

# PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY



## FOREWORD

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## EXECUTIVE SUMMARY

The Finnish shipbuilding industry is part of Finland's broader maritime cluster, which has a total turnover of approximately EUR 13 billion and a total value added of EUR 3.8 billion, representing 1.8% of GDP. Within the maritime cluster, the marine industry includes marine equipment manufacturers, designers, software and system providers as well as shipbuilders and ship repairers with a total turnover of approximately EUR 8 billion. The sales of Finnish shipyards amounted to approximately EUR 1 billion in 2015 according to Finnish Marine Industries. In 2016, Finland was the 17<sup>th</sup> largest shipbuilding economy with vessel completions amounting to 122 000 cgt, representing a share of 0.34% of the total output of the global shipbuilding industry. However, ship completions in cgt are volatile and their share of the world total would be significantly higher in value terms as Finland produces sophisticated vessels. Moreover, Finnish maritime system providers and marine equipment suppliers deliver products to the global market which are included in ships and are not included in these statistics.

The Finnish maritime industry has evolved over five development waves that have made the industry innovative and technologically advanced. Finnish yards are very dependent on the global market given the relatively small size of Finland's domestic market and the fact that only special vessels are ordered by domestic operators, such as passenger ferries, ice breakers and military ships. Finland's shipbuilding industry is currently very active in two broad market segments: cruise/passenger ships and Arctic and specialised vessels. In the 2016 report "The Finnish maritime cluster: towards the 2020s" issued in the context of a programme run by the Finnish Ministry of Economic Affairs and Employment, six main market segments were identified for the Finnish marine cluster: cargo transport market, cruise market, car ferry and ro-ro traffic market, oil and gas production market, renewable energy production market, and vessels ordered by the public sector.

Finland belongs to the small circle of four European countries that construct very large cruise ships. As Finnish trade and welfare depend on exports, and as its harbours freeze in winter, the country positioned itself to be the centre of Arctic expertise with the continuous development of ice breaking and special vessels production. Today, around 70% of the world's ice breakers are produced in Finland and the country invests in knowledge building in this segment. Finland's marine industry also develop "green" marine technology, notably the new generation of dual-fuel engines leading to a reduction of almost 100% of sulphur oxide and 85% of nitrogen oxide emissions. Finland has a wide network of companies involved in manufacturing equipment for ships, offshore and other marine activities.

The Finnish marine industry employed around 28 800 workers in 2015, which represented approximately 2% of the country's total workforce including 2 800 workers in shipyards. Average labour costs per hour in Finland for the whole economy (excluding agriculture and public administration) are around 10% higher than in the EU-28. Finland's maritime industry managed to maintain its international competitiveness thanks to its capability to innovate and develop new solutions, which have sometimes then been adopted widely in the international maritime sector.

Economic factors, such as the cyclical nature of the maritime business and the rise of competitors pose challenges for the Finnish marine industry as well as the need to find skilled labour force required for the ongoing development of the sector. Therefore, the Finnish maritime industry aims to invest in cost

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efficiency using notably more digitalisation, automation and robotisation as well as innovations, and to strengthen international networks to counteract potential downturns in the industry and remain internationally competitive. In addition, the government provides support available for all concerned sectors for retraining laid-off labour force and facilitate re-employment opportunities.

The Maritime Transport Strategy for Finland 2014–22 was published by the Ministry of Transport and Communications of Finland in September 2014. The strategy analyses the changes that have taken place in the past years and future challenges, highlighting topics including the development of efficient transport chains that support competitiveness, the international activities of the sector, and green growth. In addition, Finnish expertise on sea and ice shipping, and the opportunities offered by the Baltic Sea are considered. The strategy also sets out a vision for maritime transport in 2030, which was determined in collaboration with the maritime transport sector and with users of its services. The goal of the strategy is to maintain competitiveness on world markets, as well as safety and the environment of the Baltic Sea, particularly with respect to reducing the risk of oil spill accidents.

