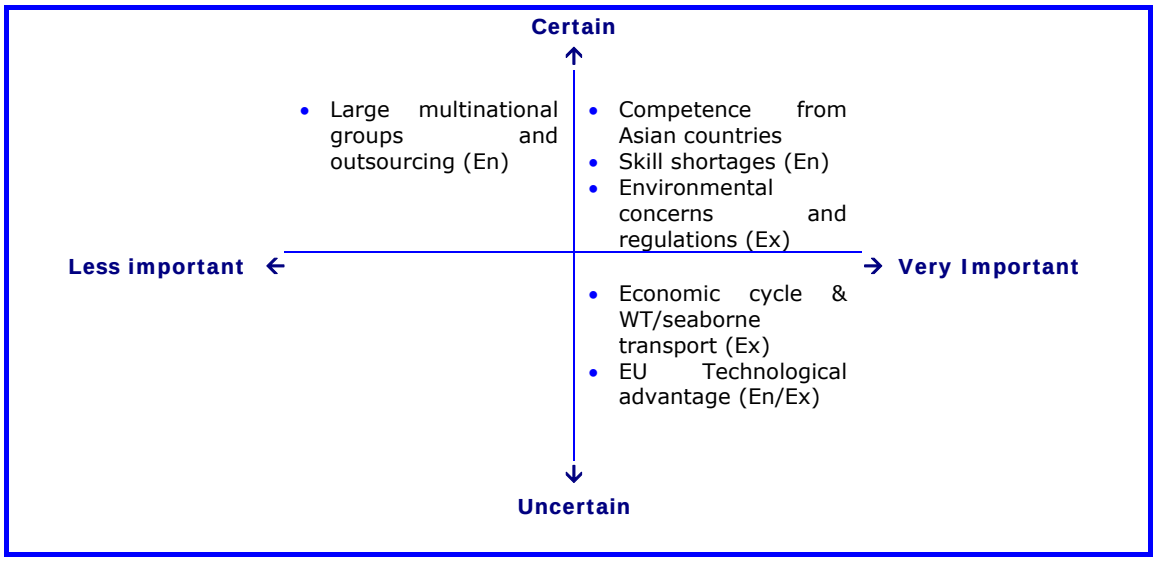
- Certainty or uncertainty of their occurrence
- Their exogenous to the sector or endogenous nature
- Their level of importance for the next future of the sector

Table 48. Classification of drivers of change

Drivers	Uncertain / Certain	Exogenous / Endogenous	Very Important / Less important
Economic cycle & world trade/seaborne transport evolution	U	Ex	VI
Competence from Asian countries	C	Ex	I
European technological advantage (innovation, R&D investment)	U	En/Ex	VI
Large multinational shipyard groups and increased outsourcing	C	En	LI
Skill shortages	C	En	I
Environmental concerns and regulatory framework	C	Ex	I

If the degree of certainty and the level of importance of the drivers are combined, it is possible to identify those to be considered crucial for the future of the sector and thus the basis for the construction of scenarios.

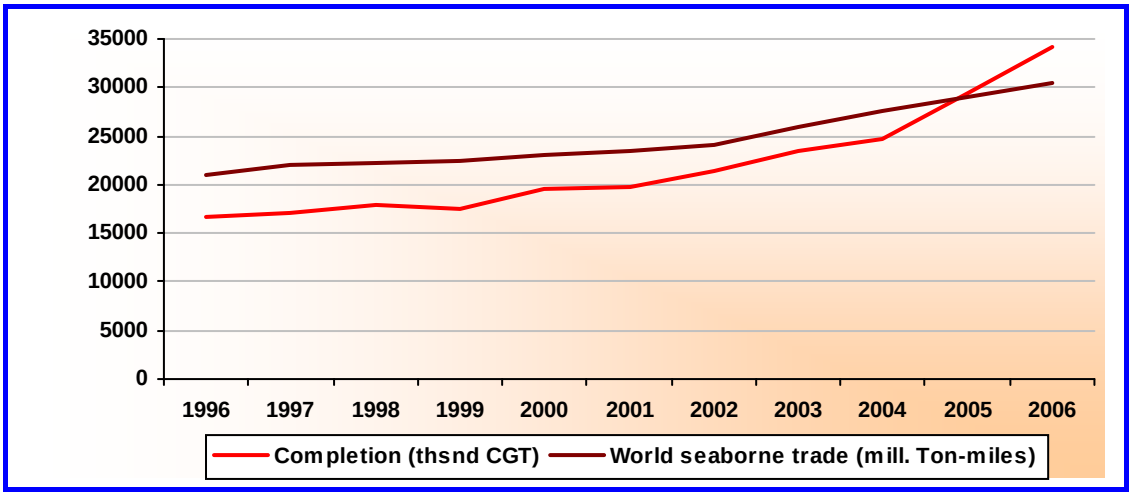
Table 49. Ranking of drivers of change



As a result, as it can be observed on Table 49, the influence of the current adverse economic cycle on world trade/seaborne transport and thus on ship demand, together with the maintenance of the European technological advantage over the Asian competitor countries, emerge as the key factors which will shape the future of the sector in Europe:

1. ***Economic cycle and future evolution of world trade and sea transport:***
   - Nowadays 90% of world trade is carried by ship
   - Thus, the evolution of world trade can be considered the main demand factor for shipbuilding (cargo ships and other specialised vessels).

Graph 41. Global seaborne trade vs Shipbuilding completions. 1996-2006.



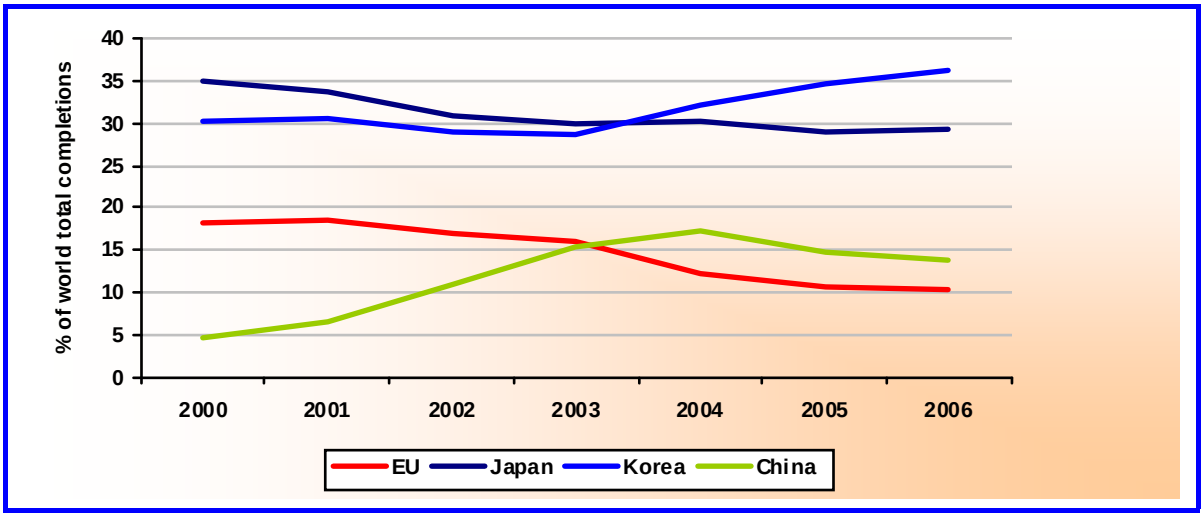
Source : CESA

- At a secondary level, also the evolution demand for cruise tourism must be mentioned as an important factor for building of cruisers, ferries, etc.
- In this sense, the evolution of world trade and sea transport (both cargo and people) in a mid/long-term horizon will primarily determine the demand for shipbuilding.
- Both demand factors are following a fast growth trend which, however, is currently under question due to the uncertain situation of the world economy, with negative perspectives specially affecting western countries.

2. Preservation of the European technological advantage:

- During the last years Europe has progressively lost share in world shipbuilding, basically in favour of Korea and China.
- These countries have a growing order book and plans to increase capacity in the next years.
- They are able to produce at lower prices (labour costs, state aid…), but they are mainly specialised in producing standard cargo ships.
- However, technological development of production in these countries is improving. Particularly Korea is concentrating efforts on building highly engineered vessels that can compete directly with European production.
- How this question develops in the medium and long run will determine the future of the European shipbuilding sector.

Graph 42. Evolution of share in world total ship completion: EU vs. main competitors



Source: Lloyd's Register

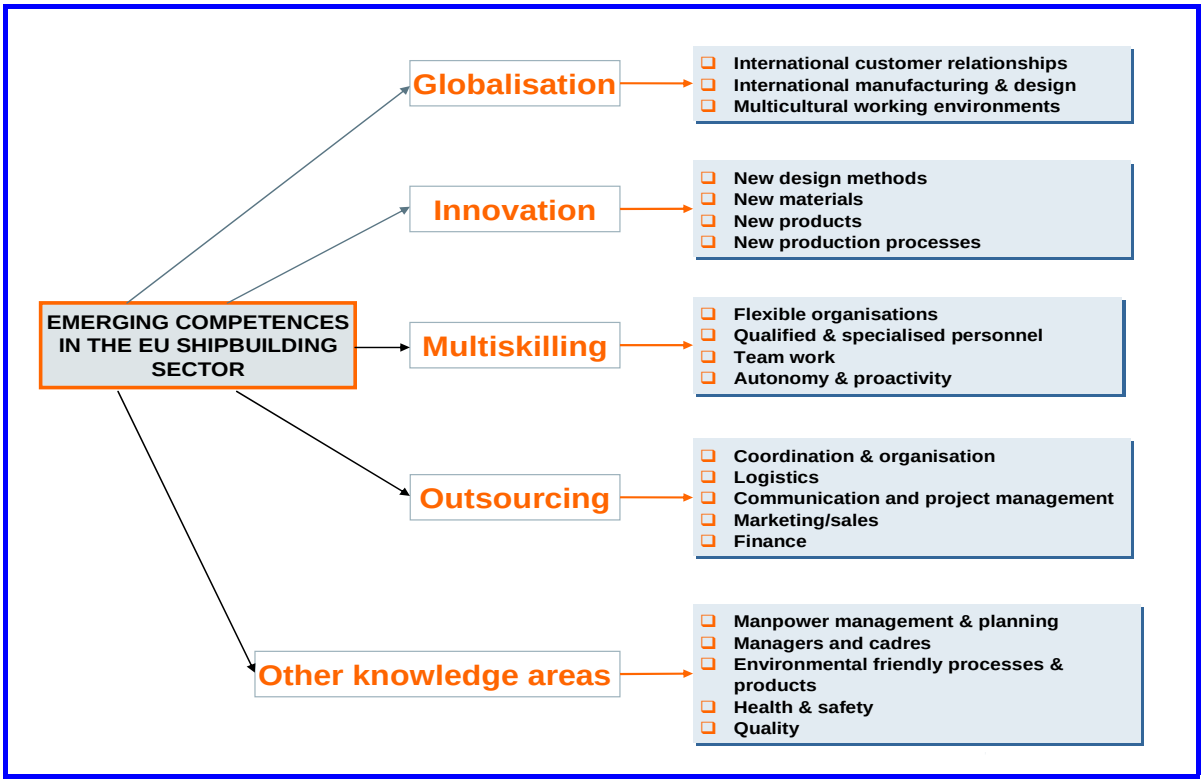
7. EMERGING COMPETENCES

7.1. EMERGING COMPETENCES IN THE BUILDING AND REPAIRING OF SHIPS AND BOAT SECTOR

As already described in the previous chapter, the main drivers of change affecting the building and repairing of ships and boat sector include, amongst others, a growing competence from third countries (which in turn requires an increasing internationalisation of the European sector), emphasis on RDI investments in new products/materials/manufacturing methods for maintaining the European competitive advantage, a growing demand of qualified and highly specialised personnel and, finally, increasing and more complex outsourcing practices (at international and/ or national level). All these drivers pose new expectations and possibilities for the sector, whereas in turn generate not only difficulties in recruitment (as already explained in a previous chapter) but also a change in the requested skill profiles and therefore a number of emerging competences.

This section is interested in analysing and discussing the most relevant emerging competences for the building and repairing of ships and boat sector (Section 7.1). Subsequently, these new emerging competences will be presented by occupational functions in the sector (Section 7.2).

Graph 43. Areas of emerging competences in the EU shipbuilding sector



Source: Own elaboration

7.1.1. Emerging skills linked with globalisation

The growing competition experienced from third countries, together with an increasing use of foreign migrant workers in manufacturing activities[44] and international outsourcing practices, are all elements fostering the demand for skills linked with the management of multicultural situations, including as well the need for an operating knowledge of foreign languages (specially English). Also, the sector needs world-class management skills to be able to develop in an international context.

Thus, and on the one hand, high-rank professionals and managers are increasingly involved in international activities, not only when establishing customer relationships but also in manufacturing and designing activities (very often carried out on a decentralised basis amongst different suppliers located in different countries). On the other hand, the increasing presence of foreign workers within working places and production chains is requesting from both production managers and production workers an ability to successfully operate and manage multi-cultural environments and production chains, which also implies a need to effectively communicate with people from different cultural backgrounds. In this context, knowledge of foreign languages (especially English) becomes very relevant, especially in those countries characterised by poor knowledge of foreign languages. Finally, it is also very important to take care of the social aspects of the life of immigrant workers (facilities for children, housing, etc), so they may feel as comfortable as possible and reduce therefore the risk of leaving their work for returning to their home countries.

