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Global Competition in Shipbuilding: Trends and Challenges for Europe

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1. Introduction

Shipbuilding is known as one of the oldest, most open and highly competitive markets in the world. Although shipbuilding industry has a big experience in how to survive over peaks and slumps of economy, the current global crisis hit shipbuilding industry rather severely. The global order book over the past 6 quarters since the end of 2008 was 4.5 times lower than that for the 6 previous quarters. In 2009, the portfolio of new orders of European shipyards was almost 4 times lower than in 2008. With such a decline, the world's shipbuilding industry is certainly among the sectors worst affected by the financial and economic crisis. It can have the most painful impact on many shipbuilding countries of the world due to the biggest overcapacity of shipyards ever seen and far greater supply of fleet than required by the market. Not all lessons were learnt from historical development of the shipbuilding industry.

Until the middle of the last century, European shipbuilding dominated the world. Fast growth of the Japanese economy and successful coordination of supporting program for shipbuilding as a strategic industry helped to win leadership for this country. For some time, Japan and Europe controlled 90% of the market, but gradually dominance was overtaken by Japan. In 1970s, S. Korea following previous experience of its neighbour country announced shipbuilding as strategic industry and in combination with low labour costs began to reach the leadership. Next Asian player, China, caught the industrial expansion strategy and surpassed Japan in 2006 and S. Korea in 2009 (if measured by order book volumes). New shipbuilding entrants such as Vietnam, India, Turkey, the Philippines, Brazil, and Russia grew up and together reached the quantity of orders to equal European total. Europe has gradually been losing its positions in shipbuilding despite of its strategic specialization as a niche player. Unfair competition on the part of Asian shipyards and delayed agreements in global playing field have distorted the market, shifted it to the Far East and created extra problems fighting against crisis. In September 2008, the new building boom that ran since 2003 ended sharply. The crisis didn't have pity neither for leaders nor for ordinary players. Even at the end of 2010, despite the signals of economic recovery, order book for new building was decreasing continuously. By the end of September 2010, new global building portfolio was 26% smaller in comparison to the quantities of the same period in 2008. Good news is that the total number of contracts in 2010 was higher by 205% than in 2009. Shipyards should begin thinking about new orders by investigating new patterns for successful competition.

Factors affecting the shipbuilding industry can be divided in two groups: macro factors (world seaborne trade, oil prices, economic stability, and political stability) and market factors (subsidies by the government, scrapping of old vessels, charter rates, vessels on order). According to some experts, seaborne trade should grow by 6.7% next year. Less optimistic experts wait for a double fall instead of real recovery of the world's economy. The Organization of the Petroleum Exporting Countries (OPEC) informs that in 2009 global oil demand reduced to 84.5 million barrels per day but grew at 1.8 million barrels per day in 2010 partly because of cold winter. Despite the fact that Japanese economy experienced phenomenal growth in 2010 at 3.9%, the earthquake suspended a successful recovering of their economy. The combination of various factors even natural forces complicates talks about economics stability in these days.

The next factors determining competitiveness of particular shipyard is the productivity, production range, and attractiveness of product, subsidy rate, exchange rate and cost position (Bertram, 2003). Productivity is influenced by technology, facility, management competence, work organization, work practice, the level of workers' skills and motivation.

The competitiveness of the European shipbuilding has been increasing through excellence, as it is defined in the LeaderShip 2015 – the strategy of the European shipbuilding industry. Created in January 2003, document summarizes the results of an intense discussion process among stakeholders. After the last revision of Leadership 2015, the conclusions about weak impulse in the implementation of strategy were announced. Experts have especially been worrying about the lack of trade rules because Europe again chooses quality and excellence over the low costs. A new European maritime policy proposes opportunities for innovative companies working on the development of energy efficiency and low emission ships. A large part of technical innovations have to be presented in relation to the goal of reduction of exhaust gas emissions NO_x, SO_x and CO_2. New hull designs, advanced hull paint, rudder and propeller design, speed nozzle, LNG as fuel, ballast water management systems, and etc. – all promise to have an environmental edge. Many issues related to the environment and climate change are relevant to the shipyards, too. Carbon trace associated with production, transportation of ship construction, ship maintenance and repair, dismantling and recycling have to be reduced. "Green growth" challenges provide the shipbuilding industry with the possibility of moving toward life-cycle environmental approach.

2. The industrial development of global shipbuilding

In time wood was replaced by iron and steel, leadership in the global shipbuilding (in GT, CGT) went from hand to hand: from G. Britain to Japan, then to S. Korea, and finally to China (Table 1). Nowadays ex-leader S. Korea is on the post-growth stage (Lorentzen & Stemoco, 2006). The world has been waiting for lodgment of a new leader, doubtless China. Announced by China, the programme "5 – 3 – 1" put down a marker to reach global leadership by 2015 (Dan, 2009). However, fortune was kinder to China than it might have expected. Its emerging economy, huge human potential, and State support have resulted in its target accomplishment in half the time.

Britain took over the leadership in shipbuilding in the 1850's and lost this position because of failure to modernize their shipyards. Some experts say that Britain was too slow in increasing its productivity by implementing new technologies and production management methods, unlike their competitors in Scandinavia, Germany, Japan. In the 1950's leader's position was gradually being taken over by Japan, mainly due to the rapid growth of the

Japanese economy after the Second World War and well coordinated State shipping and shipbuilding program. Japan dominated the world for more than three decades. For some time European and Japanese shipbuilders together controlled even 90% of the market. The Japanese shipbuilders began to lose their global dominance for several reasons. Firstly, Japanese shipyards faced difficulties in recruiting new young engineers and suffered from high labour cost. Secondly, Japanese shipbuilders were not flexible and did not adapt to changes in the global market that demanded bigger and bigger vessels. Third, over 60% of Japanese ship production was for the domestic market which didn't promote technological development and implementation of new production management methods. The latest reports of 2010 confirm this: Japanese shipbuilders are working for Japanese owners at 82.4%. Then the gap between the demand and supply for materials, increased delivery time and prices of its national currency strengthening against USA dollar – all in total hit the competitiveness of the Japanese shipbuilding industry (Song, 2003). It caused ceding the leadership to S. Korea in the middle of 1990's. On-stream as continuous low cost shipbuilders, they focused on large tankers, large/ultra large containership, LNG/LPG, offshore drilling rigs, and even on cruise ships that it is still niche of a few specialized European shipyards. Despite the fact that S. Korea still has many advantages some experts imply that S. Korea's competitiveness has been diminishing because of high cost of human resources, insufficient quantities of domestic steel and ever-rising prices of imported materials and components. The appreciation of Korean Won is worsening the competitiveness of their shipbuilders, too (Lorentzen & Stemoco, 2006).

Duration of the leadership	Country	Stage of business cycle	Causes
1860's – 1950's	G. Britain	Lost leadership	Failure to modernize shipbuilding industry
mid1950's – mid1990's	Japan	Post-maturity, weakening of competitive power	Ageing and high cost human resources. Reduced by shipyards R&D budget to less than 1%. The gap between the demand and supply for steel, increased prices of steel.
From mid1990's	S. Korea	Post-growth, maintenance of competitive power	High cost human resources. The gap between steel demand and domestic supply increased steel prices. The appreciation of Korean Won has worsened the competitiveness of Korean shipbuilding.
Since 2010, earlier than it was planned	China	Acceleration of growth	The lowest labour cost. Ambitious State programmes for the development, growing shipyards capacity, governmental subsidies.