Team Finland is a group of institutions promoting growth and exports of Finnish companies including those of its marine cluster. It includes Tekes offering funding and expert services for R&D projects carried out by companies, research organisations, and public sector service providers based in Finland. Tekes' interventions focus on projects aiming to reduce emissions in the maritime transport sector and technology development in big data, industrial Internet, artificial intelligence and robotisation which are expected to provide operational efficiency gains. Innovation aid, jointly managed by the Ministry of Economic Affairs and Employment and the local Centre for Economic Development, Transport and the Environment (ELY Centre) is also provided under the forms of direct grants funding industrial implementation of innovative products and processes.

Team Finland also includes Finnvera and its wholly owned subsidiary Finnish Export Credit (FEC), which provides both pre-delivery financing and post-delivery financing. Export credits for ships accounted for 28.4% of total export credit transactions between 2005 and 2014 in Finland, more than the share of 16.3% in OECD countries. The volume of Finnish export credits for ships has been growing sharply since 2015 driven by the exports of large cruise ships. Finnish Industry Investment Ltd (Tesi) provided temporary funding in equity to Turku shipyards in 2014 and funding to Rauma Marine Constructions Oy (RMC) in 2015. Tesi's investment policy requires that Tesi remains a minority shareholder and has an exit strategy.

**PEER REVIEW OF THE FINNISH MARITIME INDUSTRY**

In 2012, the OECD's Council Working Party on Shipbuilding (WP6) introduced a peer review process, focused on support measures provided by governments to their shipbuilding sectors. Under this process, each economy participating in the WP6 will undergo an in-depth study of their shipbuilding industry and related government measures. Non-WP6 economies may also join the process and be the subject of a WP6 review.

The main goal of the peer review process is to strengthen the identification of government policies, practices and measures affecting the shipbuilding sector and to support discussion of these within the WP6. The analysis of support measures is accompanied by contextual detail of the industry, so as to enable a richer discussion of shipbuilding policy and its impact. A key element of the process is active debate and discussion of peer review drafts by WP6 participants, with a view to promoting transparency and experience-sharing.

Finland is the sixth country to be subject to a WP6 peer review, following the reviews of Japan (2012), Portugal (2013), Korea (2014), Germany (2015) and Norway (2016).

The information in the report is drawn from public information sources, statistical series available to the Secretariat, Finland's response to the peer review questionnaire and discussions with government officials and stakeholders. The Secretariat expresses its gratitude to the government and industry stakeholders who participated in the review.

The analysis focuses on the shipbuilding industry (including repair and conversion facilities), but also provides information on the marine supply industry, which manufactures the components that are used in ships. The report has four principal parts:

- *Global perspective*: This part provides a brief overview of the global market and the role that Finland plays in it.
- *Structure and features of the Finnish shipbuilding and marine supply industry*: This part analyses the structure of the Finnish industry and assesses industry and market developments in recent years.
- *Government policies affecting the shipbuilding industry*: This part reviews the policy measures that have been adopted to support the industry in recent years.

## GLOBAL PERSPECTIVE

Finland's economic and social development in the second half of the 20<sup>th</sup> century has been supported by continued investment in education, research and innovation, Finland achieved a successful transition from a largely resource-based to a leading knowledge-based economy shifting towards high-technology manufacturing and knowledge-based services.

Finland was, however, hit hard by the global economic crisis in 2009. New disruptive technological change contributed to reducing the handset business activity of the largest Finnish company at that time, Nokia. It also led to a sharp drop in exports of information and communication technology (ICT) goods.

Finland needs to build new export strengths, while established industries extend their capabilities to compete in high value added segments on international markets. The four largest industries in 2015 were: metal industry (41.4% of total value of output); chemicals (21%); forest industry (19.9%); food, and alcohol and tobacco industries (10.8%) (OECD, 2017).