7.1.2. Emerging skills linked to new products/materials/manufacturing processes

As already suggested in a previous chapter of this report, the European specialisation in high value added/technologically advanced vessels requires an important emphasis on investments in RDI activities that is expected to keep in the coming years. These RDI activities are intended to innovate and develop new materials and design/manufacturing methods that may help maintaining the European competitive advantage, and result in a need of new skills for managing and successfully adapting to changes (new materials, new processes, etc).

Thus, and as far as new materials are concerned, the sector is currently involved in RDI activities in a number of fields such as (Waterborne, 2007):

- Innovative solutions in composites, matrices;
- Light metals for shipbuilding (new alloys, nano-scale structures, re-crystallisation models), with durable use qualities;
- Innovative duplex steel types with low alloy costs and enhanced corrosion resistance and mechanical properties;
- New nano-scaled structures (100-300 nm grain size) formed in Al alloys which increase mechanical strength whilst preserving ductility;
- New Al alloys with high-temperature fatigue resistance;
- Environmentally-friendly, smart materials;
- Innovative, multi functional coatings (including bio-coatings);
- Bio-composites;
- Innovative solutions in thermoplastics and polymers, GRP/FRP composites (specially for boatbuilding);

[44] The use of migrant workforce in the European building and repairing of ships and boat sector as a response to cope with existing skill gaps will be further analysed in chapter 9.

Meanwhile, and referring to manufacturing processes, the integration of the latest developments in ICTs, logistics and technology into the shipbuilding process, together with the need to successfully manage the supply chain (lean manufacture, just in time practices, robotisation of some functions, etc) are resulting in a number of new manufacturing processes developed or to-be-developed by the sector, including, amongst others (Waterborne, 2007):

- Process Optimisation & Control: Systematic investigations of shipbuilding processes by means of simulation (the virtual enterprise) in order to reduce time-to-market and building cost while improving value to the customer;
- Shipbuilding Logistics Control: Systematic investigations into techniques to rationalise inventory management and process logistics by means of ICT, with closer interactions (co-design and engineering) between customers, contractor and subcontractors;
- Knowledge mobilisation in the shipbuilding production environment: Systematic investigations into technology and learning schemes for IT-supported training and production assistance in the workshops;
- Knowledge management in design & engineering: Research & development into a distributed internet-supported framework for harnessing knowledge of specialist service providers;
- Virtual prototyping to allow craft design to be optimised without recourse to prototype manufacture,

where these research objectives are expected to produce results in a number of fields, such as the rapid identification and evaluation of innovations, the fast development of new products and intelligent manufacturing processes or the fast implementation of innovations. Examples of emerging manufacturing processes include, amongst others, new generations of arc welding technology with lower heat input, innovative hybrid laser welding techniques (laser plus MAG welding) or advanced moulding, modularisation and lamination techniques in the manufacturing of recreational boats, together with an increasing use of robots/automatisation techniques for accomplishing a number of complex/risky activities (Heyes, 2005).

In this respect, design activities (including modelling and simulation tools such as CAD/CAM, CIM techniques, co-design activities with suppliers and clients, Knowledge based engineering[45], etc) are getting an increasing value in the shipbuilding activity as they have an important positive impact on many other costs like materials, subcontracting or production/maintenance activities, as well as on delivery time and management of disposals (Andritsos and Pérez-Prat, 2000)[46]. The importance of design activities has been recognised by the big EU yards, which invest considerable sums on enhancing and integrating their design activities, often carried out in geographically distant environments. Not surprisingly, the Waterborne Strategic Research Agenda (Waterborne, 2007) suggest a number of research priorities in the development of design and analysis tools, such as:

- Tools and software for design, analysis and modelling of composites, advanced structures and engineering systems (FEM, SPH, VOF, etc.);
- Prediction methods for failure, ageing and durability;
- Knowledge management networks for shipyards;
- Life long learning programmes for European shipyards;

[45] Knowledge Based Engineering (KBE) is a technology that deals with the capture of knowledge for engineering processes within a software environment. It has been used extensively in the aerospace industry in many areas of component design and analysis. It is also widely implemented as a solution to the automation of engineering and manufacturing data

[46] This importance is particularly relevant in the case of the most complex vessel types such as cruises.

- Development of systems and tools for simulation and modelling in different fields such as transport chains, ship operational life cycle costs, module design and production processes or, finally, functional performance.

7.1.3. Multiskilling

Currently, the need for more flexible organisations (fostered by lean production techniques) together with the need to successfully cope with existing skill shortages, requires multi-skilled people capable of performing either different job tasks or work on different phases of the production chain. This trend, often referred to as 'multi-skilling', requires a workforce well grounded in the fundamentals and able to absorb training for new technology and manufacturing and business processes, and has a number of implications for the workforce, briefly:

- An enrichment of the work contents
- Higher levels of self-autonomy and responsibility at work, often implying a higher involvement in suggestions for the improvement of manufacturing processes
- Increasing importance of team work, which requires a higher level of interaction and dialogue between team members and an increasing attention to the social aspects of shipyard work.
- Lower demand for middle managers in final shipyards as workers themselves (both in isolation as well as in working groups) become increasing responsible of their work.
- Increasing need for complex problem solving skills, that is to say, developed capacities used to solve novel, ill-defined problems in complex, real-world settings

7.1.4. Emerging skills linked to outsourcing and subcontracting practices

Interestingly also, the current importance of outsourcing and subcontracting practices, together with the necessity to liaise and successfully coordinate with the work performed by the various subcontractors in the supply chain, is fostering an increasing differentiation of skill requirements between final assembling yards and supplying yards.

Thus, final assembling yards are primarily involved in four key activities, that is to say, basic engineering activities (intended to correctly design the vessel accordingly to the clients' needs), development engineering (intended to define and plan the whole production process including the supply chain), the final assembling of all the different parts/units provided by the different subcontracted suppliers (which obviously implies the control and supervision of these suppliers' activities)[47] and, finally, the testing and delivery of the vessel to the client (for a further description of a typical shipbuilding process see Table 30 in this report).

Therefore, and as it can be seen, final assembling yards are particularly requiring high-level skills related to a number of areas such as:

- General coordination and organisation of increasingly complex operations;
- Marketing/sales activities for managers and cadres involved in these activities, and intended to maximise demand especially through expanding activities in foreign markets (particularly in the boatbuilding subsector);
- Finance and cost accounting activities, given the importance of finding suitable external finance for financing and reducing operating costs of building a ship;

[47] Meanwhile, equipment suppliers are very often responsible of integrating their equipments within the vessel, always under the control of the final assembling shipyard.

- Logistic activities, due to the increasing presence of outsourcing and international supply chain management practices and lean manufacturing techniques.
- Design activities (already discussed);
- Communication and project management skills for production managers and intermediate manufacturing cadres (team leaders), as these skills are essential to successfully organise resources, meeting deadlines and budgets, especially for controlling and verifying the activities of subcontractors in the current context of lean manufacturing practices.

Meanwhile, supplying yards (mostly involved with the manufacturing of shipbuilding parts/units) are primarily requesting medium-low level skills primarily related to manufacturing activities, although managers and intermediate cadres of these supplying yards are also demanding communication and project management skills for effectively interacting with other shipyard customers.

7.1.5. Additional emerging skills in other knowledge areas

Finally, it is possible to identify a number of additional knowledge areas that, despite being currently important, are expected to be even more important in the coming years and therefore will request a number of skills for successfully coping with them. These knowledge areas include, amongst others:

- Manpower management (social aspects of shipyard work). Examples of related skills include coordination, instruction, negotiation, effective communication, service orientation and persuasion skills.
- Manpower planning, with a need to manage increasingly higher skilled labour through the peaks and troughs of the shipbuilding demand and to re-skill them to stay abreast of technological innovations. In this context, it becomes also crucial for managers and human resources managers to understand the current and future training needs of the workforce, as well as the training provision market so that they can source providers who understand their business context.
- Skills for managers and cadres to manage and adapt to changes of market conditions in an uncertain environment (economic downturns and upturns, new materials, new processes, etc), with an emphasis on pro-activity rather than reactivity
- Management and development of environmentally friendly processes and products, recycling of existing materials and disposal of redundant materials
- Management of working conditions, health and safety issues in the workplace and job satisfaction, also in relation to subcontractors.
- Management of Quality

7.2. NEW CRITICAL COMPETENCES BY OCCUPATIONAL FUNCTIONS IN THE BUILDING AND REPAIRING OF SHIPS AND BOAT SECTOR

Having in mind the most relevant emerging competences for the building and repairing of ships and boat sector analysed in the previous section, this section is interested in presenting these new emerging competences by main occupational functions (see Table 50), following for this purpose the methodology suggested by Professor Rodrigues.

Main jobs in the building and repairing of ships and boat sector by suggested occupational functions are:

- General Management: General and operations managers; industrial production managers; financial managers; purchasing managers; sales managers; human resources managers; administrative services managers, etc
- Marketing: Sales representatives; supervisors of sales workers; customer service representatives, etc
- Financial and administrative: accountants and auditors; financial analysts; human resources and labour relations specialists; office clerks in general; supervisors of office and administrative support workers; executive secretaries, administrative assistants and secretaries, etc
- R&D: Design and engineering managers; naval architects; designers; engineers (structural, electrical, shipbuilding); draughtsmen (CAD), etc
- Logistics: purchasers and purchase managers; delivery and logistics controllers; stock clerks and order fillers, etc
- Production (service) management: Work preparation and production managers; project managers and production coordinators; dockmasters; foremen; shipwrights/master shipbuilders, etc
- Quality: Quality-related managers and workers; health and safety-related managers and workers
- Maintenance and repair: Maintenance technicians, Metalworkers/steel frame workers; assembling operators/steel shapers; welders; cutting mechanics; fitters/pipefitters/plumbers; electricians; carpenters; service technicians; docking assistants
- Production (service): Metalworkers/steel frame workers; assembling operators/steel shapers; welders; cutting mechanics; fitters/pipefitters/plumbers; electricians; carpenters; service technicians; docking assistants, etc

Table 50. New critical competences by occupational function in the building and repairing of ships and boat industry

Main Drivers / Functions	Economic Demand	Economic Supply	Technology Processes	Technology Products and services	Organisation Conceptual	Organisation executive	Others
	• Influence of the economic cycle (short run, orderbooks full) • Increase in world trade, but deteriorating perspectives • Increased use of sea transport, both long and short distances	• Competence from third countries (China) • Large multinational groups • Specialised suppliers	• Short time design/shipbuilding processes • Increased RDI investments • ICTs • Flexible production processes	• Multimodal transport functionalities • ICTs and autonomous ships • Environmental friendly and energy efficient ships/boats • Specialised high-tech, customised vessels and boats	• Increased and more complex international/national outsourcing, both materials/equipment and modules • Emphasis on basic and development engineering, project management	• Growing demand of qualified personnel • Shortages of personnel • Outsourcing practices, collaborative approaches with suppliers • Internationalisation of suppliers	• Growth of fuel and other raw materials costs • Increasing safety and Environmental concerns • Regulation on sea transports • Strong public-private cooperation, specially EU level
General Management	• Skills to manage and adapt to change • International Financial management under credit restriction • Manpower planning and management • International/national customer relationships • Focus on individualised customer needs	• World-class management skills • Knowledge of foreign languages • Multicultural management	• Identification of training needs for the workforce • Knowledge of new/emergent manufacturing/ assembling/outfitting processes and technologies • Knowledge of logistic processes • General ICT skills	• Knowledge of new materials/products	• International networking and contacts with enterprises and other stakeholders • Lobbying activities at national and international level • Creating international workplaces	• Outsourcing and international supply chain management skills • Negotiation and communication skills • Psychological skills to cope with stress • Social skills for successfully interacting with relevant stakeholders	• Knowledge of EU and national/regional regulations in different domains (environment, occupational health & safety, security, quality, standards,...)
Marketing	• International/national customer relationships • Market research	• Knowledge of foreign languages			• Lobbying activities at national and international level	• Social skills for successfully interacting with clients	Increasing knowledge of health & safety, security and quality, standards for marketing purposes.
Financial and Administrative	• International financial management under credit restriction	• Knowledge of foreign languages	• General ICT skills	• General ICT skills	• International administration	• Social skills • Fiscal and legal knowledge, both at national and international level	
R&D / Design activities	• Development of new individualised ships/boats	• Knowledge of foreign languages • Multicultural management	• Knowledge of new/emergent manufacturing/ assembling/outfitting processes and technologies • Knowledge transfer from other sectors • Specialised ICT skills	• Management of innovation • Knowledge of new materials/products • Knowledge transfer from other sectors • Protection of intellectual property rights	• Integration of design and manufacturing processes • Design of interiors (specially in some subsectors such as cruises, mega-yatches, etc)	• Integration of design and manufacturing processes ➔ Knowledge based engineering • Cooperation with other relevant R&D/design related organisations	• Knowledge of EU and national/regional regulations in different domains (environment, occupational health & safety, security, quality, standards,...)
Logistics		• Knowledge of foreign languages	• On-line supply chain management (ICT skills)	• In-depth technical knowledge of logistics-related issues	• Outsourcing and international supply chain management	• Social and communication skills • Psychological skills to cope with stress	