Table 1. Leadership in the global shipbuilding

Though China entered world shipbuilding-market as a low cost shipbuilder in the 1980's, Chinese shipbuilders have only been a really serious competitor in the last 5-6 years. Chinese order book enlarged from 1.9 billion CGT in 1998 to 62 billion CGT in 2008 and grew more than two times faster than worldwide order book in total (ECORYS SCS, 2009). This with strong governmental support and huge investments, co-operation with MAN B&W, Wärtsilä, and other ship equipment manufacturers improved Chinese position incredibly. In 2010, they began domination in the world shipbuilding market. The strategic agenda of Chinese shipbuilding industry includes changes in the structure of their products towards more sophisticated, upgrading technologies, merger of shipyards for the developing of the specialized giants. Expansive and competitive industry requires more qualified technical employees and researchers. Chinese labour cost per unit product is still by far the lowest, i.e. nearly 50% of Japan and 30% of Korea (Lorentzen & Stemoco, 2006). Combination of listed actions with improving of credit conditions and providing of bank guarantees gives excellent example how significantly market factors can impact global shipbuilding competition.

Let briefly follow the dynamics of the global shipbuilding development over the last years.

In 2009, it delivered the highest number of new ships – 44.4 millions CGT. During 9 month of 2010 completion reached 40.5 million CGT. Full 2010 year deliveries should reach the record of 53 million CGT (see Table 2).

Million CGT /year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010 1-3 Q
Order book	45.9	48.3	48.9	70.8	92.8	107.2	138.0	183.7	194.2	156.2	134.9
New orders	29.4	23.3	20.5	41.7	45.1	39.6	57.3	85.3	43.0	16.6	26.3
Completion	20.3	20.2	21.4	22.8	25.5	29.4	34.1	34.6	41.9	44.4	40.5

Table 2. World shipbuilding results in CGT during 1999-2010 1-3 Quarter (CESA AR, 2010)

In 2009, China overtook S. Korea having won 44.4 % of all new orders compared to 40.1% of S. Korean. Market share of new orders, completion and order book by main regions in million CGT are shown in the figures 1-3 (CESA AR, 2010). Despite a large total order book, this is shrinking fast because of a decrease in new orders. The last cancellations also took away: 209 ships or 2 million CGT in 2008, 506 ships or 7.8 million CGT in 2009, and 180 ships or 3.5 million CGT during 1st quarter of 2010. The majority of cancellations have been related to tankers, bulk carriers and dry cargo/passenger ships.

Japanese new orders market shares halved over the nine months of 2010 in comparison to 2009. In a period of 10 years, completions of Japanese shipyards reduced by 10%. The recent news announced about the exit of Japan's shipbuilding industry within 5 -10 years because of losing market shares. Additionally, the earthquake of 11th March, 2011 followed by tsunami broke Japan's economy very seriously. It might result in the decision of the State not to support shipbuilding industry sooner, as was expected before *force major*.

European shipyards' completions have become fewer after the gradual loss of the global order book share that was taken by new shipbuilding players such Vietnam, India, Brazil, Russia, Turkey, and the Philippines. They actually began expansion in the growing new building market before 2005. In 2008, they took 6% of new orders in global market, while CESA gathered 4.9%, in 2009 – 4.8% and 3.4% respectively. Shipbuilding industry of the Philippines has progressed quite noticeably. The Philippines controlled even 2.1% of the world's order book at the end of the 3rd quarter 2010, while in 2005 they took just 0.4% of CGT.

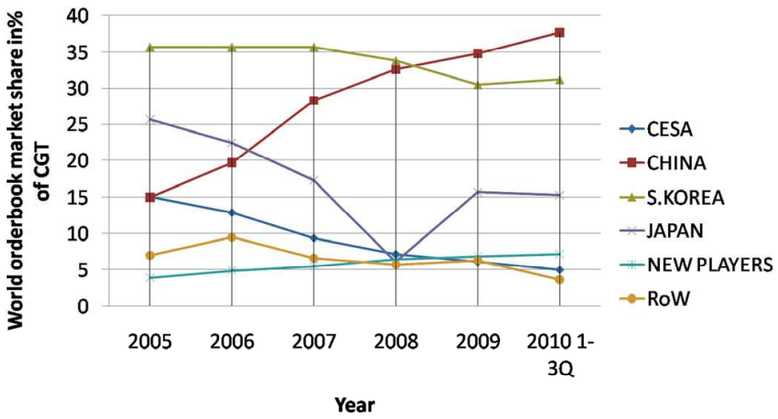

Fig. 1. Distribution of the world order book among the main players in % of CGT

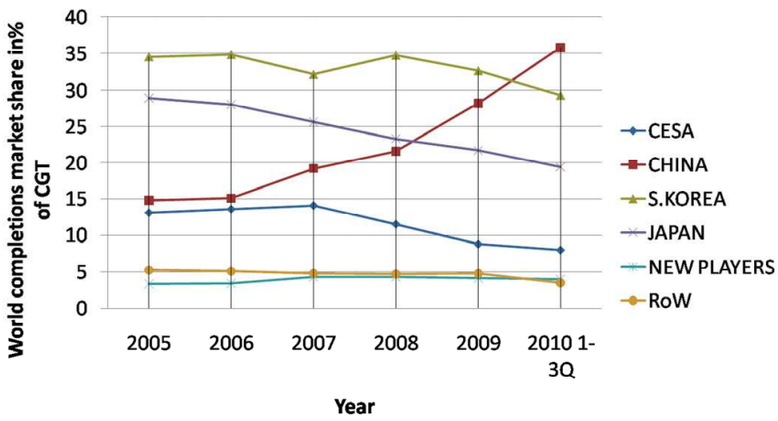

Fig. 2. Distribution of world completions among main players in % of CGT

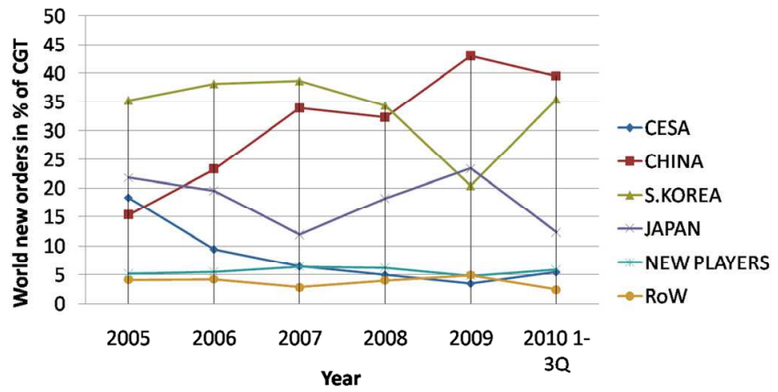

Fig. 3. Distribution of world new orders among main players in % of CGT

The statistics of the new players' market shares for new orders, completions and order book are shown in the Figures 4-6 (CESA AR, 2010).