The Finnish shipbuilding industry is part of the broader maritime cluster with a total turnover of approximately EUR 13 billion and a total value added of EUR 3.8 billion, representing 1.8% of GDP. Within the maritime cluster, the marine industry includes marine equipment manufacturers, designers, software and system providers as well as shipbuilders and ship repairers with approximately in total a turnover of EUR 8 billion. The shipyard's sales amounted to approximately EUR 1 billion in 2015 according to Finnish Marine Industries.

In 2016, Finland was the 17<sup>th</sup> largest shipbuilding economy in terms of vessel completions with 122 000 cgt representing a share of 0.3% of the total output of the shipbuilding industry worldwide. Completions in Finland accounted for 5% of total European completions making Finland the 8<sup>th</sup> largest European ship producer in 2016 in terms of cgt.

Finnish shipyards have produced a variety of vessel types in the last ten years including cruise ships, passenger and car ferries, platform supply vessels, roll-on/roll-off (Ro-Ro), icebreakers and oceanographic survey vessels. Since 2014, shipbuilding in Finland has mainly focused on cruise ships and icebreakers as well as other ice-going vessels such as offshore supply vessels used at Arctic offshore oilfields. Between 2007 and 2016 Finland has accounted for 13.4% of the global production of cruise ships in cgt terms, for 12.3% of the global production of ice breakers and for 9.5% of the global production of passenger or car ferries. In the considered period Finland also produced platform supply and backhoe dredgers vessels (Table 1).

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Table 1. Completions of vessels in cgt and gt by ship type in the world and by Finland, 2007-16

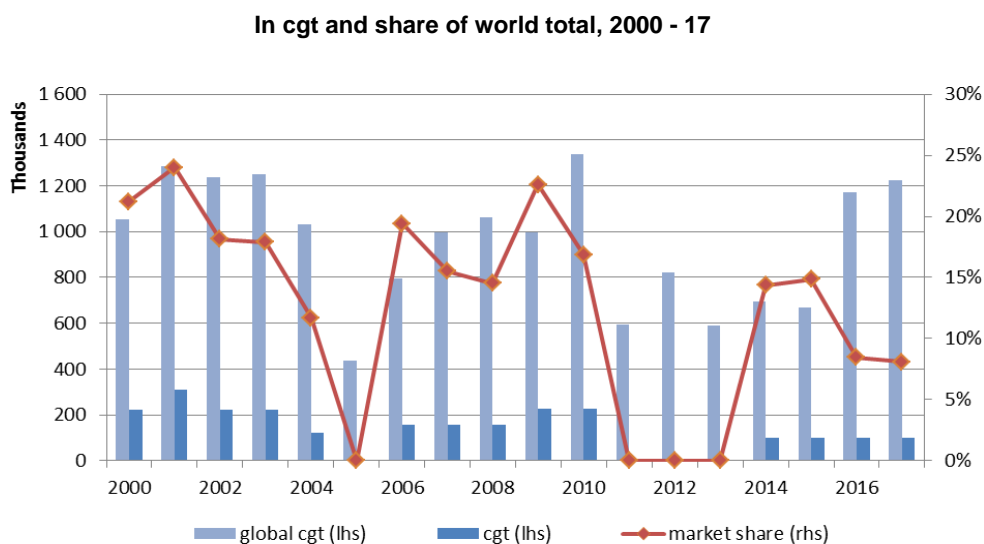
Ship type	World			Finland				
	#*	cgt (in 1000s)	gt (in 1000s)	#	cgt (in 1000s)	in % of total	gt (in 1000s)	in % of total
Cruise Ship	98	17 481	16 874	8	2 345	13.4%	2 501	14.8%
Pass./Car Ferry	313	5 549	4 728	14	527	9.5%	582	12.3%
PSV/Supply 4 000 DWT+	373	4 009	2 034	3	36	0.9%	23	1.1%
Icebreaker	7	257	222	3	32	12.3%	22	9.8%
Ro-Ro	123	2 008	2 618	1	18	0.9%	23	0.9%
Backhoe/Dipper/Grab								
Dredger	43	184	68	2	5	2.8%	1	7.5%
Oceanographic survey	20	121.9	62	1	16	13.3%	13	20.8%

Source: OECD calculations based on Clarkson's World Fleet Register, 2017.