Main Drivers / Functions	Economic Demand	Economic Supply	Technology Processes	Technology Products and services	Organisation Conceptual	Organisation executive	Others
Production management	• Social abilities for successfully interacting with clients	• Knowledge of foreign languages • Management of multicultural working environments	• Knowledge of new/emergent manufacturing/ assembling/out fitting processes and technologies	• Knowledge of new materials/products	• International supply chain management • Management skills • Project management skills • Skills for successfully interact with skill suppliers	• Social and negotiation skills (up and down in the production chain). • Psychological skills to cope with stress • Integration of design and manufacturing processes ➔ Knowledge based engineering	• Applied knowledge of existing regulations on environment, management disposal, occupational health & safety, security, quality, standards,…
Quality			• Management of quality standards	• Management of quality standards			• Knowledge of EU and national/regional regulations in different domains (environment, occupational health & safety, security, quality, standards,…)
Maintenance and repairing			• Applied knowledge of new/emergent manufacturing/ assembling/out fitting processes and technologies	• Applied knowledge of new materials/products		• Multi-skilling and flexibility to changes • Psychological skills to cope with stress • Project management skills • Social and negotiation skills, specially in multicultural environments	• Applied knowledge of existing regulations on environment, management disposal, occupational health & safety, security, quality, standards,…
Production / service			• Applied knowledge of new/emergent manufacturing/ assembling/out fitting processes and technologies (automatization and robotization)	• Applied knowledge of new materials/products		• Multi-skilling and flexibility to changes • Psychological skills to cope with stress • Project management skills, both individually and in groups. • Social and negotiation skills, specially in multicultural environments	• Applied knowledge of existing regulations on environment, management disposal, occupational health & safety, security, quality, standards,…

Source: Own elaboration

8. SCENARIOS

8.1. KEY VARIABLES AND HYPOTHESES

- According to the analyses and ranking of drivers of change described on section 6, the following variables have been selected in order to construct scenarios for the future the European building and repairing of ships and boats sector:
- Economic cycle and future evolution of world trade and sea transport
- Preservation of the European technological advantage
- For each of these two variables, two hypotheses (one favourable, one unfavourable) are made, thus defining 4 prospective scenarios:

1. Economic cycle and future evolution of world trade and sea transport:

Two hypotheses are considered regarding future evolution of world trade or, to put it differently, regarding the impact of the economic cycle downturn in world trade (and recreational boat demand):

a. Favourable: small influence of economic cycle

- The economic slowdown is short, with a rapid recovery of the world economy
- World trade keeps on growing at a similar rate as in the last 5-10 years (5% annual for seaborne trade)
- The regulatory framework compensates the short slowdown
- No major financial restrictions
- Demand of ships and boats grows at current levels
- Demand of specialised and high technology vessels keeps expanding

b. Unfavourable: the cycle has an important impact

- Long term crisis (recession)
- Growth of world trade is severely affected (2% annual rate) for seaborne.
- Regulatory framework is not able to compensate (other sectors' demands)
- Financial restriction affects particularly a sector as shipbuilding
- Demand of ships and boats is stagnant
- Demand of high-tech vessels is also affected

2. Preservation of the European technological advantage:

Two hypotheses could be established regarding the mid-term evolution of building and repairing of ships and boat industry in Asian countries:

a. Favourable: EU keeps technological competitive advantage against third countries

- Capacity and production of third countries keeps on growing at high pace
- But technological level lags behind that of European shipyards
- Main Asian production is of standard vessels
- European shipyards keep their current share in world production

b. Unfavourable: Asian countries technological level progressively equals the European

- Capacity and production of third countries keeps on growing at high pace

- Their technological level develops rapidly (especially in China)
- As a result, European competitive advantage decreases rapidly
- European shipyards decrease their current share in world production

8.2. SCENARIOS

The combination of the former variables and hypotheses give place to the following scenarios.

Table 51. Definition of future scenarios for the EU European building and repairing of ships and boats sector

		COMPETENCE FROM THIRD COUNTRIES AND EU TECHNOLOGICAL ADVANTAGE	
		Favourable: EU keeps technological competitive advantage	**Unfavourable:** Asian technological level equals EU
ECONOMIC CYCLE AND WORLD SEABORNE TRADE	**Favourable:** Small influence of economic cycle	Scn1 ++	Scn2 +-
	Unfavourable: the cycle has an important impact	Scn3 -+	Scn4 --

SCENARIO 1: GROWING DEMAND OF SHIPS AND BOATS AND PRESERVATION OF EU TECHNOLOGICAL ADVANTAGE

ρ Key assumptions

- The economic slowdown is short, with a rapid recovery of world and EU economy
- European economy grows at similar pace as recently (2% a year)
- World trade keeps on growing at a similar rate as in the last 5-10 years
- Moderation of fuel prices
- The regulatory framework (sea motorways, safety and environmental regulations, etc.) helps compensate the short slowdown and fosters demand of specialised ships
- No major financial restrictions for shipbuilding activity
- High investment in R&D activities in EU, cooperation and IPR safeguard
- Capacity and production of third countries keeps on growing at high level
- But their technological level lags behind that of European shipyards

ρ Consequences

- Demand of ships and boats grows at current levels
- Demand of specialised and high technology vessels keeps expanding
- Continuing introduction of innovations
- Main Asian production remains of standard vessels (low-medium tech)
- European shipyards keep their current share in world production
- Important activity related to replacement of old vessels
- Important level of repairing (including complete transformation) and maintenance activity

- Outsourcing ➔ Auxiliary sector integrates and keeps strong position: technology contents as competitive factor
- Overall figures of employment increase in EU as a whole:
  - Increases in EU15
  - Restructuring of shipyards in some NM States could have a significant medium-term impact on labour. Although compensated by increases in the activity
- Replacement needs: ageing, restructuring, requalification
- High demand for qualified personnel (engineers, electronics, new materials, ICT specialists; metalworkers, project management, financial)
- Possible international workers mobility

SCENARIO 2: GROWING SHIPBUILDING DEMAND BUT LOSS OF EU TECHNOLOGICAL ADVANTAGE

ρ Key assumptions

- The economic slowdown is short, with a rapid recovery of world and EU economy
- World trade keeps on growing at a similar rate as in the last 5-10 years
- Moderation of fuel prices
- The regulatory framework (sea motorways, safety and environmental regulations, etc.) helps compensate the short slowdown and fosters demand of specialised ships
- No major financial restrictions for shipbuilding activity
- Relatively high investment in R&D sectoral investments, although third countries' technological level develops rapidly (especially in China) and rapidly catches up with European technological standards.
- Capacity and production of third countries keeps on growing at high pace

ρ Consequences

- Demand of ships and boats grows at current levels
- Demand of specialised and high technology vessels keeps expanding
- Continuing introduction of innovations, increasingly in third countries
- Main Asian production increases its technological standards (increasing output of high-tech vessels)
- European technological competitive advantage decreases rapidly
- European shipyards decrease their current share in world production
- Stiffening of world competition
- Important activity related to replacement of old vessels
- Important level of repairing (including complete transformation) and maintenance activity
- Outsourcing ➔ Technology contents of auxiliary sector as competitive factor is increasingly lost.
- Relatively high demand for qualified personnel (engineers, electronics, new materials, ICT specialists; metalworkers, project management, financial)
- Relative decreases in employment levels, specially in manufacturing functions and specially in the old EU-15 Member States)
- Reduced international workers mobility
- Possible closure of shipyards.
- Possibility of third countries setting up in EU (acquisition of shipyards in crisis)

SCENARIO 3: STAGNANT SHIPBUILDING DEMAND BUT PRESERVATION OF EU TECHNOLOGICAL ADVANTAGE

- Key assumptions
  - Long term crisis (recession)
  - Growth of world trade is severely affected.
  - The regulatory framework (sea motorways, safety and environmental regulations, etc.) helps partially compensate the economic slowdown and fosters demand of specialised ships and boats
  - Financial restriction affects particularly a sector as shipbuilding
  - Reduction of R&D sectoral investments, although investments are still very significant and important. Technological cooperation and IPR safeguard
  - Capacity and production of third countries keeps on growing at high level
  - But their technological level lags behind that of European shipyards

- Consequences
  - World demand of ships and boats is stagnant
  - Demand of high-tech vessels is also affected
  - Continuing introduction of innovations
  - Main Asian production remains of standard vessels (low-medium tech)
  - European shipyards keep their current share in world production
  - Replacement of vessels is reduced
  - Repair activity increases as old ships are kept functioning
  - Outsourcing ➔ Auxiliary sector integrates and keeps strong position: technology contents as competitive factor
  - Important demand for qualified personnel (engineers, electronics, new materials, ICT specialists; metalworkers, project management, financial)
  - In absolute terms, relatively important employment decreases (both EU15 and NM States), specially in manufacturing activities
  - Possible international workers mobility, especially for conception-related professionals.

SCENARIO 4: STAGNANT SHIPBUILDING DEMAND AND LOSS OF EU TECHNOLOGICAL ADVANTAGE

- Key assumptions
  - Long term crisis (recession)
  - Growth of world trade is severely affected.
  - Regulatory framework is not able to compensate (other sectors' demands)
  - Financial restriction affects particularly a sector as shipbuilding
  - Reduction of R&D sectoral investments
  - Capacity and production of third countries keeps on growing at high pace
  - Their technological level develops rapidly (especially in China)

- Consequences
  - World demand of ships and boats is stagnant
  - Demand of high-tech vessels is also affected
  - Introduction of innovations slows down
  - European technological competitive advantage decreases rapidly

- European shipyards decrease their current share in world production
- Replacement of vessels is reduced
- Repair activity increases as old ships are kept functioning
- Both at shipyards producing standard cargo ships and high-tech
- Demand for qualified personnel decreases
- Important employment decreases (both EU15 and NM States)
- Inexistent international workers' mobility
- Outsourcing ➔ Auxiliary sector also affected. Technology contents as competitive factor is lost.
- Possible closure of shipyards.
- Possibility of third countries setting up in EU (acquisition of shipyards in crisis)

8.3. SCENARIOS' IMPLICATIONS FOR EMPLOYMENT TRENDS

8.3.1. Demographic change and skills requirements

The *European Sectoral Social Dialogue Committee* (SSDC) of the shipbuilding and ship repair industry has recently presented last June 2008 a study in a selected number of EU countries[48] on demographic change and anticipated skills requirements in the European Shipbuilding and Ship Repair Industry ('t Hart P. And Dick Schotte, 2008). The main results of this very important study can be summarised as follows:

- Over the next five years, 11,000 workers will be needed every year in the shipbuilding sector, where this figure represents a 11% of the present EU-14 shipbuilding technical workforce (see Table 52). Retirements taken into account (minus 1%), and considering an average migration of technical employees between shipyards of about 4%, the EU-14 shipbuilding technical workforce still has to grow by 6% per year.

Table 52. Annual need for technical shipbuilding personnel: distribution by occupational categories and countries (% of increase over current workforce)

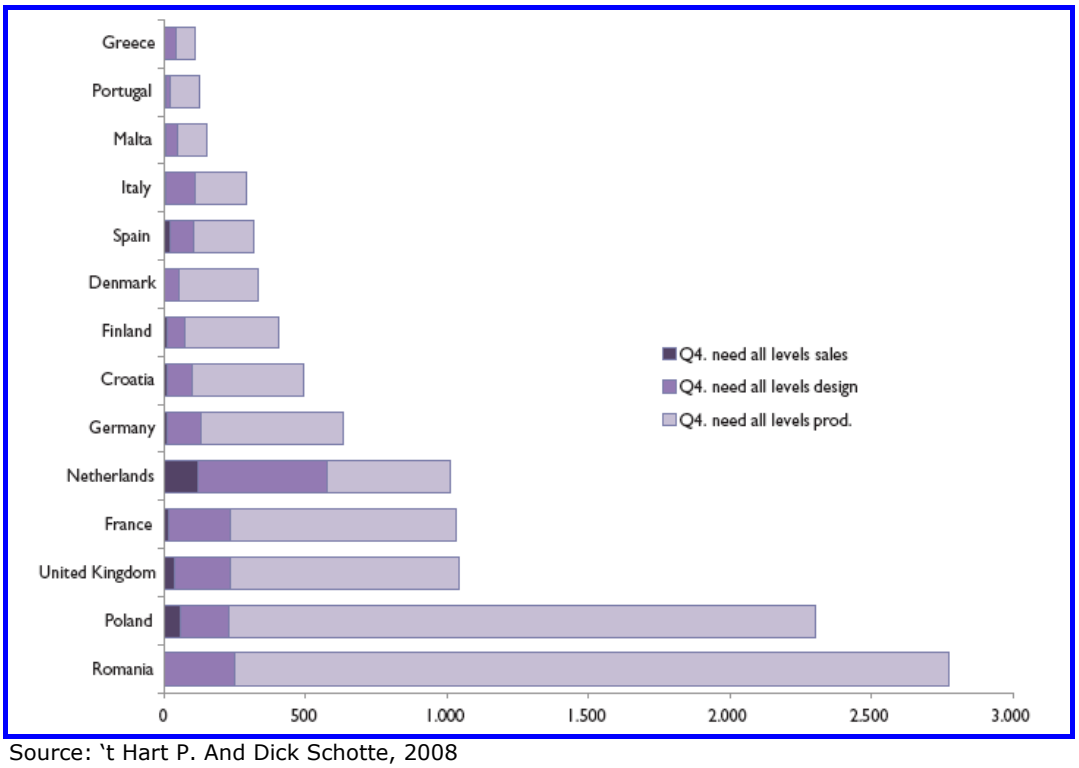
	Total	Occupational categories		
		Sales and after sales	Design and engineering	Work preparation and production
Romania	22	0	29	22
Poland	17	84	18	19
United Kingdom	15	43	13	15
Netherlands	14	18	33	8
Malta	13	20	135	10
European average (*)	11	15	15	10
Denmark	11	0	34	9
Finland	10	13	18	9
France	8	6	9	8
Portugal	7	8	12	7
Greece	6	6	81	4
Spain	5	11	10	4
Germany	4	4	7	4
Italy	4	4	8	3

The European average also includes data for Croatia.
Source: 't Hart P. And Dick Schotte, 2008

[48] The study has been carried out in the EU Member States of Denmark, Finland, France, Germany, Greece, Italy, Malta, The Netherlands, Poland, Portugal, Romania, Spain and The United Kingdom, as well as in Croatia.