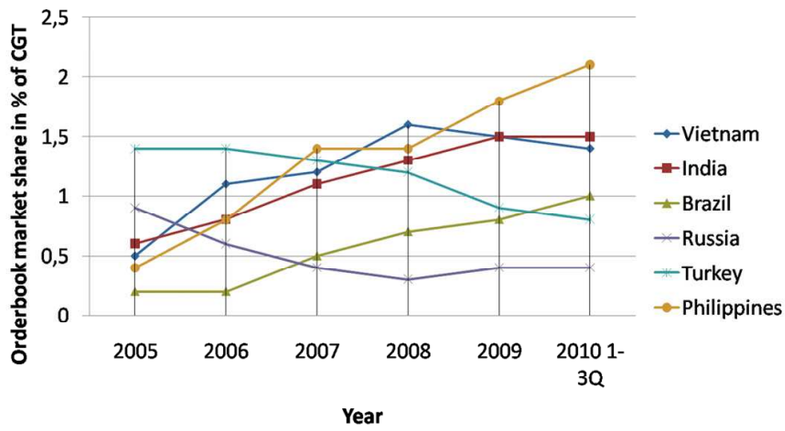

Fig. 4. Order book market share among the new players

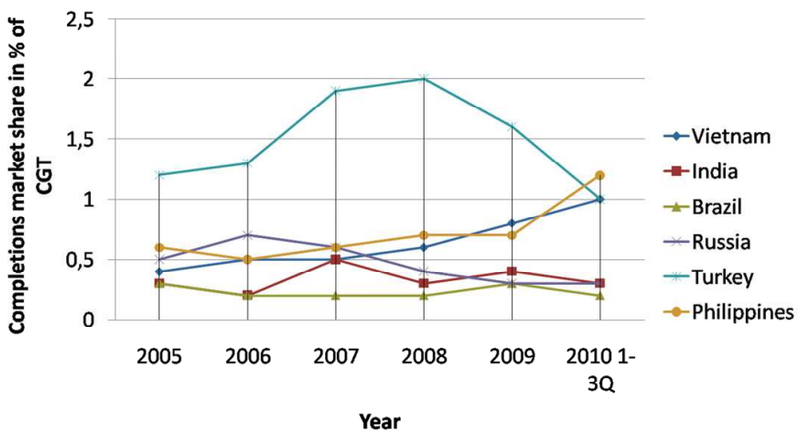

Fig. 5. Completions market share among the new players

The coefficient completions/order book is distributed by regions as following (Figure 7). New players' countries' (India, Vietnam, Philippines, Turkey, Russia, Brazil) position is better because of relative high order book and not expanded capacities of shipyards.

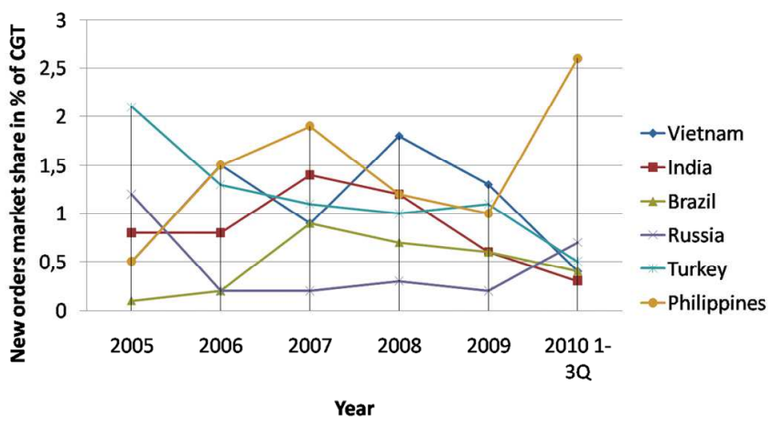

Fig. 6. New orders market share among the new players

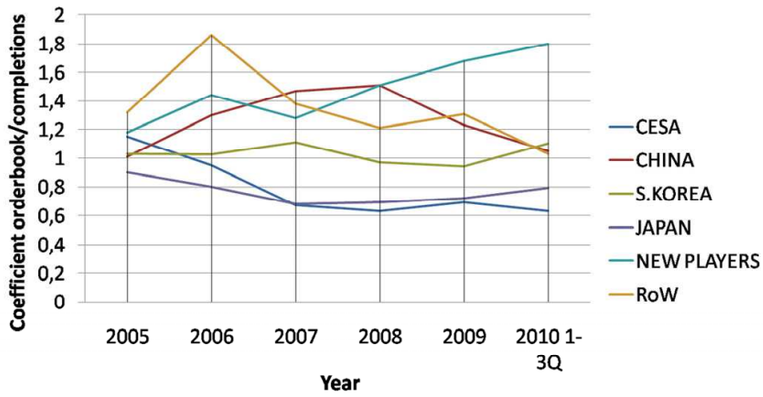

Fig. 7. Distribution of the completions/order book coefficient among the new players

In September 2010, among the main global shipbuilding players this coefficient was distributed in the following way: CESA – 2.1, China – 3.5, S. Korea – 2.9, Japan – 2.1. It is one more important criterion describing the density of orders. Despite the fact that by the end of 2009 Chinese shipyards held the order books of 188.17 million dwt distributed among 200 shipyards, around 30 S. Korean shipyards hold 172.23 million dwt. It means the orders held by Chinese shipyard are one fifth of that of South Korea (ECORYS SCS group, 2010).

2.1 Key players of the world's shipbuilding

The Chinese shipyards are divided into two conglomerates: China Shipbuilding Industry Corporation and China State Shipbuilding Corporation. Both are State owned. All large shipyards fall under these two corporations. The biggest shipyards are these: Dalian Shipbuilding Industrial (Rank No7 in the world), Jiangnan Changxing (8), and Jiangsu Rongsheng (10). In 2009, outputs of 11 shipyards exceeded 1 million dwt. Shanghai Waigaoqiao Shipbuilding Co., Ltd. completed 6.03 million dwt, Dalian Shipbuilding Industry Corporation completed 3.8 million dwt, Jiangsu New Century shipbuilding Co., Ltd. completed 2.57 million dwt. In 2009, China exported ships and boats to 159 countries and regions, mainly to Asia (Singapore, Hong Kong) and Europe (Germany). Gross Industrial Output Value of the same year was 548.4 billion yuan. The average growth rate between 2004 and 2009 was near 43% (ECORYS SCS group, 2010). Most of the production is bulk carriers and oil tankers, however, high value-added production capacity accounts for less than 10% of the world's market. Chinese shipbuilders are proud of three LNG carriers, first ultra-deepwater drilling oil storage platform, 3,000 meters deep-water pipe-laying ship and 356 feet jack-up platform. Head-start in parallel to Adjustment and revitalization plans of Chinese Government with the aim to stabilize the production of shipyards, control shipbuilding capacity, develop the offshore engineering and ship repair industry, merge & acquire shipyards, and improve innovation development should ensure their leadership in shipbuilding no worse than it was done by previous leaders. There are some challenges such as increasing steel prices, cancellations of 250 vessels (7 million dwt) between the third quarter of 2008 and the first quarter of 2010 that makes pressure for Chinese shipyards.

No-one could believe such impressive results of Korean decision to give strategic top priority to shipbuilding industry in the early 1960s. Established by Government "Special Maritime Administration Committee" together with Shipbuilding Promotion Law (1958), Shipbuilding Industry Encouragement Law (1967), Shipbuilding Industry Promotion Plan

(1975), Industrial Development Law (1985), Shipbuilding Industry, Rationalization Measurement (1989) ensured support for the development of shipbuilding industry. The best example illustrating the situation in today's S. Korean shipbuilding industry is that seven of their shipyards are ranked as mega size in World Top 10 Shipyards by Clarkson in 2008: 1. Hyundai Heavy Industries (HHI); 2. Samsung Heavy Industries (SHI); 3. Daewoo Shipbuilding & Marine Engineering (DSME); 4. Hyundai Mipo Dockyard (HMD); 5. Hyundai Samho Shipyard (HSHI); 6. STX Shipyard (STX); 9. Sungdong Shipbuilding & Marine Engineering. All these shipyards are designed to build VLCC size vessels. 8 more medium size shipyards produce AFRAMAX / SUEZMAX size vessels. More than 150 companies represent shipbuilding suppliers. 14 universities and 2 colleges provide naval architecture/marine & ocean engineering study programs, 2 large R&D centres are working for the needs of shipbuilders through the sponsorship on the part of the Government. Today S. Korea is represented by Korean Shipbuilders' Association (KOSHIPA) mainly because 81% of the order book is theirs. The biggest part of 105 000 employees involved in shipbuilding work as subcontractors, management and administration represent 5-6 thousand persons. Despite Korean efforts, they lost the leadership in shipbuilding last year. The world prefers the lower cost again.