Note : # corresponds to the number of vessels produced in the world and in Finland between 2007 and 2016

Between 2000 and 2010, cruise ship production in Finland has kept pace with that of the global market with the Finnish market share staying around 20% with the exception of 2005 when no cruise ships were delivered in Finland (Figure 1). In this decade, Finland was the 3<sup>rd</sup> largest cruise ship producer sharing the market with Italy, Germany and France. In 2011, 2012 and 2013, there was no completion of cruise ships in Finland. Completions recovered in 2014 when Meyer family and Tesi, the public Finnish investor, jointly acquired STX Finland and its shipyard in Turku.

Figure 1. Completions of cruise ships in Finland and at the global level



Source: IHS Maritime & Trade, 2017.



## FEATURES OF FINLAND'S MARINE INDUSTRY

### Overview

The Finnish marine industry encompasses ship and offshore yards, ship repair facilities, marine equipment manufacturers, turnkey suppliers, designers, software and system providers. The industry has evolved over five development waves which have made the industry as innovative and technologically advanced as it is today. Finland had already shipbuilding activities in Turku and Helsinki before World War II mainly to satisfy domestic demand and national needs. However, after World War II, Finland was required to pay war compensation to the Soviet Union, which resulted in the production of 500 different vessels built by around a dozen newly constructed shipyards over one decade. This development let Finland's marine industry grow and enabled capabilities to enter the export business.

Subsequently in the 1950s, political and trade relations between Finland and the Soviet Union had improved and led to the second wave of development where Finnish shipyards built cargo ships, river boats, tankers as well as ice breakers.

During the third wave of development which begun in 1960s, Finland built ice-going ferries operating between Finland and Sweden as well as five Urho-class icebreakers. In addition, the Soviet Union gradually shifted its orders for long series of simpler ships to its own shipyards. At the same time, ever more specialized ships, such as Ro-Ro vessels, arctic tankers and cruise ships, were ordered from Finland thanks to the special bilateral trade relationship. As a remarkable achievement in the 1980s, Finland produced nuclear ice breakers, floating fish processing plants and advanced research vessels that it delivered to the Soviet Union.

The fourth wave of development started with the collapse of the Soviet Union in the early 1990s. Finnish shipyards received orders from new customers on special vessels, such as catamarans made of aluminium and gas tankers. In addition, the Finnish government invested in multipurpose ice breakers, which required shipyards to adopt new innovative technical solutions, such as the Azimuth and the Azipod propulsion systems which are famous for their ability to save fuel and make steering easier.

In the early 2000s, more emphasis was put on research and development for energy efficiency, emission reduction technologies and alternative fuels. Significant amount of R&D work was done in cooperation among the Finnish maritime industry companies and universities as well as research institutions. The Strategic Centres for Science, Technology and Innovation (SHOKs)<sup>1</sup> - an organization of public-private partnerships with the aim to speed up the innovation process - played a major role in supporting R&D work. In 2008, the financial crisis triggered the fifth and current wave of development. Due to the financial crisis Finnish shipbuilding in particular in the area of cruise ship production had troubles receiving new orders and some orders were lost to competitors. The loss in new orders to competitors was mostly related to difficulties in receiving appropriate ship financing rather than to the competitiveness of the shipyards' products. In 2014, the German cruise ship builder family Meyer acquired 70% of the biggest Finnish shipyard, STX Finland in Turku Oy (today under the name Meyer Turku Oy), and became 100% owner in 2015, enabling the country to keep its substantial share in the cruise ship market (Meyer Werft, 2015).