- The four countries with the highest annual need for technical shipbuilding employees (i.e. Romania, Poland, United Kingdom, and The Netherlands) are responsible for 65% of the total need, where Romania and Poland represent 46% of the total need in shipbuilding, partially due to a large demographic shift of labour force moving to work in other countries over the last years (see Graph 44).

Graph 44. Shipbuilding expected annual need for technical personnel



Source: 't Hart P. And Dick Schotte, 2008

- The overall annual need for EU-14 shipbuilding personnel in sales and after sales activities and design and engineering activities at all levels is 15% for both, which means a relatively high emphasis on sales/after sales (explained by a need to maximise international demand) and design and engineering activities in the years to come (given the need to produce new innovative models and the positive impact of these design activities in reducing costs and successfully managing manufacturing activities). Meanwhile, the current need for work preparation and production workers (10%) is slightly lower than the EU average of 11%[49].
- The need for sales and after sales employees is very high for Poland (84%) and also for the United Kingdom (42%). Malta and The Netherlands also have an above average annual need for sales and after sales personnel. Meanwhile, there are seven countries with an above average need for personnel in design and engineering activities, this is, Malta, Greece, Denmark, The Netherlands, Romania, Poland and Finland. Finally, United Kingdom and specially Poland and Romania are the countries with an above average need for personnel in work preparation and production.
- Finally, the study confirms a trend towards more high skilled employees. Thus, the EU shipbuilding technical workforce has a high need for technical employees at MSc/BSc level (15%), an average need for technical employees at vocational level (12%) and no need for unskilled labour (<1%). This large need for employees at MSc/BSc level is especially clear in sales/after sales and design and engineering activities, whereas the need for vocational level studies is predominant amongst work preparation and

[49] These results especially apply for final assembling shipyards, whereas the need for work preparation and production workers might be expected to be higher amongst subcontractors.

production workers. In any case, these results suggest a clear trend in Europe to only employ people who have received proper education and training.

Interestingly also, other studies (SEMTA, 2006) confirm this increasing need of suitably qualified technical workers, capable of using the latest technologies and materials in production and design activities and preferably with previous work experience. In this sense, the UK is currently experiencing skill shortages for a number of jobs and occupations, such as naval architects and engineers, as well as jobs at craft level such as engineering, electrical/electronics, welding and fabricating, metal and piping, as well as interior designers and carpenters/ laminators amongst boatbuilders. Information at Pan-European level also confirms the importance of this skill shortage problem as identified by the sector (see for instance information contained in previous Section 4.5 of this report).

8.3.2. Implications for employment trends in the different scenarios

Having in mind the sector's own perceptions, next Table 53 tries to identify the possible employment trends in the time horizon of 12 years in comparison with the present situation, in terms of increase, maintain or decline in absolute/relative terms the employment levels. For this purpose, the information will be desegregated distinguishing functions accordingly to their conceptual (i.e. marketing functions, R&D/design activities) or executive nature (i.e. production management, production/service activities, maintenance and repairing activities, quality and logistics activities). Also, the information will be disaggregated accordingly to the situation in the 'old' EU-15 Member States and the new Member States (NMS), as the existing information shows a higher presence of personnel in executive activities in the NMS (as well as an above average need for personnel in these functions) in comparison to the situation in the 'old' Member States, who show a higher presence of people in conception-related functions and occupations.

Table 53. Scenarios' implications for employment trends in the building and repairing of ships and boat industry

	EU-15		NMS	
	Conception	Execution	Conception	Execution
Scenario 1: Growing demand of ships and boats and preservation of EU technological advantage	I	I	I	I
Scenario 2: Growing shipbuilding demand but loss of EU technological advantage	M	?	M	M
Scenario 3: Stagnant shipbuilding demand but preservation of EU technological advantage	M	D	?	D
Scenario 4: Stagnant shipbuilding demand and loss of EU technological advantage	D	D	D	D

'I': Increase the employment level
'M': Maintain the employment level
'D': Decrease the employment level
'?': Uncertain trend
Source: Own elaboration

Detailed information for each scenario is presented next:

- In Scenario 1 (Growing demand of ships and boats and preservation of EU technological advantage), it can be expected positive increases in absolute terms in overall employment figures, both in the EU-15 and the NMS. In any case, it can be expected an increase in the relative presence of conception-related jobs in Europe as a whole, specially important in the EU-15 Member States and relatively less important in the NMS (much more focused on manufacturing activities). Also, final assembling yards are expected to experience a relatively higher presence of conception-related employment in comparison to subcontractors (more focused on production activities)
- In Scenario 2 (Growing shipbuilding demand but loss of EU technological advantage), the world demand of high-tech ships and boats will not fully benefit the European shipyards as it will be increasingly absorbed by other competitors. Having in mind this situation, it might be expected that the absolute presence of both conception and

execution-related employment will be maintained, and provided that the growing demand compensates decreasing shares of EU producers. This situation is expected to affect both EU-15 and NMS countries, although in the EU-15 case the absolute presence of execution-related jobs may be negatively affected by increasing subcontracting practices (both to other EU-15 or NMS shipyards for benefiting of lower manufacturing costs). In relative terms, it can be expected an increase in the presence of conception-related jobs in Europe as a whole.

- In Scenario 3 (Stagnant shipbuilding demand but preservation of EU technological advantage), this negative scenario might affect sector employment in a number of ways. On the one hand, the stagnant demand combined with the need to continuously introduce new innovative solutions and products may result in the maintenance in absolute terms of conception-related employment levels. This result will be specially the case in the EU-15 Member States, whereas the situation in the NMS is less clear and will depend on the presence of national final assemblers (the larger number of local final assemblers, the more likely that conception-related employment will remain stable in the area). Meanwhile, execution-related employment is expected to suffer from a decline, both in absolute and relative terms and for final assemblers/subcontractors for the whole of Europe. Possible mobility flows of conception-related professionals from NMS to EU-15 countries (in search of better jobs and working conditions) may accentuate these trends.
- Finally, and as far as Scenario 4 is concerned (Stagnant shipbuilding demand and loss of EU technological advantage), this last scenario is expected to have very negative impact in terms of employment, both in the EU-15 and the NMS and for final assemblers and subcontractors, always in absolute terms. In any case, it might be expected that, in relative terms, the presence of conception-related jobs will increase its participation on the total employment, specially amongst the EU-15 Member States and the final assembling yards.

8.3.3. Quantitative approach to employment evolution by scenarios

The present section will try to envisage the impact on employment which could be expected in the different scenarios which have been previously defined. More precisely, scenarios 1 and 4 will be considered, as they outline the more extreme situations for the sector evolution and its employment.

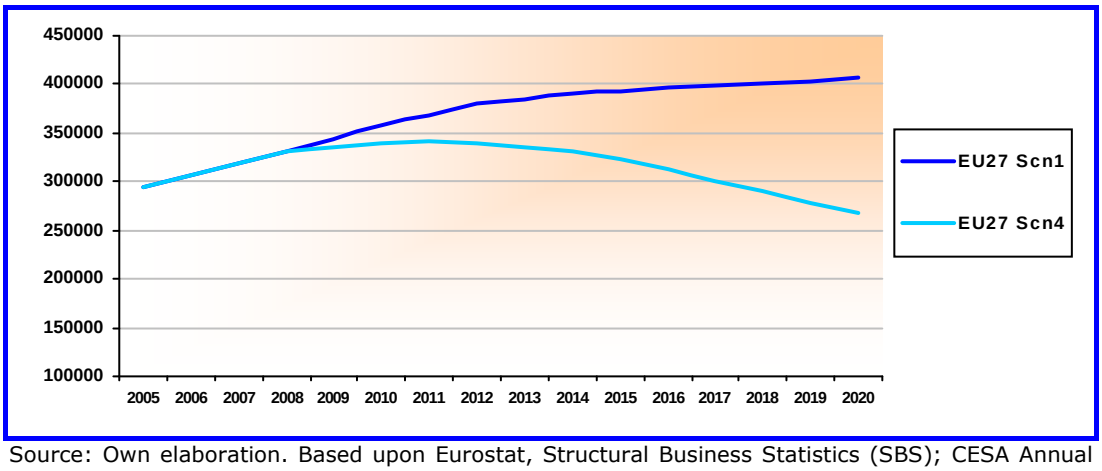
It is important to underline that the sector's perceptions and needs as expressed on the SSDC report will be considered as the starting point, as they establish by themselves a trend for the next 5 years. As it has just been explained this trend is very positive and responds to the current high level of sector activity and of new orders. However, it seems that this trend must somehow be re-examined in view of the recent evolution of the world economy and its deteriorating perspectives, as it is envisaged in Scenarios 3 and 4.

Graph 45 presents an employment forecast at EU-27 level until 2020, under scenarios 1 and 4:

- Under scenario 1, the sectoral employment is supposed to grow at a cumulative yearly rate of 3.6% until 2012. This rate is based on the 6% growth for the CESA shipyards estimated on the SSDC report, but attenuated for the sector as a whole, this is, including other shipyards, the auxiliary industry and the boat building subsector, whose employment is are expected to grow at a slower rate.
- It is assumed that even in this positive scenario 1 (where the sector nearly is not affected by the current crisis), employment cannot grow indefinitely at the same rhythm as it is expected for these very good years and that the rate will slowdown progressively afterwards. Thus it is assumed that employment will increase at an annual rate of around 1% or less from 2012 until 2020.
- As a result, in this scenario the sector might employ an overall figure of 380,000 persons by 2012 and of 400,000 persons by the end of the period, always at EU27

level. As it can be seen, this would imply a very significant increase in comparison to the 320,000 employees that can be estimated for 2007, increase which is concentrated on the next 5 years according to the sector stated perspectives. As a reference, the employment recorded by CESA in 17 EU main producer countries was over 461,000 people in 1975.

Graph 45 Employment forecast 2005-2020 for the EU-27 shipbuilding sector: Scenario 1 vs Scenario 4



Source: Own elaboration. Based upon Eurostat, Structural Business Statistics (SBS); CESA Annual Report 2006-07; SSDC Report 2008

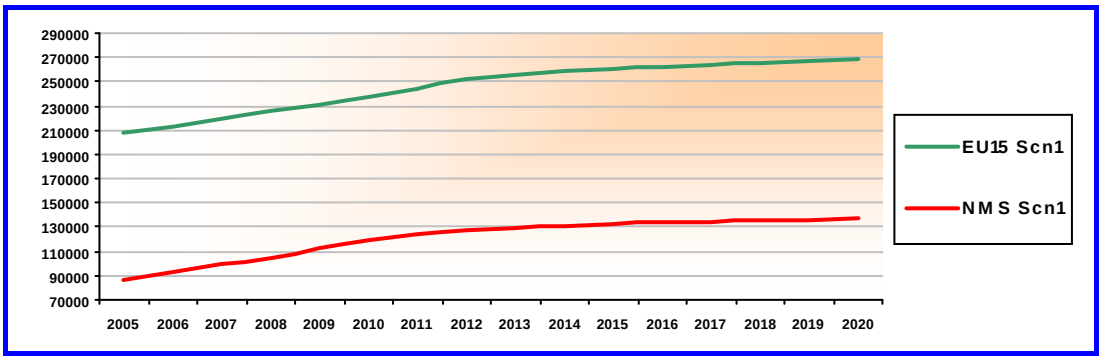
- On the contrary, if scenario 4 is considered, employment evolution would not be as expansive even in the first period up to 2012, as a result of the economic and financial crisis and its consequences in terms of reduced sector activity, possible orders' cancellations, etc. Thus, it is assumed that employment would only grow slightly over a 1% rate until 2012 (2% for the CESA shipyards).
- This process, together with the increasing Asian competence and the progressive lost of the European technological advantage, would be accentuated afterwards, driving to a severe reduction of employment (yearly rate of about -3% until 2020).
- In overall figures, under scenario 4 employment in the sector could still grow up to 340,000 people until 2012, but then would decrease down to 270,000 people in 2020, as a result of the very unfavourable market conditions assumed for the whole EU27.

Graph 46 shows in comparative terms the possible evolution of employment at EU15 level and NMS level, under scenario 1. The following comments can be extracted:

- According to the SSDC report, employments needs concentrate on NMS, particularly in Romania and Poland (which nearly account for a 50% of the overall current European needs), mainly due to the migrant work process. In this sense, under this favourable scenario it is assumed that employment in the NMS will grow around a rate of 5% (nearly 8% in CESA shipyards) until 2012, against a more moderate rate under 3% in EU15 (4% in CESA shipyards).
- However, both areas would experiment an attenuation of growth afterwards, which would limit employment increase to a rate of around 1% until 2020. Some NMS shipyards would have to undergo restructuring processes in this period, but the overall balance could still be positive.
- In absolute terms, employment in EU15 could grow from the current 220,000 people up to 250,000 in 2012 and more slowly to 270,000 people in 2020. As a reference, the EU15 sector employed as much people as that in 1988, when a severe reconversion process was already underway. Before that, there were maximum historic figures well over 300,000 employees.

- As for the NMS, employment would increase from 100,000 people up to nearly 130,000 people in the first period and to 137,000 in 2020.