In 2009, Japanese shipbuilders' order book totalled 51.8 million GT (gross tonnage). Six types of vessels were ordered in the following ratio: 59.2% of bulk ore carriers (30.7 million GT), 21.3% oil and chemical tankers (11.0 million GT), 6.9% of Ro-Ro and Pure Car Carriers (3.6 million GT), 5.1% of containerships (2.6 million GT), 2.2% LNG and LPG (1.1 million GT) and 5.3% of others (2.8 million GT). The majority of orders were received from Japanese owners (82.4%), others – mainly from Europe, the USA, and Hong Kong (CESA AR, 2010).

Japan dominated in bulk carries segment for a long time, but now it has gone to China. For the same reason Japan may expect more and more competition from emerging countries like India and Vietnam that are willing to lead not only the production of bulk carriers but also that of tankers and containerships in the nearest future. The biggest shipyards are Oshima S.B. Co (Rank No12 in the world), Tsuneishi Zosen (14), and Imabari S.B. (25) (ECORYS SCS group, 2010). In 2003, workforce began to grow from 40000 to more than 50000 in 2008. 46% of employees are older than 50 and 24% are younger than 30. The main Japanese shipbuilders' challenges are high steel prices and unfavourable currency index comparison.

European shipbuilders are mainly represented by CESA, the Community of 14 National Shipbuilders' Associations from the EU, Norway and Croatia. CESA members produce more than 99% of the EU shipbuilding production in more than 300 shipyards. European shipyards supply more than 100,000 direct jobs for a highly skilled labour force, generating an annual turnover of 30 – 40 billion Euros. Ship and off-shore construction repair and conversion activities in Europe are conducted by more than 400 companies – smaller and bigger specialized repair shipyards. The annual turnover of the European repair shipyards exceeds 3.5 billion Euros, and shows systematic increasing tendency (CESA AR, 2010).

2.2 Factors affecting the development of shipbuilding industry

In the 1940s the world moved on from Colonial System to Globalisation. This movement was accompanied by rapidly growing trade and the need for effective means of transport and its systems. Shipping industry has explored every chance and anchored in the world trade. Over the 50 years, seaborne trade grew by 64 per cent faster than GDP (Stopford, 2007). The growth was not stable: 1960-1975 seaborne trade was driven well above GDP trend due to increased consumption of raw materials by industries of Europe and Japan; in

1980-1996, sea trade was below GDP trend because of two oil crises of 1973 and 1979; 1997-2005 seaborne trade was above world GDP due to the growth of Asian countries. In 2008, before the crisis, maritime nations imported 2.7 billion tons of energy commodities (oil, coal and gas); 500 million tons of agricultural product (grain, fertilizer sugars, etc); 1 billion tons of raw materials (Stopford, 2007). The development of new technologies for communication (telephone, telex, fax, email, and world wide web), fast travelling (air transport), globalized materials and market supply (opening new energy sources, reducing transport costs by developing special types of ships, mechanized cargo handling, containerization), and business models (newly-developed flags, long-term time charters) assisted successful growth of the seaborne trade. In this context, the development of shipbuilding industry also wasn't monotonous. Let follow briefly what caused changes.

Over the past millennium, world population rose 22–fold. Within the exponential growth of population, world economy grew as well: per capita income increased 13–fold, world GDP nearly 300–fold. Since the 19th century, world development has become more dynamic: population rose more than fivefold and per capita, income more than eightfold. From 1950 to 1973 world economy growth has been higher than before: world per capita GDP rose nearly 3% a year, world GDP by nearly 5% a year and world trade by nearly 8% a year. (OECD, 2011). The demographic status of the world's population is shown in the Figure 8. World population as that of July 2010 was approximately 6.83 billion (Geohive, 2011) and is going to grow up: the mid-range estimate is 9.08 billion people by 2050 (DSD, 2008). Due to the fact that the main countries of growing population are India, Nigeria, North America, Pakistan, Indonesia, and China, main trade directions servicing the development of regional industries and international companies have to be clear. If China add extra billion tons of the trade in the nearest future the foreign shipping companies will not win much because of Chinese policy to enlarge its own fleet for servicing its own internal and external trade.

The urban population of the world continues to grow faster than the total population of the world. Currently about 3 billion people or just over 50% of the world's population are living in urban settlements. Consequently, a rise in urban population is expected to reach 5 billion by 2030 (DSD, 2008). This fact can also have a positive impact on seaborne trade because a large urban population not only creates a domestic market for goods and services but also drives the economic growth and innovation. Next probable positive consequence of the increasing urbanization is the development of strong middle class that tends to have higher consumption of goods and services.

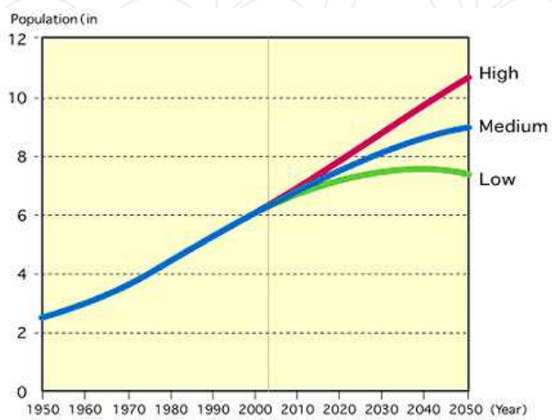

Fig. 8. Growth of world population

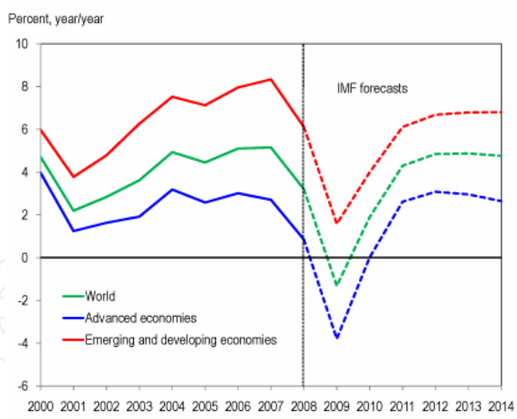

Fig. 9. Growth of world GDP

Globalisation requires tremendous amount of energy and raw materials. Thanks to uneven distribution of natural resources, growing population and water covering more than 70% of surface, shipping gave a crucial role in the process of integration global economy and developing the world into a single market place. Today sea trade is 8 billion tonnes that is 17 times bigger than in 1950. Since 2000 to 2008 seaborne trade grew even at 5% per annum. In the long perspective until 2050, due to the growth in world population and the emergence of new economies, the movement of goods should grow at 2.4% per annum. It is forecasted that sea trade will reach 23 billion tonnes in 2060 (Stopford, 2010).

GDP growth, energy (oil and coal mainly) demand, seaborne trade are in very tough relation. International Monetary Fund estimates the growth of seaborne oil trade because global economy recovers faster than previously expected and due to industrial demand from emerging markets, mainly China and India. The price of oil depends on the global demand. In 2035, the average real price of crude oil in the Reference case is $125 per barrel in 2009 dollars (Figure 10). World liquids consumption grows from 84.9 million barrels per day in 2009 to 92.2 million barrels per day in 2015 and to 110.8 million barrels per day in 2035 (EIA, 2011).

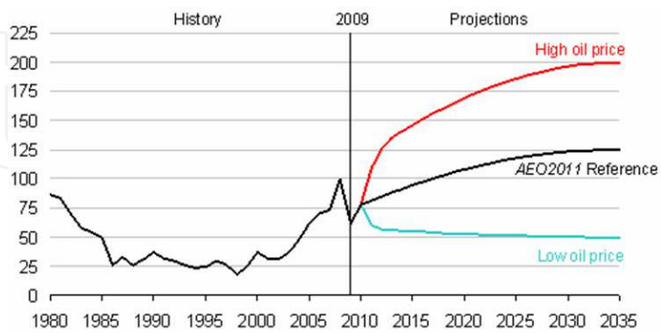

Fig. 10. Oil prices in 1980-2035

Energy Information Administration (EIA) expects continued tightening of world oil markets over the next two years, particularly in light of the recent events in largest oil producing regions North Africa and the Middle East. The currently Libya, that is the 13th largest crude oil exporter in the world and a very large producer of light sweet blends, has been

producing supply disruption. According to various reports, much of the country's production of total liquids of 1.8 million barrels per day has been shut in and it is unclear how long this situation will continue.