Today Finland's shipbuilding focuses on three market segments: cruise and other passenger ships, Arctic vessels and technologies as well as green technologies. First, Finland achieved its leading position in cruisers and passenger ships in the first decade of the new millennium due to changes and systematic investment in passenger ship technologies. Ships under construction utilise high-level technology, and new innovations and enhanced specialisation are created within ship projects. Finland constructs some of the

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biggest and the most luxurious cruise ships such as the Oasis of the Seas, 225 000 gross tons built in Turku and delivered to Royal Caribbean in October 2009.

Second, the industry's know-how of Arctic technologies has advanced in recent years; since Finland is geographically located in the high North, its harbours can easily freeze and the country experienced harsh Arctic conditions. As Finnish trade and welfare depends on exports, the country positioned itself to be the centre of Arctic expertise with the continuous development of ice breaking and special vessels production. Today, about 60% of the world's operating ice breakers are built in Finland and the country invests continuously in knowledge building in this segment. As an example, in 2016 Arctech Helsinki Shipyard delivered the world's first LNG powered ice breaker for the Finnish Transport Agency. Furthermore, the shipbuilding industry gained many of its experience in other marine industry sectors, such as in the oil and gas sector with regards to the construction of oil platforms. Over around forty years the majority of floating, deep-sea platform hulls have been designed and constructed in Finland. Today, Finnish yards have the knowledge to incorporate also oil spill recovery features in ice breakers.

Third, green technology is an important part of the Finnish marine industry. The Sulphur Directive required the production of "greener" vessels in the SECA area including the Baltic Sea. Shipyards considered this directive also as a possibility to foster the know-how they had in clean technology. As Finland sees it as important to preserve the fragile Baltic Sea and in order to be the forerunner in green technology a state aid for environmentally vessels was introduced (see section on "Government Policy") in order to promote the usage of green technologies. To meet the Sulphur Directive targets also lead to other "green" innovations in vessels such as more energy efficient and less "noisy" hull design. New generations of dual-fuel engines using LNG led to a reduction of almost 100% of sulphur oxide and 85% of nitrogen oxide emissions. Finnish technology enables the production of lightweight, energy efficient ships as well as offshore wind farms which are becoming more and more sophisticated (FMEAE Questionnaire, 2017; Salmi-Lindgren, 2015).

Finland's marine equipment companies supply products for ships, offshore and other marine purposes. Many famous parts, such as environmentally friendly LNG fuelled engines and the most advanced and energy efficient propulsion systems are made in Finland. Finnish turn-key companies are able to deliver complete spaces for vessels, such as fully equipped kitchens, stairways, restaurants and cabin modules. Finnish design offices offer a wide variety of consulting, design, research and development services. There are also companies providing software for the design and operation of ships. In addition, they provide feasibility studies and develop optimization tools using the latest technologies.

In the system level the Finnish maritime cluster range is broad: i) medium sized engines for many vessel types, ii) propulsion equipment for icebreakers, OSVs, tugs, cruise ships iii) automation and navigation equipment for many vessel types iv) cargo handling equipment for container ships, general cargo ships, bulkers and for terminals v) accommodation and cabins and supporting systems like HVAC for cruise ships, ferries and offshore platforms vi) engineering and design for all vessel sites. Green technology remains a special niche and requires the expertise of many system providers

In addition, Finland has over forty years of experience in completing oil platforms. The majority of the floating, deep-sea oil platforms are designed and constructed in Finland. Besides, the Finnish offshore industry designs and manufactures various types of offshore supply vessels as well as equipment related to offshore wind power.

This chapter provides a more detailed picture on the industrial structure of the shipbuilding and marine equipment supply segment of the marine industry and describes generally the wider maritime industry of Finland.

## Shipbuilding industry

Structural changes in the marine industry are visible in the shipbuilding segment; before the 1970s yards used to manufacture almost everything internally. Since the 1970s supply networks began slowly to establish in particular as ships became more specialised. Thanks to these supply networks yards were able to exploit the suppliers' expertise for every ship component. Another advantage of these networks lies in the flexibility; economic changes and the volatility of orderbooks do not require changes in yard capacity thanks to this outsourcing possibility. During the following decades the supply networks became more connected, which resulted in the wide marine cluster as it is today. The ship yards collaborate today across the maritime industry and agree on the shipbuilding contract, organize the finance and take the responsibility of the whole project. Up to 80% of a large vessel is built within the yards' network. The flexibility and the skills of the network are one the assets of the Finnish marine industry (FMEAE Questionnaire, 2017).