Graph 46 Employment forecast 2005-2020 for the shipbuilding sector in Scenario 1: EU-15 and NMS

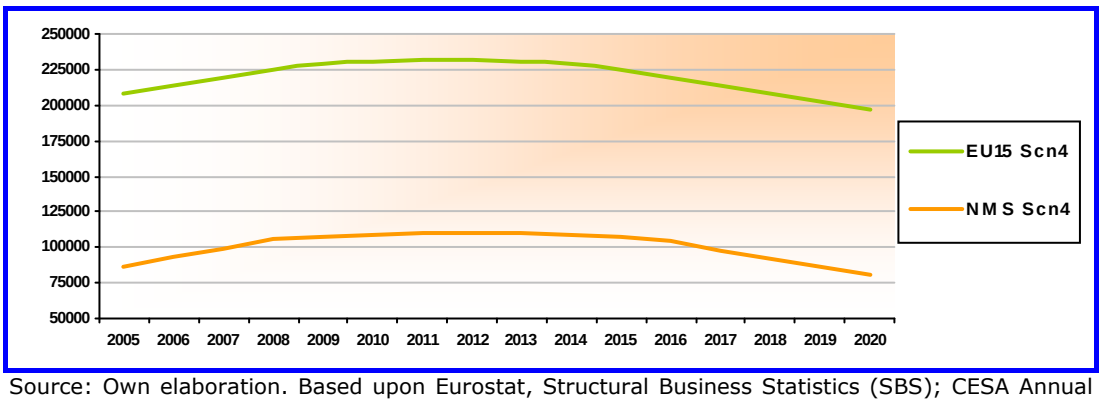


Source: Own elaboration. Based upon Eurostat, Structural Business Statistics (SBS); CESA Annual Report 2006-07; SSDC Report 2008

Graph 47 concentrates the analysis on scenario 4, comparing the projected evolution for EU15 and NMS:

- In this case, both European areas would quickly experience the slowdown induced by the economic and financial crisis, severely reducing the very positive perspectives of scenario 1.
- Thus, it is assumed that NMS employment would increase at a rate fewer than 2% until 2012 (against 5% in Scenario 1) and EU15 employment at slightly over 1% in the same period. Afterwards, employment evolution would take a very negative trend in both areas, but particularly in the NMS, which could be more affected by the Asian competence and its technological development (rates of -2% in EU15 and of nearly -5% in the NMS).
- As a result, employment in EU15 would grow from 220,000 people to 230,000 in 2012 and then decrease to approximately 195,000 people in 2020, with an overall loss of 25,000 jobs in the period. As for the NMS, figures would go from the current 100,000 jobs to nearly 110,000 in 2012, reducing later down to 72,000 jobs in 2020 (almost -30,000 for the whole period).

Graph 47 Employment forecast 2005-2020 for the shipbuilding sector in Scenario 4: EU-15 and NMS



Source: Own elaboration. Based upon Eurostat, Structural Business Statistics (SBS); CESA Annual Report 2006-07; SSDC Report 2008

8.4. IMPLICATIONS OF SCENARIOS FOR COMPETENCES AND OCCUPATION PROFILES

This section is interested in analysing the feasible implications of the different four scenarios for competences and occupation profiles. In this sense, and following the methodology suggested by Professor Rodrigues, this section will identify, for the best and worst scenarios distinguished in chapter 8 (Scenario 1 and Scenario 4, respectively), the implications for each occupational function in terms of jobs expanding, transforming or in decline (see Table 54 and Table 55).

8.4.1. Scenario 1: Growing demand of ships and boats and preservation of EU technological advantage

The Scenario 1, characterised by a growing World and European demand of ships and boats combined with a preservation of the EU technological advantage, is expected to have a positive impact in overall absolute employment figures. This positive impact can be expected particularly in some specific functions such as marketing and R&D/Design activities, together with production management functions, whereas in other functions (i.e. Financial and Administrative, Logistics, Quality, Production) the expected increases will be probably less important (although positive in any case). Particularly, increases in employment figures for the productive function are expected to benefit to suppliers and NMS countries, whereas conception-related functions (i.e. marketing functions, R&D/design activities) might be expected to benefit specially final assemblers and old EU Member States. Also, the relative presence in total employment of these conception-related functions is expected to increase, irrespectively of the location of the shipyards.

Table 54. Jobs in expansion, transformation or decline in two selected scenarios

Economic Demand	Existing jobs in expansion	Jobs in transformation	Jobs in decline
Scenario 1: Growing demand of ships and boats and preservation of EU technological advantage	Particular expansion in Marketing, R&D/Design and Production management. Less relevant expansion in Finance and Administration, Logistics, Quality, Production. Production jobs particularly increases amongst suppliers and NMS. Conception-related functions (i.e. marketing functions, R&D/design activities) particularly increase amongst final assemblers and old EU Member States. Increase of the relative presence of conception-related functions.	All functions, specially amongst general management functions, R&D/Design functions and Production-related functions (including production-management functions)	Service-related functions (security guards, fire fighters, cleaners), due to external contracting practices:
Scenario 4: Stagnant shipbuilding demand and loss of EU technological advantage		All functions, especially as far as execution-related functions (i.e. production management, production/service activities, maintenance and repairing activities, quality and logistics activities). Decline of jobs in conception-related functions (i.e. marketing functions, R&D/design activities), although increase of relative presence in total employment.	All functions, particularly general management functions, R&D/Design functions, and Production-related functions (including production-management functions).

Source: Own elaboration.

Table 55. Jobs in expansion and decline in two selected scenarios, by concrete functions

Scenarios	General Management	Marketing	Financial and Administrative	R&D/Design activities	Logistics	Production management	Quality	Maintenance and repairing	Production /service
Scenario 1: Growing demand of ships and boats and preservation of EU technological advantage	=	++	+	++	+	++	+	+	+/-
Scenario 4: Stagnant shipbuilding demand and loss of EU technological advantage	-	-	-	-	--	--	--	--	--/--

'+' means increase in employment
'=' means no changes
'-' means decrease in employment
Source: Own elaboration.

Meanwhile, some service-related functions (i.e. security guards, fire fighters, cleaners) are expected to experience a decline due to external contracting practices to specialised suppliers, although this trend is already well established in the EU-15 Member States but probably yet to be accelerated in the NMS. Finally, general management functions are expected to maintain in time.

In addition to this, it could be argued that existing jobs in all functions are expected to be affected by serious transformations in their nature and contents. In any case, some special functions will be particularly affected, such as general management functions, R&D/Design functions and Production-related functions (including production-management functions)[50].

8.4.2. Scenario 4: Stagnant shipbuilding demand and loss of EU technological advantage

By way of contrast, the fourth scenario can be defined as the most negative one and would be characterised by a stagnant shipbuilding demand accompanied with the loss of EU technological advantage. In this scenario, it could be expected a very negative impact in terms of employment that is likely to affect all existing functions, specially as far as execution-related functions (i.e. production management, production/service activities, maintenance and repairing activities, quality and logistics activities). In any case, those conception-related functions (i.e. marketing functions, R&D/design activities) might increase their relative presence in total employment, although this employment will be also affected by job losses.

Finally, and equally to the previous scenario, it is possible to expect that existing jobs in all functions will be affected by serious transformations in their nature and contents, irrespectively of market or competitive conditions. Also, some special functions will be

[50] For a further discussion on some of the expected transformations affecting these functions, please see chapter 1 for a discussion on this.

particularly affected, such as general management functions, R&D/Design functions, and Production-related functions (including production-management functions).

9. STRATEGIC CHOICES OF THE EUROPEAN SHIP AND BOAT BUILDING INDUSTRY TO MEET LABOUR AND SKILL SHORTAGES

9.1. CURRENT STRATEGIC CHOICES OF THE EUROPEAN SHIP AND BOAT BUILDING INDUSTRY TO MEET LABOUR AND SKILL SHORTAGES

The European ship and boat building industry is actively involved in a number of strategic choices in order to meet existing labour and skill shortages detected by the sector. These strategic choices include a number of solutions that are currently described in further detail.

9.1.1. Training of employed workers

The provision of in-house training activities for employed workers in the industry is the most typical solution for coping with the problem of skill shortages. Usually, solutions are company-specific ones, although in some countries specific actions have been developed by individual or group of enterprises in collaboration with the public sector.

Thus, and as far as company-specific solutions are concerned, some examples can be identified for this purpose:

- The French shipbuilder Chantiers de l'Atlantique (currently part of Aker yards) started in 2000 a project called "Carrières 21+", intended to set up a global system for the management of jobs and skills as well as for the definition of the different requirements for each job position available in the company. Amongst the activities carried out, "Carrières 21+" did outline and appraise the key skills needed for each person, identifying further training needs for each person. Also, this work allowed the enterprise to negotiate an agreement with the trade unions on skills and careers (European Shipbuilding Social Dialogue Committee, 2005).
- Fincantieri, the large Italian shipbuilding group, is very active in the training domain. Thus, and in the first two years of work at Fincantieri, new employees follow a number of training activities intended to improve their skills and their technological knowledge, basically as a result of the existing gap between the skills provided at the Universities and the skills required by the enterprise. Also, Fincantieri has got a company intranet and a training catalogue showing available training opportunities for employees. There are four basic areas of training (technical know-how, relationship competence, institutional knowledge, and special projects), and the company holds several technical conferences throughout the year. Also, some special training projects are carried out for some specific jobs/activities (i.e. a master of Naval engineering for BSc engineering students, a course for interior outfitting design for initial vocational training students or welding courses for blue collar employees). In 2007, Fincantieri provided 103,000 hours of training, involving 4,000 people in different areas. Interestingly also, Fincantieri organises direct safety training courses for all employees who enter in the shipyards' premises as suppliers (information supplied by Fincantieri).
- The activities carried out by VT Shipbuilding, in the United Kingdom (see Table 56).

Table 56. VT Shipbuilding's training activities, UK

- VT Shipbuilding is a division of the VT Group, quoted company that it is also involved in defence contracting, communications and other activities. VT Shipbuilding is one of the last remaining major shipyards in the UK. Training has been a central concern for this company for many years, but the emphasis placed has further intensified in recent years due to three inter-twined factors, this is, the need to ensure the ability of the workforce to take full advantage of new technology, the problems derived from a large proportion of older workers approaching retirement and therefore resulting in potential skills shortages, and finally, the decision by the UK Ministry of Defence to commission a number of major shipbuilding projects, which will lead to a 50% increase in the shipbuilding workforce by 2009.
- The company discussed with trade unions and representatives of the local Learning and Skills Council initiatives to boost basic skills across the workforce, and the result was the set up of a workplace learning centre. The South East England Development Agency also provided further funding. The centre was formally opened in July 2002, as a project mainly focused on extending opportunities for skills and further IT courses, due to the relatively high presence of school leavers with no qualifications.
- An important element of success was that the basic skills training would be separate from the normal vocational training provided by the company. It was the trade union that ran the learning centre, not the employers, so staff could talk in confidence with their colleagues and discuss suitable training.
- The company says that the initiative has resulted in time saving and a 20% productivity increase, with positive results for accident rates and sickness absence as well. The VT training initiative demonstrates how the needs of the workforce for basic training and those of a company for a better motivated and educated workforce can come together and be effectively addressed.

Source: European Foundation for the Improvement of Living and Working Conditions, 2008

On the other hand, individual or group of shipbuilding enterprises usually collaborate with the public sector for the definition and provision of training activities specifically aimed at the sector. Some relevant examples include:

- The UK example of the Sector Skills Agreements for the Marine Sector (SEMTA, 2006). Generally speaking, Sector Skills Agreements (SSAs) are government initiatives designed to deliver action to meet priority skills needs that will improve business performance. They provide a means for employers in each sector to identify productivity and skills needs, the actions to be taken in order to meet these needs and the ways to collaborate with providers of education and training in order to better fine-tune the existing training supply. Specifically, the Sector Skills Agreements for the Marine Sector has been elaborated by the Sector Skill Council of SEMTA (The Sector Skills Council for Science, Engineering & Manufacturing Technologies). This agreement identifies existing skills need, current provision and gaps and the areas where actions are needed to be taken by companies and key stakeholders (primarily training providers). The scope of the Marine SSA is shipbuilding and repair, boatbuilding and repair and marine equipment companies.
- In Denmark, ship and boat building companies cooperate with local centres for vocational education and training in developing specific training and re-education programmes for workers. They also co-operate in the development of training leave schemes as a means to invest in the workers' skills during periods of weak demand (Müller, 2007).
- The Italian Fincantieri group is helping regional public authorities to create special technological districts in Italy, specialised in shipbuilding activities, and comprising scientific institutions, training centres and enterprises with the aim of developing innovation and technological expertise/skills. Examples of these districts can be currently found in the Friuli-Venezia Giulia region (Technological district of shipping), the Liguria region (Marine Technological Polo), the Campania region (Technological district of metal construction engineering) and Sicily (Technological district of shipping). Fincantieri also cooperates with regional public authorities in the provision of training courses for young people.

Also, it is worth stressing that the sector is getting increasingly aware of the importance of 'learning through work' practices as a key element for successfully dominating the work tasks. In this context, transmission of knowledge from 'senior' personnel to 'new' in-

comers to the sector is increasingly regarded as a key element within the training of any person (see Table 57).

Table 57. The 'Learning through Work' Method

- The necessity of learning through work has been neglected during the last two decades as, so far society and enterprises have specially valued degrees instead of abilities and expertise. However, occupational skills are best learned after years of repeated practice, when a newcomer works side by side with an older and experienced worker (the so-called 'learning through work' method).
- If learning through work is not supported, there is a real danger that a big part of occupational skills got lost. Fortunately, shipbuilding companies are increasingly aware of the importance of this method which, in turn, requires that company managers must approve the idea of professionals having such skills and knowledge that are not available somewhere else. Also, the 'learning through work' model requires a right proportion of young and experienced workers working together, as well as the availability of specific resources (time, money, etc) for developing this model.

Source: Tuukka Pääkkönen, Akeryards

To end with this section, it is worth stressing that according to some recent estimations ('t Hart & Schotte, 2008), the shipbuilding education and training budget is estimated at 80 million Euro per year for the total of 14 European countries[51], where more than half of the available budget is devoted to work preparation and production. The report also shows that average budget per person is 800 Euro, but it varies greatly per country.