There are many reasons for market uncertainty that could push oil prices higher or lower than current expectations. Among the uncertainties are: the continued unrest in producing countries and its potential impact on supply; decisions by key OPEC member countries regarding their production response to the global recovery in oil demand and recent supply losses; the rate of economic recovery, both domestically and globally; fiscal issues facing national and sub-national governments; and China's efforts to address concerns regarding its growth and inflation rates.

The world tanker fleet is totalling 441 million deadweight tons depends on oil demand. 10.2% of it is single hull tankers that are in the phase-out state. 129 million dwt (or 29.1% of the existing fleet) of coming tankers are waiting on-order. Of course, some of new orders will be cancelled or it will be agreed on the postponement of their delivery time. Some of existing tankers have to be refitted according to new requirements for CO_2, SO_x, NO_x emissions or dismantled. Tanker Fright market, slow steaming, floating storage, changing trade patterns from Latin America and West Africa to China also should positively and better than expected influence the world's tanker fleet in prospect. The analysis of offshore investment trends shows its strong continuous growth to 360 billion US dollars by 2013. Offshore drilling in deepwater is expected to grow stronger than in shallow water. This together with sufficient oil prices to develop offshore projects and delayed large-scale projects will result in increase in new building demand for offshore in the long-term perspective.

The world coal and iron ore trade demand depends very much on the biggest purchaser China. Coal import increased to 100 million tons in 2009 and tends to rise upwards until 2020. In 2009, iron ore import demand to China reached 2/3 of the world's iron ore trade. The second biggest purchaser in the world is India that is looking for new suppliers in Russia and Latin America seeking to fill increased needs. Despite the fact that bulker market shows recovery signals since the end of 2009 the nearest future of shipbuilders focused on bulker carriers is not yet safe. During the first four months of 2010, it contracted 185 new bulk carriers (15 million dwt). Though prices of new building incentives have fallen by 30% the order book for 2010-2014 is overfilled: 3286 new bulkers (43.6% of existing bulker fleet) totalling 287.1 million dwt (59.7%)(CESA AR, 2010). This means that shipyards of China, S. Korea, Japan and new players focused on production of bulkers should turn to the building of other ship types. Consequently, the competition among high added value shipbuilders should be more intense.

Coming to a conclusion about further world fleet development the positive belief is disappearing. If at the beginning of the shipbuilding boom in 2003 the world's order book amounted for 13% of the existing fleet, now it reaches 48%. Some prices of ordered ships today are not reasonable; therefore, financing delivered ships is to be complicated. The recovery of seaborne trade will not supply enough shipping contracts to those suffering from the lack of cargo fleet. Some older ships will be dismantled; some inefficient ones should be renovated or converted. But one is clear: the world doesn't need as big shipyard capacity as is has today. Figure 11 illustrates shipbuilding overcapacity located in China, S. Korea, Japan, some new player countries, and Europe mainly. A huge reduction of 40-50% is estimated for existing capacity in the next 10 years (China's shipbuilding economy research centre, 2008).

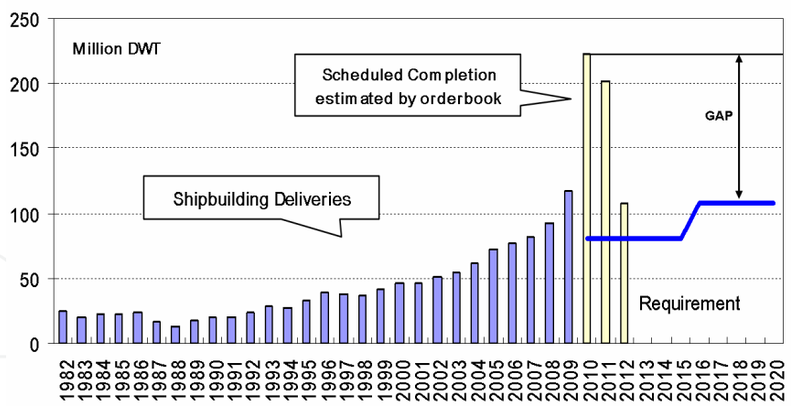

Fig. 11. The capacity utilization rates of the world shipbuilding industry

Such a danger as "tenth wave" is poising now over the global shipbuilding industry. What shipyards of what countries will survive it? It might be that some countries will decide to reduce shipbuilding capacity or even close it before their shipyards collapse.

The next factor determining the competitiveness of shipyards is the productivity. Productivity is the amount of output achieved for a given amount of input (materials, manpower and energy). According V. Bertram, the competitiveness depends on productivity (CGT / man year), production range (personnel cost / total cost), attractiveness of product (market price / CGT), S - subsidy ratio, X - exchange rate and K - cost position (labour cost / man year) (Bertram, 2003). These criteria are used for comparing shipyards, countries or regions with each other. Among the production costs, labour cost is the key determinant of the competitiveness of shipyards (Figure 12).

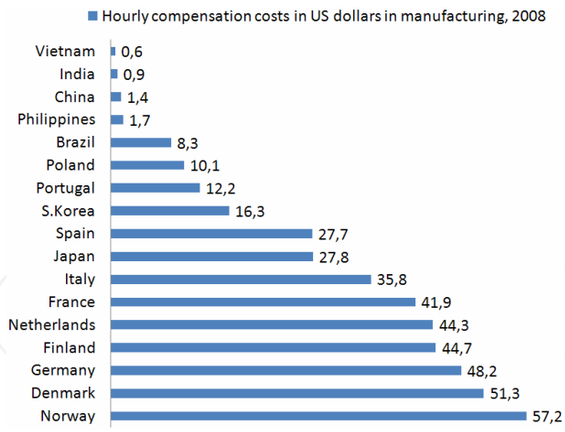

Fig. 12. Hourly compensated costs in thousands of US dollars included hourly direct pay, employer social insurance expenditures and labour related taxes. Source: Eurostat

Keeping of the low labour costs facilitate competition of China and new players in the global market despite of their low productivity.

Productivity is influenced by technology, facilities, management competence, work organization, work practice, the level of workers' skills and motivation. The level of the shipyard's technology is one of the most important factors influencing the cost competitiveness, especially for the large enterprise.

Traditionally shipbuilding is classed as an assembly industry and divides into two parts: steelwork – the pre-fabrication, assembly and erection of the steel structure of the ship; outfit – the installation of the systems, equipment and fittings into the ship. There are 14 processes in these two parts (Andritsos & Perez-Prat, 1999). As is known automation and/or robotize of the industrial operations increases efficiency and productivity of its. A very high level of automation as such is not of the highest priority in the development plans of the shipyards because one-of-a-type production. The processes of major interest from the automation point of view are the following: marking, cutting & conditioning of steel plates and profiles; fabrication of 2D blocks: welding of flat and shaped sub-assemblies (panels and sub-blocks); fabrication of 3D blocks in workshop; prefabrication of pipes, supports, modules; blasting and painting/coating; transport & handling; dimensional control & inspection. There are 6 levels of technological development of shipyards (Table 3). Very few world shipyards have reached the highest 6th level. The majority keep staying at the 4th level or even lower.