While in 1980, the industry consisted of 13 yards with a total workforce of around 17 700 people after the restructuring phase in 2010 only five main shipyards<sup>2</sup> remained. Table 2 provides an overview of the main shipyards in Finland and their ownership structure. Many companies in the shipbuilding industry are partly or wholly owned by foreign interests. Two of the biggest new-building yards are owned by foreign interests, notably the major cruise ship producer Meyer Turku Oy is owned by Meyer familybased in Germany, and Arctech Helsinki Shipyard by Russian United Shipbuilding Corporation (USC). Arctech Helsinki has focused in recent years on the construction of ice strengthened special vessels mainly for Russian companies and ice breakers for domestic owners. The biggest repair yard, Turku Repair Yard Ltd in Naantali, is owned by Estonian BLRT Group. Smaller yards are privately owned by Finnish interests (FMEAE Questionnaire, 2017).

**Table 2. Main shipyards in Finland**

Company, location	Owned by	Field of operation	Services
Meyer Turku Oy, Turku	Family-owned company Meyer family, Germany  <u>History from 1990s - 2016:</u>  Wärtsilä Meriteollisuus - 1989 Masa-Yards - 1991 Kvaerner Masa-Yards Oy - 2004 Aker Yards 2008 STX Finland - 2014 Meyer Turku	Construction	Meyer Turku Oy specializes in building highly complex, innovative and environmentally friendly cruise ships, car-passenger ferries and special vessels. Meyer Turku Oy is one of the world's leading cruise ship builders.
Turku Repair Yard Ltd, Naantali	Owned by Estonian BLRT Group	Repair	Turku Repair Yard Ltd - one of the Northern Europe's leading ship repair facilities with the largest drydock in the Baltic area.
Uudenkaupungin Työvene Oy (UKI) Workboat, Uusikaupunki	Owned by management (MBO in 2015)	Construction	Tailor-made turn key projects, boats and vessels of steel and aluminium up to 100m for professional use.

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Rauma Marine Constructions Oy (RMC), Rauma	Partly owned by Finnish state through Tesi  <u>History from 1990s - 2016:</u>  1991 Finnyards Oy – 1998 Aker Finnyards Oy - 2004 Aker Yards Oy - 2008 STX Finland - 2014 RMC	Construction and repair	Vessels up to 260 meters in length, services including dry-docking, upgrades, conversion and repairs.
Arctech Helsinki Shipyard Inc., Helsinki	Owned by Russian United Shipbuilding Corporation (USC)  <u>History from 1990s - 2016:</u>  Wärtsilä Meriteollisuus - 1989 Masa Yards – Kvaerner Masa-Yards – Aker Finnyards – 2004 Aker Yards - 2008 STX Finland – 2010 Arctech Helsinki Shipyard (50% USC) – 2014 Arctech Helsinki Shipyard (100% USC)	Construction	Arctech Helsinki Shipyard has a focus on icebreakers and other ice-going vessels designed for arctic conditions
Oy Western Shipyard Ltd, Teijo, Salo	Owned by Finnish APX-Metalli Oy	Repair	Ship and floating construction repairs.
Technip Offshore, Finland Oy, Pori	Owned by Technip FMC plc (London, Paris, Houston)	Offshore	The yard in Pori is specialized in Spar hulls engineering and fabrication, subsea equipment delivery, offshore construction services and heavy industrial products.

Source: FMEAE Questionnaire, 2017.