9.1.2. Recruiting and training unemployed workers

Other strategic solution to deal with the problem of shortage of qualified people is the possibility to recruit and subsequently re-train registered unemployed people so that they meet the skill requirements of the industry. This possibility is, for instance, extensively used in Poland. Thus, and as it will be later on discussed, in Poland there is a particularly important problem of shortage of qualified people, probably explained by a 'labour-drain' situation where many highly-skilled specialists leave the country for earning higher wages abroad. In order to solve this situation, Poland is extensively using money provided by the European Social Fund in order to re-train registered unemployed people in order to qualify them for the skill requirements of the sector. Thus, the joint project 'Looking into the future' has been initiated by the Gdynia Shipyard Group, the Gdynia regional employment office and an independent HR consulting company in order to train unemployed people for the sector. In the context of this joint project, a total of 180 unemployed people were trained between January and September 2005, and 162 of them were hired by the Gdynia shipyard (Müller, 2007). Also, in Finland it is the case that unemployed workers are required to carry out sector-related training activities, so they may not lose the contact with their former job and may therefore reincorporate later in time.

9.1.3. Recruiting young people coming from the education system

The sector in general is very conscious of the importance of recruiting young people and reinforcing the attractiveness of shipyards as a workplace for young graduates and professionals. Initiatives in this field include, for instance, the so-called "European Shipyard Week", developed in several years and previously described in this report.

Also, individual shipyards are also conscious of the importance of recruiting and attracting young people to the sector. Notwithstanding this, national shipyards are confronted with a double difficulty related to the recruitment of young people:

[51] These countries include the EU Member States of Denmark, Finland, France, Germany, Greece, Italy, Malta, The Netherlands, Poland, Portugal, Romania, Spain and The United Kingdom, as well as Croatia.

- On the one hand, it is often the case that national education systems deliver low quantities of youngsters with the right starting qualifications.
- On the other hand, the adaptation period of young workers to become 'autonomous' professionals capable of working on board without supervision and being aware of the risks related to their work can take a long period (ranging from two to five years, depending on the function), because of the complex and highly specific tasks to be performed in the sector.

One of the best practices for attracting students in the best conditions to the sector is given by the so-called "dual system" practice, particularly developed in Germany. This "dual systems" combine study periods in the University/technical centre with practical training practices on individual enterprises. Some important German shipyard groups are actively involved in these practices (see Table 58 for the case study of ThyssenKrupp Marine Systems AG).

Table 58. Dual systems studies in ThyssenKrupp Marine Systems: a possibility to bring young people to the sector

ThyssenKrupp Marine Systems AG is the leading European system provider of naval vessels – submarines and surface combatants – specialised commercial ships and large, complex yachts. Essentially, the group comprises Howaldtswerke-Deutsche Werft and HDW-Gaarden in Kiel, Nobiskrug in Rendsburg, Blohm + Voss und Blohm + Voss Repair in Hamburg, Nordseewerke in Emden, as well as Kockums in Sweden and Hellenic Shipyards in Greece.

The ThyssenKrupp Marine Systems AG is experiencing an increasing ageing process in its staff, so in 2007 up to 30.8% of the workforce was over 51 years old in comparison to 28.8% in 2005. In this respect, demographic change is one of the main challenges for the near future of the group, which results in predicted shortages of skilled workers (mainly engineers) in the near future. In order to solve this situation, the enterprise, the group is involved in dual systems studies practices for university/technical university students, combining study periods in the University with practical training practices on the Group's yards.

In this sense, students are offered an employment/training contract, which allows them to receive a salary (continuous training allowance) as remuneration for their activities in the yards. The provided training plans in the company include basic compulsory as well as optional modules (depending on major field of study and training objective), with a strong orientation towards practical, on-the-job training (including personal development, soft skills improvement and networking activities), usually in different departments of the yard and, if possible, at other sites at home or abroad in order to make the students familiar with the whole group activities. As a kind of compensation, students are required to remain at least 2 years in the Group after graduation (so far, no student has left the Group). Approximately 80 students have taken part in this initiative in the time period 1999-2008, 19 students in 2008. The most typical studies profiles include mechanical engineering, shipbuilding engineering and business management students.

For the company, this initiative has got a number of advantages. Thus, the Group meets its own needs of engineers, especially in specialist positions that are difficult to find on the market. On the other hand, participating students are not only highly motivated and committed to the Group but also are familiar with the Group as a whole (processes, departments, colleagues, etc), so they act 'beyond their noses' when starting their target positions. Finally, the Groups reckons that involvement in training activities improves the social image of the Group.

Of course, for the Group this initiative has got an important impact in economic terms, basically due to the high training costs associated (salary, tuition fees, qualification measures, events, etc). In addition, this initiative requests an active involvement of the human resource and the technical departments of the Group, as well as an active and timely planning process of the target position(s). In any case, ThyssenKrupp Marine Systems AG is fully committed to the dual system studies system for the future, as an integral part of its personal strategy in order to guarantee the future promotion and recruitment of junior staff.

Source: ThyssenKrupp Marine Systems AG

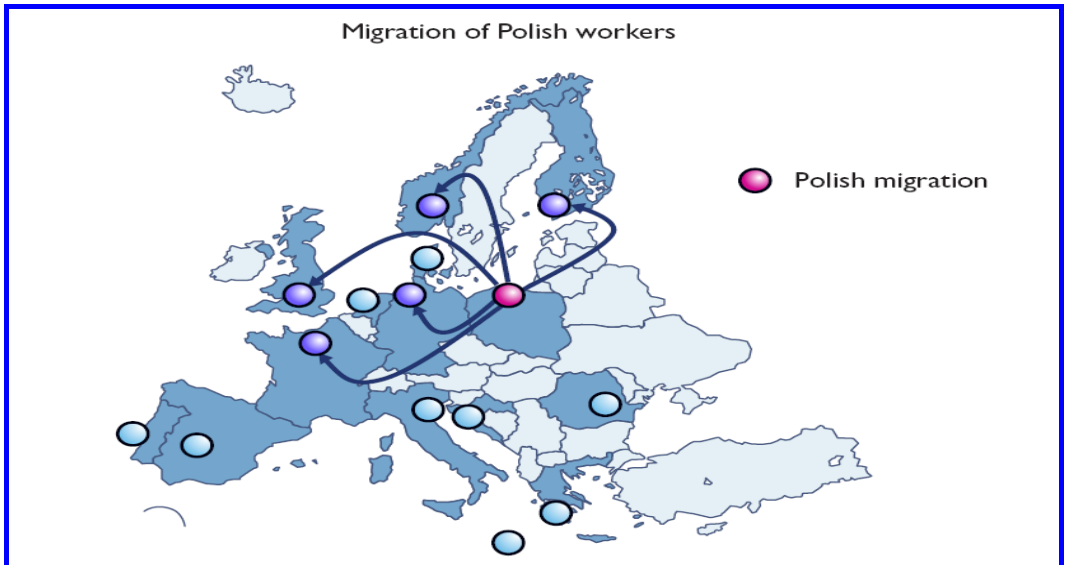
In other cases, and in order also to recruit in the best conditions young people to the sector, some shipyards are developing specific activities. Just to give an example, the Italian Fincantieri group is very active in interacting with universities, having initiated relationships with the universities of Genoa, Trieste, Naples and Udine, through which they

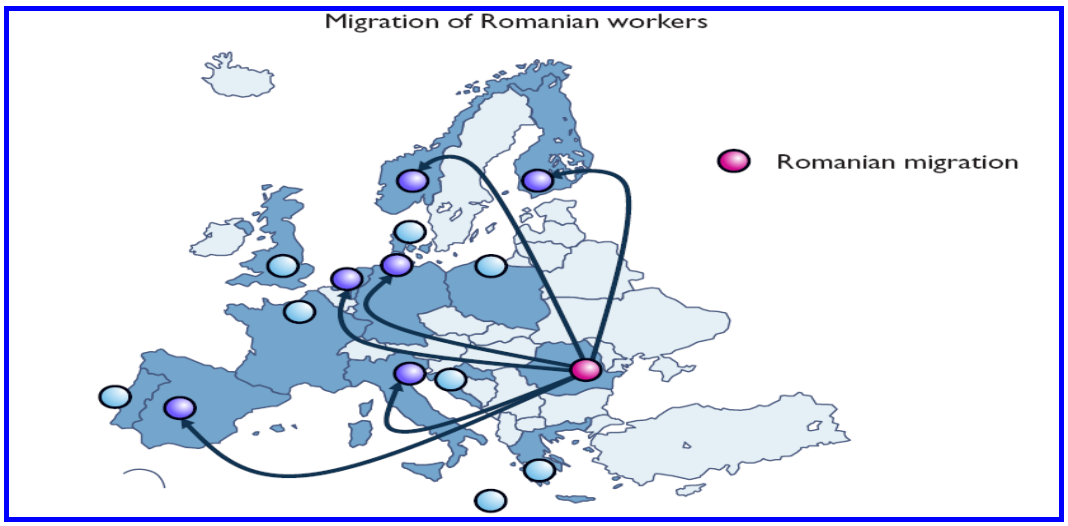
have developed training and work experience schemes for university students, as well as more specific initiatives for students who have already finished their degrees. Fincantieri has also successfully organised a course about job security in the shipbuilding sector at the engineering universities of Genoa and Trieste, basically intended to make students familiar with the sector's own characteristics before entering the job market. Finally, Fincantieri has linked up with the University of Genoa to help shipbuilding engineers develop skills such as marketing, understanding contracts, project management, and production systems, all of which are covered by a Master degree.

9.1.4. Recruiting workers from other countries (Member and non-Member States)

Another strategic choice adopted by the sector in order to cope with existing labour shortages and skill needs is related to the attraction of foreign workers from other EU (especially Poland, Romania and Baltic countries) and non-EU countries (i.e. Russia, Ukraine, India or Pakistan). This strategic choice, although well extended in all EU countries, is especially used by Northern European yards in Finland, Germany, The Netherlands or The United Kingdom), is also gradually extending to other Southern yards in Spain or Italy, and it is equally used by shipbuilding and ship repair activities, as well as by boatbuilding activities (see Graph 48 for a discussion of migration flows of Polish and Romanian workers).

Graph 48. Migration flows of Polish and Romanian workers





Source: 't Hart & Schotte, 2008.

Of course, this situation is benefiting those countries and shipyards that are attracting these foreign workers. By way of contrast, this situation can negatively influence the development of the domestic sector in those countries experiencing the outflow of qualified workforce, basically due to a "brain drain" situation that usually affects the highly-skilled people, not only working in production but also in design and engineering activities, who leave the country because they can earn higher wages abroad (Table 59).

Table 59. Migration of Romanian shipbuilding workers to other European countries and the USA

"The Romanian shipbuilding industry association Anconav confirms that, over the last three years, the Romanian shipbuilders have faced a huge migration of their workers to Europe and the United States of America. This applies especially for workers in the age group of 30 to 45 years. It is estimated that about 2,000-2,500 Romanian workers with piping, electrical and carpentry skills receive a working visa for nine months to work in the USA every year. After nine months, they return to Romania for a period of three months, and in the following year, the whole procedure starts all over again. Since the European borders are now open to Romanian workers, many skilled workers have moved to work in Norway, Finland, Italy, Spain, Germany and The Netherlands. It is estimated that 1,500-2,000 skilled workers from the Romanian shipbuilding industry are presently working in another country in Europe. This does not only apply to people working in production, but also to designers and engineers."

Source: 't Hart P. And Dick Schotte, 2008, taken from page 21.

9.1.5. Changing work organisation patterns: multiskilling and outsourcing practices

Generally speaking, one of the main goal of training initiatives in the European ship and boat building industry is to develop the workers' skills so that the same worker can perform several different jobs (i.e. multi-skilling) within their activities (i.e. electricians or locksmiths being trained to also perform the job of another specific occupational group such as welders and shipwrights). This practice, quite extended in the sector but specially typical in production activities, is done for increasing the internal vertical and horizontal mobility of workers.

On the other hand, outsourcing and subcontracting practices are increasingly widespread in the sector. The main reasons pursued by these strategies are basically three, this is (Müller, 2007):

- Technology, in the sense that shipyards are increasingly focusing on their core competencies, so they do no longer have the capacities to perform certain tasks so

they have to move the production process out of house, either vertically by externalising support functions or horizontally by outsourcing some stages of the product and/or service supply chain;

- Volume, so the risks of cyclical fluctuations in demand are simply passed on to the subcontracted external companies as shipyards minimise the number of permanent staff to reduce their fixed personnel costs
- Costs, so yards use subcontractors (often from eastern European countries) that can perform the same job for a lower cost.

In any case, it is important not to forget that the use of outsourcing and subcontracting activities can, accordingly to certain conditions, redound in the loss of industry-specific knowledge and skills, an issue that is particularly important for this highly technical sector.

9.1.6. Other solutions

Interestingly also, and in some countries with and extensive tradition of co-operative industrial relations, social dialogue also plays a key role in solving the labour/skill shortage problem. In this sense, a good example of these co-operative industrial relations can be found in Germany and the Netherlands, whose social partners are particularly conducive to the negotiation of flexible solutions which suit the interests of both social parties. In both countries, these cooperative relations between employers and employee representatives are based on strong participation rights of works councils at company-level and a long corporatist tradition of decision-making at the political macro level, which fosters an institutional bias towards dialogue between the social partners.