Level	Description
1	Reflects typical practice of the early 1960s – welded hulls, combination of blocks and assembly at erection, small cranes (<50 t), multiple open berths, post launch outfitting and little mechanization. Manual operating systems.
2	Reflects yard modernization of the late 1960s/ early 1970s. Fewer berths or dock, larger cranes (<250 t), some mechanization and pre-outfitting, numerical controlled metal cutting machines. Some computerized systems.
3	Good practice of the late 1970s, new/fully redeveloped yards, large capacity cranes (>350 t), some weather protection at dock or single construction area. High degree of mechanization and use of computers. Block manufacturing shops.
4	Technology advances of the middle 1980s. Generally large docks, protected microclimate zones, extensive early outfitting and fully developed operating systems. High lifting capacity of Goliath cranes (>800 t)
5	State of the art of the 1990s, with automation, integration of operating systems, use of CAD, CAM, CAPP. Computer aided material control and Quality Assurance. Increased automation and robotics in welding, pipe shops. Goliath cranes (>800 t)
6	2000 to present: large, renovated and some completely covered shipyards, large grand and ultra blocks to 3000 t, mainly robotics for welding and part assembly. Goliath cranes (>800 t)

Table 3. Technology (best practice) levels of world shipyards (Lamb, 2007).

Technology benchmark provided by T. Lamb shows very interesting results forcing to think what is more valuable for the shipyards competing in the market. It compares typical production elements such as steelwork and outfitting production, other pre-erection, ship construction, layout & environment, design & drafting, and organisation/operating of the main shipbuilding countries/regions. The highest overall level has Japan (4.43), the second – S. Korea (4.00), then Europe (3.4), and the lowest is of China (2.88) (Lamb, 2007). Is China a winner just because of low labour price? Or is Chinese labour cost lower because of small investment? Another reason impacting (more specifically – distorting) the competitiveness

of shipyards is State support that goes to increasing of the national shipbuilding capacity. For example, over the past decade Korea almost quadrupled its production capacities while Japan and Europe kept stable production volumes. Since 1998 to 2009, S. Korean shipbuilding capacity grew by 10.8 million CGT and Chinese - by 7.9 million CGT (ECORYS SCS, 2009). China and S. Korea continues to follow a highly aggressive expansion path. Under Chinese "Shipbuilding industry adjustment promotion plan" the government has defined provision of operating funds to shipyards and expansion of financial support to owners who order export ships. Not only these countries but also new players such as Brazil, Turkey, India, etc provide huge amounts of support and financial assistance to their domestic producers by using various forms of subsidies including investment aid, loans and payment guarantees to shipbuilders, suppliers, governmental bailouts, subsidies on ship prices for domestic ocean going ships' buyers, mandatory requirements to order ships at domestic yards and subsidized loans for domestically built ships, direct loans and debt guarantees to ship-owners, etc.

In such conditions, keeping a competitive edge of European shipyards becomes more and more complicate. Despite of the reduced order book Europe chooses quality and excellence over the low costs as the main strategic point of further development of the shipbuilding industry.

3. LeaderShip 2015 – the strategy of the European shipbuilding industry

LeaderShip 2015 defines the future of the European shipbuilding and ship repair industry by increasing in competitiveness through excellence. This document was created by a High Level Advisory Group for the LeaderSHIP 2015 in 2003. The Strategy summarizes the results of an intense discussion process among stakeholders, based on 8 key areas, which have challenges described and concrete recommendations spelled out (CESA, 2003). The activities such as development of Waterborne Technology Platform, VISION 2020, Strategic Research Programme, Implementation Road Map, etc. proved these plans were weighted and achievable. The summary of steps undertakes by 2010 is presented in the Table 4 (CESA, 2005-2010). One of the main objectives to apply World Trade Organization (WTO) rules to shipbuilding was not successful despite efforts of 20 years. This with coming downwards shipbuilding development cycle, overcapacity of shipyards, and fleet overproduction has all been aggravating not only European but also other main players' problems. European shipbuilding must solve own specific problems (Table 4).

1st key area: Establishing a level playing field in world shipbuilding
Recommendations of 2003: Continuation of the present EU trade policy approach with determination. Full enforcement of applicable WTO rules to shipbuilding. Development of enforceable OECD disciplines through a new shipbuilding agreement by 2005 and an unambiguous interpretation of existing rules.
Progress report, 2005: Problems remain unchanged. The EC indeed vigorously pursued all available avenues to address the issue. The WTO procedures on shipbuilding were finalised in 2005. Effective international rules to be agreed at the OECD have, therefore, become even more important.
Progress report, 2007: Not much result has been achieved in this field. The difficulties with the application of international trade rules (on subsidies) were illustrated in the

WTO case between the EU and Korea. Progress in the attempts to negotiate an international shipbuilding agreement under the OECD (addressing subsidies and dumping prices) has been halted in 2005. However, progress has been made in starting bilateral discussions, including the shipbuilding Dialogue with China and, expectedly, an EU-Korea FTA negotiation process.
2nd key area: Improving Research Developing & Innovation (RDI) investment in the EU shipbuilding industry
Recommendations of 2003: The European dimension of shipbuilding RDI should be strengthened through integrating and concentrating efforts, with the aim to create Technology Platforms. Work being undertaken within the Maritime Industries Forum should form the base for this approach. Shipbuilding should, in substance, enjoy the same conditions as other industries that engage in similar RDI activities. Aid intensities need to reflect the actual technological risks taken in all phases of design, development and production. New definitions, notably regarding innovation aid, need to be developed where necessary. RDI investment support needs to aim at enhancing European technological leadership and should reward risk taking.
Recommendations of 2005: The Technology Platform WATERBORNE TP was launched in January 2005 and a Strategic Research Agenda was concluded by the end of 2005. In April 2005, a new initiative was launched to systematically develop "visionary concepts for vessels and floating structures". The new EC framework for state aid in shipbuilding, which entered into force at the beginning of 2004, has taken the a.m. recommendation fully into account and now includes appropriate provisions related to support measures for innovation.
Progress report, 2007: In the field of RDI stimulation, the updated provisions on innovation aid to shipyards have been an important improvement for the sector. Germany, France, Spain, the Netherlands and Italy have subsequently developed national funded schemes supporting innovation. The launch of the WATERBORNE TP and the increase of the budget for surface transport under Framework Programme 7 (FP7) have also been considerable steps in strengthening RDI in the EU shipbuilding sector. Industrial clusters play an increasingly important role in maritime industries.
3rd key area: Developing advanced financing and guarantee schemes
Recommendations of 2003: Explore the possibility of establishing an EU-wide guarantee fund for pre- and post-delivery financing. The alternative of harmonising standards in EU member states, in line with common market and OECD rules, could also be considered, albeit difficult to fully achieve. Any such tools have to be easily applicable. Export credit insurance companies, covered by appropriate re-insurance, should offer hedging instruments of currency risks.
Progress report, 2005: Priority has been given to establish a European wide instrument to enlarge the available volume for pre-delivery financing, which shipyards see as the most urgent need. In January 2005, it was announced the goal of creating such an instrument before the end of the year.
Progress report, 2007: The focus of the Commission in working on this issue has been on pre-delivery financing schemes (refund guarantees). Extensive contacts have been initiated with the European Investment Bank (EIB) that has indicated to face statutory constraints, lack of resources and sector specific knowledge required to take a leading role. The European Commission has explored the possibility of an EU guarantee fund for shipyards.