The construction and repair yard Rauma Marine Constructions Oy (RMC) was established after the closure of STX in 2014. The closure was the result of the financial crisis which pushed down the ferry business which has been STX's focus at that time. In this transaction, the city of Rauma bought land and sea area as well as tooling for a total of EUR 18.9 million while the company's intellectual property rights (IPR) stayed with STX which subsequently sold it to Meyer family in Germany. Tesi, the state-owned investment firm, was involved in the transaction and holds an ownership share of 17.8% as of January 2016 (Table 3). The company leases land for the next 30 years from the city but bought back the automated welding lines. In addition to its specialization into passenger ferries, of which the company has one 15 000 gt vessel on order for Mols-Linien A/S in June 2018, RMC showed its reorientation capabilities into other areas in previous projects, such as trains (front shape design of Pendolino fast train) and floating structures (Beach Platform for Admares for the BurjAl-Arab Terrace project in Dubai) (Presentation by RMC during the OECD peer review mission, June 2017).

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**Table 3. Ownership structure in RMC**

as of January 1, 2016

Shareholders	# of shares	ownership %
Taaleritehdas Fund	28 570	21.3
Tesi (Teollisuussijoitus)*	23 809	17.8
Olderman Ltd	20 000	14.9
Satu Invest Ltd	20 000	14.9
Finda Ltd	19 047	14.2
Kasvattajarahasto Ky**	12 142	9.1
Aksoni Ltd	10 000	7.5
Harri Putro	250	0.2
<b>Total</b>	<b>133 818</b>	<b>100%</b>

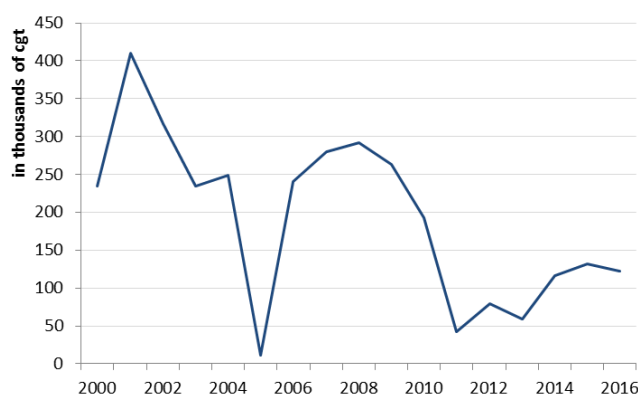
Note: \* Industry investment via state-owned investment company \*\* Local Development Fund.

Source: RMC presentation, 2017.

### *Production and orders*

While Finland's production reached 400 000 cgt in 2001 it dropped to around 11 000 cgt in 2005 with the delivery of only one offshore supply vessel. According to Finnish Marine Industry this drop in deliveries in 2005 can be explained by the takeover of Aker by Kvaerner and the changes in the organization structure of the Helsinki and Turku shipyards. In addition the global cruise market and Baltic ferry market were very weak since the early 2000s. Although the industry recovered and delivered mainly cruise ships and passenger vessels the demand dropped following the economic crisis at the end of 2008. In 2016, the industry recovered slowly to a completion level of 12 000 cgt (Figure 2).

**Figure 2. Completions of vessels built in Finland, 2000-16**



Note: Major ship types produced since 2000 were cruise ships, passenger vessels, offshore supply vessels and icebreakers.

Source: Clarkson World Fleet Register, 2017.