This institutional and ideological background certainly plays an important role in the choice of the tools to deal with labour and skill shortages in the German and Dutch shipbuilding and ship repair industries. Thus, German and Dutch shipyards are devoting considerable efforts to search for solutions which address the needs and interests of both social partners i.e. the employers' need for more flexibility and cost reductions and the employees' interest in employment security. Indicators for these efforts are the widespread use of working time accounts, which increasingly replace the use of overtime, the negotiation of company-specific agreements, the establishment of specific institutions such as transfer companies and staff pools or initiatives for improving the skill level of workers.

Interestingly also, and in both countries, the state also plays an important role in fostering dialogue between the social partners. Just to give some examples, the German government has initiated in 2005 the establishment of the Shipyard Task Force in order to develop concepts for the establishment of intercompany staff pools and for the improvement of skills and qualifications in the industry. Meanwhile, and in The Netherlands, the Round Table Group Shipbuilding brings together various actors involved in the shipbuilding industry and government representatives, promoting therefore a culture of dialogue between the social partners (Müller, 2007).

At European level, it should not be forgotten the existing Social Dialogue Committee for the shipbuilding and ship-repair sectors, which was the first of its kind in the metal trades in the EU.

Meanwhile, and also as a result of this fluent social dialogue process, social partners in some countries have been able to find innovative solutions for coping with short-term needs of highly qualified technicians in the sector. A good example of this is given by the Dutch foundation Stichting DeltaMetaal (see Table 60).

Table 60. The foundation Stichting DeltaMetaal

Enterprises active in the Dutch Metalektro Industry[52] have been aware of the importance of retaining craftsmanship and know-how. In addition, over recent years these companies have been confronted with a strong fluctuation in the amount of incoming work. To help manage these variations in customer demand, the foundation 'Stichting DeltaMetaal' was formed in 1986, by the employer and employee organisations in the Dutch region of Rijnmond and Drechtstreek. The foundation operates as a non-profit organisation composed of 26 member companies in the sector, and provides specialist outsourcing services to the associated enterprises in the Metalektro Industry through placement of highly qualified technicians. It is important to have in mind that the DeltaMetaal workers enjoy permanent contracts and similar working conditions patterns in comparison to other sectors in the Dutch Metalektro Industry.

Specifically, DeltaMetaal aims to be the leading outsourcer of technically highly qualified professionals to the Metalektro Industry, by focussing specifically on the client's individual needs. To realize this objective, 'Stichting DeltaMetaal' offers a range of distinctive job market tools:

- The outsourcing of qualified metalworking engineers and the short-term placement of trainee technicians, through the foundation 'Stichting Arbeidsreserve DeltaMetaal' or SAD.
- The outsourcing of highly qualified technicians with very strong managerial capabilities, through 'DeltaTop Techniek'.
- Providing an on-loan facility of short-term surplus staff, to allow for capacity sharing among the participating companies of the foundation 'Stichting Arbeidsreserve DeltaMetaal' or SAD.
- Improving entry to and career development of staff within the Metalektro Industry, through the foundation 'Stichting Metalektro Instroom DeltaMetaal' or SMID.
- Providing specialist training and development, for trainee technicians as well as for senior engineers.
- Policy formation on the changing job market situation and new entry issues facing the Metalektro Industry, which includes providing feedback to and close cooperation with the relevant educational institutions.
- The placement of temporary workers in the fields of Technology and Logistics, through the newly created temp agency 'DMjob'.

Source: Stichting DeltaMetaal.

9.2. STRATEGIC FUTURE CHOICES OF THE EUROPEAN SHIP AND BOAT BUILDING INDUSTRY TO MEET LABOUR AND SKILL SHORTAGES ACCORDINGLY TO THE DIFFERENT SCENARIOS

Having in mind the current strategic choices selected by the European ship and boat building industry in order to meet the existing labour and skill shortages, this section is interested in identifying, for the best and worst scenarios distinguished in chapter 8 (Scenario 1 and Scenario 4, respectively), the strategic options to be taken in the future by the sector in order to address the future skills requirement (see Table 61).

[52] Metalworking and/or electrical engineering activities.

Table 61. Strategic choices to meet skill needs

Choices to meet Skills needs / Scenarios	Changing work organisation	Training of employed workers	Recruiting unemployed workers	Recruiting young people	Recruiting workers from other Member States	Recruiting workers from abroad	Offshoring and outsourcing
Scenario 1: Growing demand of ships and boats and preservation of EU technological advantage	+ (Multiskilling practices)	+, either in isolation or in collaboration with public authorities	+, usually in collaboration with public authorities	+, specially in collaboration with training /education providers (i.e. dual systems)	+, specially from NMS	+, specially from Eastern Countries, and other	+ (outsourcing and subcontracting practices)
Scenario 4: Stagnant shipbuilding demand and loss of EU technological advantage	+ (Multiskilling practices)	+, either in isolation or in collaboration with public authorities	-	+, specially in collaboration with training /education providers (i.e. dual systems)	-	-	+ (outsourcing and subcontracting practices)

+: Relevant choice -: Irrelevant choice
Source: Own elaboration

9.2.1. Strategic future choices of the European ship and boat building industry to meet labour and skill shortages in Scenario 1 (Growing demand of ships and boats and preservation of EU technological advantage)

As already known, Scenario 1, characterised by a growing World and European demand of ships and boats combined with a preservation of the EU technological advantage, is expected to have a positive impact in overall absolute employment figures. This increasing need of new people to be incorporated into the sector, together with the need to keep the existing workforce abreast of the emergent competence needs identified in previous sections on this report, will require from the sector an additional effort in order to meet the existing/foreseen skill needs. In this sense, strategic choices to be adopted by the sector may include the following ones:

- Training of employed workers. Clearly enough, the provision of in-house training activities for employed workers in the industry will continue to be one of the key strategic choices of the sector for coping with the problem of skill shortages. These training activities will usually involve company-specific activities (either in isolation or in collaboration with public authorise), although specific group actions will be required in those subsectors/enterprises (i.e. SMEs in boat building activities) that do not have the minimum scale/resources for developing individual activities. In this last case, these group activities will be often carried in collaboration with the public sector.
- Recruiting unemployed workers. Due to the foreseen additional needs of workers in the sector, the possibility to recruit and subsequently re-train unemployed people accordingly to the requirements of the industry may be an interesting strategic choice for the sector, provided that the training not only focuses on pure sector-related skills but also in other abilities usually required by unemployed people (social abilities, schedule abilities, etc). For this purpose, a full collaboration with public authorities should be fostered.
- Recruiting young people, basically with the idea of both renewing the age structure of the workforce and incorporating new skills and impetus into the sector, specially in the context of current ageing process of the European population. For this purpose, a strong collaboration with training/education providers (both public and private ones) might be suggested as a relevant strategic choice for the sector (i.e. through "dual systems") in order to attract students in the best conditions to the sector.
- Recruiting workers from other Member States. Thus, the attraction of foreign workers from other EU (especially NMS) and specially non-EU countries will continue being an interesting strategic choice for the sector in order to cope with existing labour shortages and skill needs. In this sense, it is possible to foresee that

the current "brain drain" situation affecting NMS is being reduced in the future (mainly explained by the foreseen development of working and salary conditions in these countries), so additional needs of new people into the sector will have to be satisfied by non NMS workforce.

- Related to other strategic choices (i.e. changing work organisation, offshoring and outsourcing practices), it might be expected that the need of multi-skilling (the same worker can perform several different jobs) will continue and will be fostered by the sector in order to increase the internal flexibility of the workforce. Also, outsourcing and subcontracting practices will be reinforced in the future, as the sector may become more and more focused on high-tech production lines (which in turn will require an increased co-operation with suppliers and sub-contractors.

Finally, all these strategic choices require a fluent dialogue, not only amongst social partners themselves (social dialogue), but also between the sector and other interested stakeholders such as public authorities (at European, national or regional level, depending on the topic and the existing administrative distribution of powers), or education and training institutions. This kind of co-operative solutions can provide excellent results in the search of flexible solutions which fulfil the interests and needs of the different parties.

9.2.2. Strategic future choices of the European ship and boat building industry to meet labour and skill shortages in Scenario 4 (Stagnant shipbuilding demand and loss of EU technological advantage)

Meanwhile, Scenario 4 (characterised by an stagnant shipbuilding demand accompanied with the loss of EU technological advantage) is expected to have very negative impact in terms of employment that is likely to affect all existing functions, specially as far as execution-related functions (i.e. production management, production/service activities, maintenance and repairing activities, quality and logistics activities). In this situation, the main strategic choices to be followed by the sector will be focused on assuring a successful adaptation of the existing workforce to the emergent labour and skill needs. Examples of these strategic choices may include, basically i) the training of employed workers (for coping with the need to re-adapt existing skills and knowledge to new emergent ones); ii) the recruitment of young people (for successfully assuring the age renewal of the sector workforce) and, finally; iii) the involvement of the sector in new work organisation and outsourcing practices (multiskilling, subcontracting practices).

By way of contrast, other strategic choices (i.e. recruitment of workers from EU and non-EU countries, as well as the recruitment of unemployed workers) will be used in a lesser extent by the sector under Scenario 4, due to the limited need of new additional personnel in the sector. In any case, a fluent dialogue between all relevant stakeholders in the sector will be of key importance for assuring the future of the sector, despite the existing negative prospects of the sector.

10. MAIN RECOMMENDATIONS

10.1. GENERAL RECOMMENDATIONS

- **Develop the European ship and boat building and repairing industry as a key and strategic activity for the European economy in the coming years**: The European ship and boat building and repairing industry can be regarded as a particularly sensitive and strategic sector for the European economy for a number of reasons. Thus, the sector develops advanced technologies providing valuable by-products for other sectors, provides the basic means of transport for international trade and makes a decisive contribution to defence and security by equipping navies with technologically advanced vessels. In addition to this, the industry provides high levels of highly-qualified employment for various suppliers, and it also operates as an important economic multiplier with spin-offs into other sectors. However, and for keeping and fostering this sector in the coming years, it is important to cope with a number of challenges, including preservation/increase of key sector knowledge (through R&D activities, proper protection of generated knowledge in Europe or support to sector-related training and education providers), the strengthening of the existing European supplying tissue or the elimination of existing unfair competition practices from some Asian countries.
- **Develop activities that may help both retaining the existing sector workforce and recruiting new personnel**: A previous section of this report has shown that the European building and repairing of ships and boats sector is currently experiencing difficulties in both retaining and attracting new workforce to the sector. In order to solve this situation, a number of intertwined choices can be developed.
  - A good example includes the development of publicity campaigns that show the vitality and sustainability of the shipbuilding industry in the long term (dealing therefore with the 'bad image' problem of the sector, specially having in mind the foreseen bad economic climate in the short run), making therefore the ship and boat building industry more attractive to potential young recruits who have other career options open to them (specially as far as university graduates in engineering and technical vocational training graduates), as well as other related parties such as parents, education counsellors, etc. Also, it is very important to offer good long-term career prospects for young people within the sector, as well as flexible working practices that may satisfy the new demands of youngsters.
  - Meanwhile, and for retaining personnel in the sector, it is important to improve existing working conditions in the sector, specially as far as reducing the insufficient job security of the sector due to its cyclical nature (for instance through the reallocation to new jobs inside and outside the sector), as well as the development of a minimum level playing field that might applicable to EU and non-EU workers in final assembling enterprises as well as in subcontracted enterprises.
  - Finally, it is worth stressing the importance of fostering the mobility of workers within the sector from those shipbuilding subsectors or metal-related sectors that might be subject to particularly difficult situations to those others with good activity levels, so these workers' knowledge stock is not lost for the sector. The example provided by the Foundation Stichting DeltaMetaal in The Netherlands (see Table 60) is a good example in this direction. Also, the Finnish experience with compulsory training activities for unemployed workers can be identified as an interesting practice in order not to lose workers' skills and knowledge for the sector.
- **Importance of incorporating women to the sector**: Linked to the previous point, this report has shown that women are particularly underrepresented in the European building and repair of ships and boat sector, especially in some concrete functions and occupations. In this respect, more consideration needs to be given to ways of attracting more women into the sector (especially as far as technical professions are concerned), as they represent the main source of labour force growth in future years. Of course,

this attraction is likely to require some changes in work organisation (in terms of more flexible working arrangements).

- **Importance of recruiting and maintaining foreign personnel:** It has been already discussed the important role that the attraction of foreign workers from other EU and non-EU countries has in order to cope with existing labour shortages and skill needs. In this sense, and in order to foster this choice, companies should try to devote additional training efforts for these individuals, specially in terms of language skills and adaptation to working practices and processes in their new contracting companies. Also, and for fully assuring the integration of these foreign workers within their new companies and enterprises, it is very important to foster the social elements, specially in terms of family life and housing facilities, as well as the reduction of red tape and bureaucratic procedures for enterprises and individuals. Finally, language training activities are also very important for them. In any case, it is important to assure that foreign workers enjoy a minimum level playing field that might applicable to them, both in final assembling enterprises as well as in subcontracted enterprises.
- **Learning from and collaboration with other sectors:** Shipbuilding and specially boatbuilding enterprises can learn from other sectors (i.e. automotive or aerospace) new innovative ideas in terms of new manufacturing solutions or new materials employed. In this sense, technology transfer activities from other sectors, together with collaboration activities with other sectors can reduce associated risks and accelerate the innovation processes and may help to reduce the time to market for the research outcomes.
- **Importance of co-operative strategies between the sector and other related stakeholders:** As already shown in this report, the European building and repairing of ships sector representative organisations have always had clear that the full development and competitiveness of the sector requires the full collaboration between the sector and other sector-related stakeholders such as public authorities (either at national or European level), training centres and universities, public and private research centres, etc. In this respect, the sector is rich with experiences of collaboration with other stakeholders (see the examples of the LeaderShip 2015 Strategy or the French and Finnish maritime clusters already presented in this report). This cooperation between the sector and other related stakeholders has to be maintained and even increased in the future, as a successful and clever tool for obtaining positive results for the sector.
- **Reinforcement of social dialogue practices in the sector:** This report has also shown that fluent social dialogue practices (often helped by public authorities) can play an invaluable role in solving a number of sector-specific problems, including the labour/skill shortage problem, so innovative solutions that address the needs and interests of both social partners can be found and negotiated (widespread use of working time accounts, negotiation of company-specific agreements, the establishment of specific institutions such as transfer companies and staff pools or initiatives for improving the skill level of workers). These social dialogue practices (both at EU and at national/regional level) have to be reinforced specially in difficult market situations (so sacrifices are agreed and made by both parties) and extended to those countries/subsectors where these practices are not that common.
- **Exchange of good practices at EU level:** All the previous recommendations can be better reinforced through an extensive and intensive process of analysis and exchange of best practices developed within the different EU Member States and subsectors, so other Member States may learn from these good practices and may try to adapt them to their specific national situation.