4th key area: Promoting Safer and More Environment-Friendly Ships
Recommendations of 2003: Existing and future EU legislation has to be strictly implemented and "exported" to the international level. A more transparent, uniform, efficient and independent system of technical surveys of vessels has to be promoted. A quality assessment scheme for shipyards at world-wide level should be developed, covering new building and repair. Maintaining and strengthening ship repair capabilities in Europe is important to ensure a high level of transport safety and environmental protection. The great potential of Short Sea Shipping needs to be exploited through appropriate political and economic framework conditions.
Progress report, 2005: The European Commission is actively pursuing a strengthened coordination role related to IMO activities. CESA supports these endeavours and advocates, in this respect, a European ratification process of adopting IMO conventions instead of the 25 separate ratifications by the EU Member States. A committee addressing technical concerns related to double-hull oil tankers was created at European Maritime safety agency (EMSA) in April 2004. CESA has established a Technical Advisory Committee, which contributes its expertise to the Commission and EMSA. CESA actively contributed to the consultation related to the Motorways of the Seas, emphasising in particular that ships have to be regarded as a fundamental part of the infrastructure for Short Sea Shipping.
Progress report, 2007: the EU welcomes higher global standards. The care must be taken that such standards do not lead to unintended technology transfer and leakage of IP. Both industry and the Commission are actively providing technical expertise to EMSA and are striving in various initiatives to reduce transport pollution and increase safety, e.g. by promoting Short Sea Shipping, applying the clean ship concept widely and introducing new intermodal maritime-based transport logistics chains in Europe.
5th key area: Securing the Access to a skilled Workforce
Recommendations of 2003: Programmes for shipbuilding-specific management training need to be developed and established. New skill requirements need to be analysed and addressed, ideally through a sectoral social dialogue. Exchange of staff and know how needs to be organised on all levels, from shop floor to academia. A publicity campaign, showing the vitality and sustainability of the shipbuilding industry, has to be implemented. Regional centres of excellence could provide crucial input for the realisation of the above recommendations.
Progress report, 2005: A formal Social Dialogue Committee for the shipbuilding and ship repair sectors has been established in September 2003. An Experts workshop to exchange best practice related to training & skill retention was held in October 2005. As part of strengthened efforts to improve the public perception of shipyards as high-tech production sites and to attract young people to the industry as well as highly skilled engineers, a Europe-wide Shipyards' Week was planned for March 2006.
Progress report, 2007: CESA and European Metalworkers Federation (EMF) launched a formal Social Dialogue Committee for the shipbuilding and ship repair sectors in 2003. In this Framework CESA and EMF have been granted the status of European social partner and were consulted on social policy proposals. Practical initiatives like the European Shipyard Week serve to improve the attractiveness of shipyards as a workplace for young high-skilled professionals.
6th key area: Building a Sustainable Industry Structure
Recommendations of 2003: The EU of the 25 must further develop its policy approach

to the sector, in line with its principles on industrial policies. A consolidation process among European producers should be facilitated, providing incentives to remove less efficient production capacity and thereby freeing resources for new investments. The current closure aid rules in the EU should be scrutinized with the view to facilitate a more pro-active approach, based on the idea of "aid to consolidation".
Progress report, 2005: The consolidation process in European shipbuilding is continuously developing. Systematic analysis of parts of the European industry have identified an insufficient level of net equity, often leading to "investment congestion"; further discussions on this issue, developing possible means to address it, are on-going.
Progress report, 2007: Defining the structure of the shipbuilding industry falls outside the scope of the Commission. Some developments towards mergers, acquisitions and joint ventures have been observed, making European shipbuilding groups better equipped to compete successfully. There is however scope for improvement in this direction, when compared to the industries of Japan and Korea.
7th key area: A European Approach to Naval Shipbuilding Needs
Recommendations of 2003: Joint requirements should be established to shape a number of major projects, enabling co-operation between yards and leading to interoperability of systems, vessels and fleets. Member states should address the issue of harmonisation of export rules. Common rules to create a European market for defence equipment have to be developed, based on the Council's request to create an intergovernmental agency in the field of defence capabilities development, research, acquisition and armaments.
Progress report, 2005: In July 2004, the European Defence Agency was established by a Joint Action of the EU Council. Its scope is to support the Member States in their effort to improve European defence capabilities and to further develop the European Security and Defence Policy (ESDP). CESA has established a new working group dedicated to naval shipyards, which brings together all major European players in this field. Complementing the CESA activities, the European Aerospace and Defence Industry Association (ASD), has formed a group with a wider coverage including also system, equipment and service providers.
Progress report, 2007: A trend of consolidation and co-operation between naval shipyards at national level is observed, which is welcomed by the Commission provided that it helps building a European Defence Technological and Industrial Base. Much work remains to be done in agreeing upon common operational requirements and harmonised procurement cycles in order to reach more interoperability of vessels and fleets. The competitive advantage of the naval sector in Europe is still at risk because of market fragmentation and resulting lack of synergies. Creation of the European Defence Agency is helping to achieve the goals.
8th key area: Protection of Intellectual property Rights (IPR)
Recommendations of 2003: The existing instruments for IPR protection (copyrights, registered designs, trademarks, patents, non-disclosure and specific collaboration agreements) need to be exploited to the full. Knowledge data bases for shipbuilding, containing information about the state of the art, existing patents, and the specific competitive situation for certain products and solutions, and key knowledge holders, should be built and run by dedicated IPR entities. International patent rules applicable to shipbuilding need to be examined and possibly strengthened.

Progress report, 2005: Several cases related to IPR in shipbuilding have been closely followed and discussions have taken place related to some of the key loop-holes. A systematic approach to the issue is intended to be launched mid 2005.
Progress report, 2007: Efforts have been made in raising awareness on the value of knowledge in the shipbuilding sector and the importance of protecting it. The Commission launched a study on IPR issues in shipbuilding in 2006. A Working Group of the Maritime Industries Forum looking into Rules, Regulations and Right is addressing IPR protection. The Shipbuilding Dialogue with China and other bilateral initiatives intend to include this issue as well.

Table 4. The development and improvement of the LeaderSHIP 2015

In 2010, CESA has decided to update the Strategy by developing a new LeaderSHIP 2020. Majority of strategic aims and objectives of LeaderSHIP 2015 will be transferred into the new document. Analysis of recommendations for the LeaderSHIP 2020 received from maritime industry representatives shows that it will be continuing efforts to sign a global shipbuilding agreement for creation of level playing field. Choosing competitiveness through excellence, Europeans plan an exchange of the best practices and awareness through RDI aid schemes at Member State level, to simplify procedures and improve access to European Union level RDI programmes. Actively promotion of a maritime cluster approach to innovation should be continuing for the next 5 years. Promotion of employment in technical professions and the possibilities of a specific labour migration within European maritime cluster have to be included into list of objectives, too. Developing of standards for Short Sea Shipping, creating schemes to fleet renewing based on environmental and safety standards will be stimulate as well. At the same time the awareness of IPR protection possibilities, especially among small and middle enterprises has to be rising. Since the developing of advanced financing and guarantee schemes on EU level still is in the low stage, it will be look for possibilities for creation of a regional and central guarantee funds.

Simultaneously, European maritime industry has to accept a new challenge. The European Community has resolved to reduce the overall greenhouse gas emissions by at least 20% below 1990 levels by 2020 and by 80-95% below 1990 levels by 2050 (EC, 2010). This with external dimension i. e. the new fuel standards established by the 2008 amendment to MARPOL Annex VI will impact on shipping and maritime industry, as well. For example, mentioned above Annex VI has introduced a reduction of fuel sulphur limits for fuels used in SO_x Emissions Controls Areas (the Baltic Sea, the North Sea and the English Channel in EU) since 1.5% to 1.00% (already in force since 1st July 2010) and to 0.10% since 1st January 2015 (AirClim, 2010). Many ships (covering 85% of world tonnage) will need to comply with a new fuel standard that increases the price of marine fuels. The EU's merchant fleet is the largest in the world therefore such reductions have been requiring the European shipping to turn toward environmental approach by delivering more energy efficient, safe and sustainable maritime systems in the next decade. Much is already done.