10.2. SPECIFIC IMPLICATIONS FOR EDUCATION AND TRAINING

- **Increased attention to training activities**: As already explained in this report, the European shipbuilding industry is the global world leader in the construction of complex/high technology vessels (i.e. cruise ships, ferries and specialised non-cargo

vessels), which require tailored and knowledge-based production processes, considerable technical expenditures and a high number of specialised subcontractors. Therefore, shipbuilding can be currently defined as a capital, high technology and knowledge intensive sector. However, and from an education/training perspective, the full realisation of the opportunities opened up by new technologies and product/process innovations is directly dependant on the presence of a highly qualified, skilled, trained and educated workforce (including managerial positions) that may turn knowledge into wealth, productivity, innovation and competitiveness. Of course, this also requires an additional need to train and re-train the sector workforce not only in the current but also in the future new skill demands of the sector.

- **New skill requirement needs to be analysed and addressed, ideally through a sectoral social dialogue**: One of the key challenges for the sector is the correct identification of emergent skills and knowledge areas that are going to be required in the coming years amongst the different jobs and functions in the sector and that will be key for assuring its future competitiveness. This report has tried to draft a number of emergent competences and implications for competences and occupational profiles for the sector in the years to come. However, and in order to be fully fruitful, this identification of new skill requirements requires a sound social dialogue amongst social partners, so in-depth agreements and co-operative solutions binding for both parties can be adopted.
- **Streamlining the education/training supply with the training needs of enterprises through increased cooperation between relevant stakeholders**: One of the current weaknesses of the sector refers to the lack of correspondence between enterprises' skill needs and the skills/qualifications provided by training suppliers (either at the university or at the vocational training domain), where this situation usually demands from enterprises additional efforts in terms of internal re-skilling and continuing vocational training activities for new young employees. In order to solve this situation, additional efforts are required so education and training systems in the different Member States are equipped to teach the skills and competences required by the industry (moreover, and in the case of Eastern Europe, it is possible to identify an important problem of "under-financement" of shipbuilding-related training centres, which requires solutions to be adopted). Some countries/enterprises have already developed successful experiences for coping with this problem (i.e. the German dual system or Fincantieri's activities[53]). In any case, any strategic choice to be selected by the sector requires a fluent co-operation with education and training institutions (often of a public nature), so enterprises (or representative associations) may have close links with vocational schools, technical colleges and universities to advise them on the contents of existing educational programmes.
- **Balanced regional distributions of education/training supply**: Underlining the previous idea, it should not be forgotten that a good regional distribution of the existing education/training provision is key for assuring a good quality education/training supply, specially when considering that existing yards are sometimes located in concrete regions being structurally lagging regions (e.g. Galicia in Spain, the North-East region in the United Kingdom, Sicily in Italy, etc).
- **Importance of collaborative solutions within the sector**: It can be argued that, in some concrete fields, enterprises might obtain better results when working together than alone. This situation is relevant for both large and small shipyards, as activities conducted by representative associations may have a greater influence than stand-alone solutions. For instance, this report has shown the UK example of the Sector Skills Agreements for the Marine Sector, which shows a sector collaborative activity intended to overcome some of the main education/training-related barriers affecting UK enterprises in the sector.
- **Importance of specific public support for suppliers (specially SMEs) in their training activities**: Linked also to the previous point, suppliers investments on skill and training development should be specifically encouraged and stimulated by public

[53] See chapter 9 of this report

authorities, so they may fully satisfy the needs and requirements of their client shipyards. This situation is specially important as a large share of suppliers correspond to SMEs, characterised by important financial limitations so external aids are regarded as determinant for carrying out training activities. In this sense, this public support aimed at small and medium-sized suppliers should take into account not only the direct costs derived from training (course fees, teaching materials, travel costs), but also the indirect costs (i.e. costs due to loss of production or substitution costs), since small and medium-sized suppliers are especially sensitive to this kind of costs.

- **Mutual recognisiton of professions**: Equally to the situation in other sectors, the European building and repairing of ships and boat sector is characterised by a complex array of different professions in the different EU countries. This situation makes very difficult the possibility to compare professions amongst the different EU Member States, making also very complicated the exchange of shipbuilding specialists amongst enterprises located in different Member States. In this sense, one possible solution proposed would be related with the development of a glossary of terms for the description of different professions and occupations in the European ship and boat building industry that may foster the exchange of workers and experiences amongst countries.
- **Mutual recognisiton of educational and training systems and qualification standards in the sector**: Closely related to the previous point, it is important to underline that the existing educational and training system at all levels in the different EU Member States are far from being harmonised, which results in added difficulties also for the exchange of workers and professional amongst EU enterprises. In this respect, a possible recommendation to be suggested may include:
  - The mutual recognition of the different national educational and training systems at all levels (a good example of this could be the development of an European Maritime Design Academy already suggested by the sector), as well as
  - The reinforcement of student ex-change programmes in the sector at European level (i.e. through ESF funding, for instance).
  - Another idea is related with the importance of mutually recognising qualifications and skills amongst the different EU countries, following in this sense the EU EUROPASS initiative[54] (intended to both help people to make their skills and qualifications clearly and easily understood in Europe and facilitate the movement of professionals). An interesting initiative in this respect is given by the ENGCARD project55, intended to certify the accredited qualifications in engineering of engineering professionals in an unambiguous, standardized, transparent and condensed way, so ENGCARD can be considered as a qualifications passport for mobility. This positive experience could be extended to other qualifications.
- **Importance of recognising non-formal knowledge and skills acquired through practical experience**: Policy-makers should encourage different ways and channels to formally 'recognise' the non-formal knowledge and skills acquired through practical experience. This may help people to prove their qualifications, their skills and competencies in a way that is more likely to improve their future employability, becoming therefore a further incentive to employees and enterprises to engage themselves in education/training activities.
- **Training-related counselling and advising activities for enterprises (specially SMEs)**: One of the most typical training-related problems amongst enterprises relates to the fact that, often, enterprises (specially when referring to SMEs) have difficulties for identifying their concrete training needs and for discriminating relevant training providers. In this respect, training advisers can help enterprises to identify business needs and prioritise training that will give results quickly, overcoming therefore many of the barriers to training that companies (specially SMEs) perceive.

[54] See http://europass.cedefop.europa.eu/

[55] See http://www.feani.org/ENGCARD/PUBLIC/ENGCARD%20Leaflet.pdf

- **Importance of recognising and transmitting tacit knowledge from 'senior' to 'new' personnel**: When speaking about skills and competence, it should not be forgotten the importance of 'tacit' knowledge, that is to say, the knowledge acquired throughout the professional lives of individuals in their daily work. It should not be forgotten that the ageing process of the European workforce is currently one of the main threats affecting the European building and repairing of ships and boats sector, as a significant share of European workers in the sector (and, of course, their associated tacit knowledge) are nearly to retire. In this respect, more consideration should be put on the importance of senior workforce for knowledge management and transfer, as they can help train new entrants to the industry by passing on their skills and know-how. Interestingly also, this issue will become even more important in case large redundancies of senior personnel take place in the sector if the current economic situation is not reversed in the medium-term.

Table 62. Recommendations, distinguished for the different stakeholders

Recomendations	Concerned stakeholders					
	Companies	Workers	EU authorities	National authorities	Regional authorities	Education and training institutions
Develop the European ship and boat building and repairing industry as a key and strategic activity for the European economy in the coming years	X	X	X	X	X	X
Develop activities that may help both retaining the existing sector workforce and recruiting new personnel	X	X	X	X	X	
Importance of incorporating women to the sector	X	X	X	X	X	
Importance of recruiting and maintaining foreign personnel	X		X	X	X	
Learning from and collaboration with other sectors	X					
Importance of co-operative strategies between the sector and other related stakeholders	X	X	X	X	X	X
Reinforcement of social dialogue practices in the sector	X	X				
Exchange of good practices at EU level	X	X	X	X	X	X
Increased attention to training activities	X	X	X	X	X	X
New skill requirement needs to be analysed and addressed, ideally through a sectoral social dialogue	X	X				
Streamlining the education/training supply with the training needs of enterprises through increased cooperation between relevant stakeholders	X			X	X	X
Balanced regional distributions of education/training supply				X	X	X
Importance of collaborative solutions within the sector	X					
Importance of specific public support for suppliers (specially SMEs) in their training activities			X	X	X	
Mutual recognition of professions	X	X	X			
Mutual recognition of educational and training systems and qualification standards in the sector			X	X		X
Importance of recognising non-formal knowledge and skills acquired through practical experience			X	X		X
Training-related counselling and advising activities for enterprises (specially SMEs)	X			X	X	X
Importance of recognising and transmitting tacit knowledge from 'senior' to 'new' personnel'	X	X				

Source: Own elaboration

ANNEX A. BIBLIOGRAPHY

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ANNEX B. DESCRIPTION OF SHIPBUILDING AND BUILDING OF PLEASURE AND SPORTING BOATS IN THE STATISTICAL CLASSIFICATION OF ECONOMIC ACTIVITIES IN THE EUROPEAN COMMUNITY, REV. 2 (NACE REV. 2)

The classification of Economic Activities in the European Community, Rev. 2 (NACE Rev. 2) are comprised under the NACE Rev 2 Code 30.1 ('Building of ships and boats') and the NACE Rev 2 Code 33.15 ('Repair and maintenance of ships and boats').

Thus, the NACE Rev 2 Code 30.1 ('Building of ships and boats') includes the building of ships, boats and other floating structures for transportation and other commercial purposes, as well as for sports and recreational purposes. Thus, this 3-digit sector includes the following two subsectors:

a). Building of ships and floating structures (NACE Rev 2 Code 30.11), where this subsector includes the building of ships, except vessels for sports or recreation, and the construction of floating structures. This four-digit sector includes the following activities:
- Building of commercial vessels (i.e. passenger vessels, ferry boats, cargo ships, tankers, tugs etc.)
- Building of warships
- Building of fishing boats and fish-processing factory vessels
- Building of hovercraft (except recreation-type hovercraft)
- Construction of drilling platforms, floating or submersible
- Construction of floating structures (i.e. floating docks, pontoons, coffer-dams, floating landing stages, buoys, floating tanks, barges, lighters, floating cranes, non-recreational inflatable rafts etc.)
- Manufacture of sections for ships and floating structures

b). Building of pleasure and sporting boats (NACE Rev 2 Code 30.12), where this four-digit sector includes the following activities:
- Manufacture of inflatable boats and rafts
- Building of sailboats with or without auxiliary motor
- Building of motor boats
- Building of recreation-type hovercraft
- Manufacture of personal watercraft
- Manufacture of other pleasure and sporting boats (i.e. canoes, kayaks, rowing boats, skiffs, etc)

In addition to the NACE Rev 2 Code 30.1 ('Building of ships and boats'), it is also worth mentioning the existence of the NACE Rev 2 Code 33.15 ('Repair and maintenance of ships and boats'). This three-digit sector includes the repair and maintenance of ships and boats (however, the factory rebuilding or overhaul of ships is classified in division 30). This sector includes:

- Repair and routine maintenance of ships
- Repair and maintenance of pleasure boats

Interestingly also, the four-digit sector NACE Rev 2 Code 30.11 ('Building of ships and floating structures') excludes a number of sectors, such as:

- Manufacture of parts of vessels, other than major hull assemblies:
  - Manufacture of sails (NACE 13.92)
  - Manufacture of ships' propellers (NACE 25.99)
  - Manufacture of iron or steel anchors NACE 25.99)

  - Manufacture of marine engines (NACE 28.11)
- Manufacture of navigational instruments (NACE 26.51)
- Manufacture of lighting equipment for ships (NACE 27.40)
- Manufacture of amphibious motor vehicles (NACE 29.10)
- Manufacture of inflatable boats or rafts for recreation (NACE 30.12)
- Specialised repair and maintenance of ships and floating structures (NACE 33.15)
- Ship-breaking (NACE 38.31)
- Interior installation of boats (NACE 43.3)

Also, the four-digit sector NACE Rev 2 Code 30.12 ('Building of pleasure and sporting boats') excludes a number of sectors, such as:

- Manufacture of parts of pleasure and sporting boats:
  - Manufacture of sails (NACE 13.92)
  - Manufacture of iron or steel anchors (NACE 25.99)
  - Manufacture of marine engines (NACE 28.11)
- Manufacture of sailboards and surfboards (NACE 32.30)
- Maintenance and repair of pleasure boats (NACE 33.1)

Finally, the four-digit sector NACE Rev 2 Code 33.15 ('Repair and maintenance of ships and boats') excludes a number of sectors, such as:

- Factory conversion of ships (NACE 30.1)
- Repair of ship and boat engines (NACE 33.12)
- Ship scrapping, dismantling (NACE 38.31)