First of all, the well-known solutions such a speed optimisation, optimum trim, ballast, and propeller, proper maintenance of hull and propeller smoothness, etc. have been implementing for fuel-efficient operation of ships.

Due to increased focus on fuel consumption and CO_2 emission, the two solutions with the greatest potential were indentified for the improvement of the overall performance of the diesel engines. The first is sailing on low load mode for ships with electronically controlled

engines, the second is cutting out the turbocharger on ships with multiple turbocharger engines (Green ship magazine, 2010). Speed optimization if it agrees charter party terms not always can produce significant savings. Sailing at less than optimum speed consumes even more fuel. It may include increased vibration and soot.

Trim has a significant influence on the resistance of the ship therefore optimised trim can deliver significant fuel savings and CO_2, SO_x, NO_x emission reduction by 3% of each (Green ship magazine, 2010).

Optimum ballast achieving through right cargo planning helps to adjust optimum trim, facilitates steering. From the other point of view, pumped out ballast water transfers invasive organisms that cause harm to local ecosystems. Some researchers work on developing ballast-free ship solution (DNV, 2010) that helps to solve both problems. It is no need to transport ballast water as extras cargo in the tanks (add the reducing of fuel consumption) and any damage provided to the local ecosystems.

Using of optimum propeller, improving water inflow through fins and nozzles may increase propulsive efficiency and reduce fuel consumption to approximately 4-5%. Modern propeller combined with an asymmetric rudder can be utilised more efficiently compared to traditional rudders (Green ship magazine, 2010). Even the better voyage planning also may reduce fuel consumption if the rudder would be used as seldom as possible.

Hull resistance may be reduced by new technology-coating systems and regular cleaning. A new biocide-free fouling control paints are proposed to the market. New silicon antifouling paints saves ship daily running costs through keeping proper hull smoothness, reduction of fuel consumption and CO_2, SO_x, NO_x emission by 3-8% of each gas (Green ship magazine, 2010). The cleaning and polishing operations are very effective for propellers, too. Much work can be done in-water instead of docking.

Liquefied natural gas (LNG) auxiliary engines using for electric power supply in harbour conditions reduce emission of approximately 20% on CO_2, 35% on NO_x, and 100% on SO_x (Green ship magazine, 2010). Many other technologies such as waste heat recovery, water-fuel emulsion, exhaust gas recirculation and etc. were known to maritime society but integrated using of its in new conditions gives a new effect. All on shore and on board stakeholders should be involved into implementation of fuel saving and emission reduction measures by providing of necessary training of personnel.

European ship repairers' future has to be more favourable because all new ships will require maintenance and repair. The ship repair business differs substantially from the shipbuilding and brings obvious impact on the environment. As the industry has to fulfil a wide range of constantly increasing requirements in the scope of environmental legislation and regulation, the environmental impact of ship repair and conversion processes must be also reduced. Providing practical and cost effective solutions to the new eco-innovative ship repair and retrofitting processes is a new challenge and opportunity of European repair shipyards.

In the long-term future a lot of substantial developments have to be performed. Reducing independence from oil by implementing hydrogen-driven fuel cells and alternative energy sources, utilisation of new Northern routes, developing future concepts for inland and sea ships, floating recreational objects and marina & leisure facility, maintaining enlarged demand of off-shore industry, design of advanced hull structures, more efficient propulsion, and many other what would help to maintain growing population of our planet.

4. Conclusion

All goods have been moving depending on global development. The exponential growth of world population in the conditions of expanding globalisation requires tremendous amount of energy and raw materials. Developing of the world regions and countries has different speed for advanced, emerging or developing economies. It is estimated that world GDP will grow at 4.2 % in 2011 while advanced economies at 1-2% and emerging/developing economies – at 8-10%. This is close relation with the international trade.

Seaborne trade is essential to global prosperity on the one part and depends on world developing results on the other part. Due to faster recovering of the global economy after the last crisis of 2008, it is expected seaborne trade growth at 2.4% per annum and rising of oil, iron ore and coal consumption. It means providing with a cargo for some new built oil tankers and bulkers. Delivering of contracted new buildings within a few next years will make oversupply, especially for the bulker fleet.

Security of the shipping sector depends on how strong is world shipbuilding industry. Shipbuilding in majority of main players' countries with exception of Japan is export-oriented industry therefore most of governments try to support this industry. A flag of the shipbuilding leadership goes from hand to hand.

Asian countries have been gaining the leadership through the similar scenario: assigning national shipbuilding industry as strategic, developing and implementation industry support policy.

The global economic crisis has deeply affected the shipbuilding industry worldwide. The deep demand gap in combination with global shipbuilding overcapacity threw down new challenges to all shipbuilding countries. Further competition takes a cruel character.

Analysis shows that world shipbuilding order book is shrinking fast because of decreasing of new orders and cancellations. New players have taken portion of new orders from Europe and Japan. The global competitive position of the European industry is under severe pressure due to the difficult market environment and in particular due to extensive support measures in competing countries.

The facts speak that the large shipyards oriented to mass production may keep their market shares more successfully therefore a merger of shipyards is performing in China and Japan. Due to small and middle enterprises (SMEs) domination among European shipyards competition with Asian shipyards is not equivalent on the one part but SMEs are more flexible in adoption of innovations on the other part. The last factor must be availed as an advantage of Europeans.

Despite the fact that European shipbuilding industry keeps the gained a strong niche player's position in cruise vessel, yacht, and off-shore markets the main competitors have been shifting up towards more complex vessel segments, too. European's situation has been aggravating by highest wage levels and aging of the employees. Small companies do not have enough financial reserves and may do not survive further critical period until the next booming in new building.

As there is no base to compete on labour cost, European industry has to advance in superior products regarding ship safety, efficiency and marine environment protection as well as in innovative processes intended to increase production productivity. Choosing competitiveness through excellence, Europeans plan an exchange of the best practices and awareness through RDI aid schemes at Member State level, to simplify procedures and improve access to European Union level RDI programmes. Actively promotion of a

maritime cluster approach to innovation will be continuing for the next 5 years. Promotion of employment in technical professions and the possibilities of a specific labour migration within European maritime cluster have to be included into list of objectives, too.
European ship repairers' future has to be more favourable because all new ships will require maintenance and repair. The ship repair business differs substantially from the shipbuilding and brings obvious impact on the environment. As the industry has to fulfil a wide range of constantly increasing requirements in the scope of environmental legislation and regulation, the environmental impact of ship repair and conversion processes must be also reduced. Providing practical and cost effective solutions to the new eco-innovative ship repair and retrofitting processes is a new challenge and opportunity of European repair shipyards.

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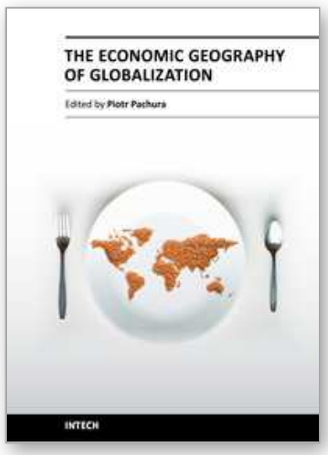

The Economic Geography of Globalization

Edited by Prof. Piotr Pachura

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Very often the process of globalization is referred the word economy evolution. Often we measure and study globalization in the economic relevance. The economy is possibly the most recognized dimension of globalization. That is why we see many new phenomena and processes on economic macro levels and economic sectoral horizons as well as on specific â€œgeography of globalizationâ€. The book The Economic Geography of Globalization consists of 13 chapters divided into two sections: Globalization and Macro Process and Globalization and Sectoral Process. The Authors of respective chapters represent the great diversity of disciplines and methodological approaches as well as a variety of academic culture. This book is a valuable contribution and it will certainly be appreciated by a global community of scholars.

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