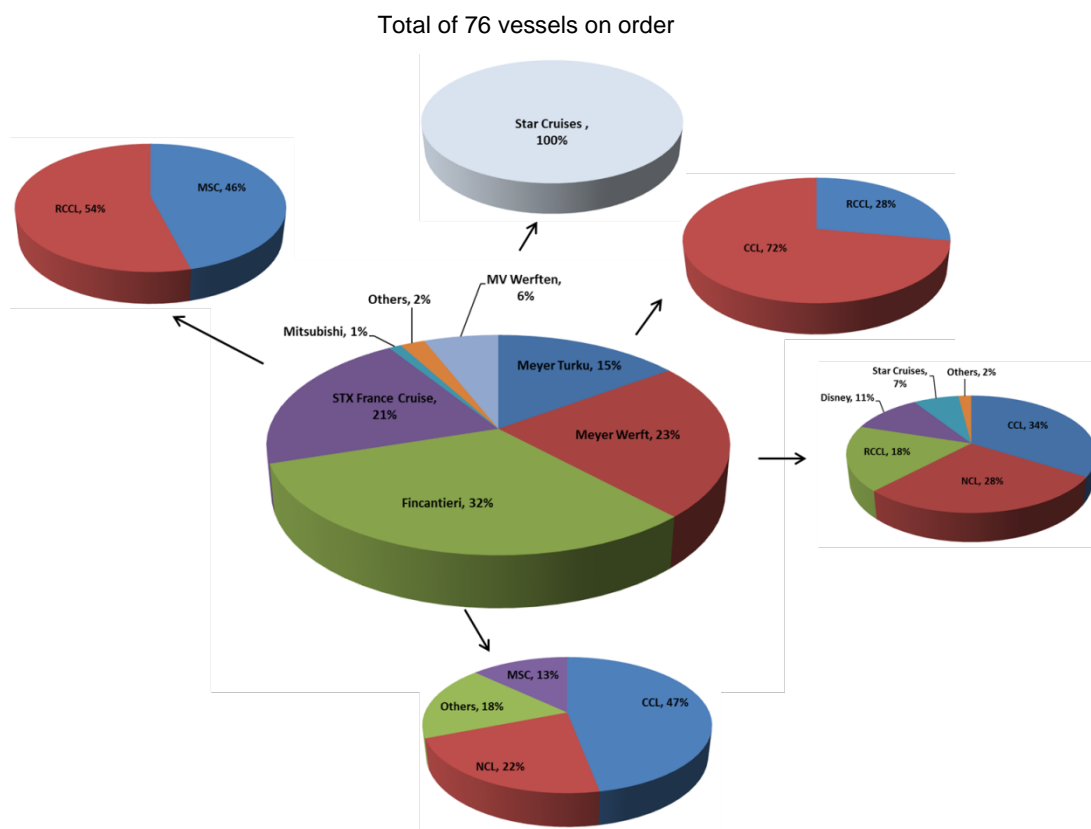
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The Finnish marine industry covers all steps from design and planning to vessel construction. The yards' specialisation and expertise lie in the construction of cruise ships, car passenger and cruise ferries, ice breakers and ice sailing vessels as well as corresponding conversion and repair works – sectors which are currently expanding. (Kauppalehti, May 2017).

Between 2015 and 2016, clients ordered 111 passenger ships and 24 special vessels and ice breakers. In this market segment, RMC is currently building a passenger ferry of 15 000 GT for the Danish shipping company Mols-Linien and plans to build military vessels for the Finnish navy.

In 2015 and 2016, the number of orders for large cruise ships almost doubled at the global level from 47 to 85 ships (FSME, 2017), and in April 2017 the global order book for cruise ships amounted to 76 vessels, including 9 vessels in Meyer Turku's orderbook (representing around 1.5 million gt, see Table 4) a market share of around 15% of global cruise ship orders. The company's customers are foreign cruise ship liners, notably Carnival Cruise Lines (CCL) accounting for 2/3 of Meyer Turku's order book and Royal Caribbean Cruise Lines (RCCL) with around 1/3 (Figure 3). Meyer Werft in Germany holds approximately one fourth of global cruise ship orders in the same year and shows a more diversified customer base with CCL, RCCL, Norwegian Cruise Lines (NCL), Disney and Star Cruises. Fincantieri based in Italy accounts for around 1/3 of the number of vessels on order in 2017 and STX France cruise 21%.

Figure 3. Cruise ship orderbook, April 2017



Note: more information on the cruise ship fleet and total orders of cruise ships in annex II.

Sources: Clarkson Research, IHS Lloyd's Register, Meyer Turku.

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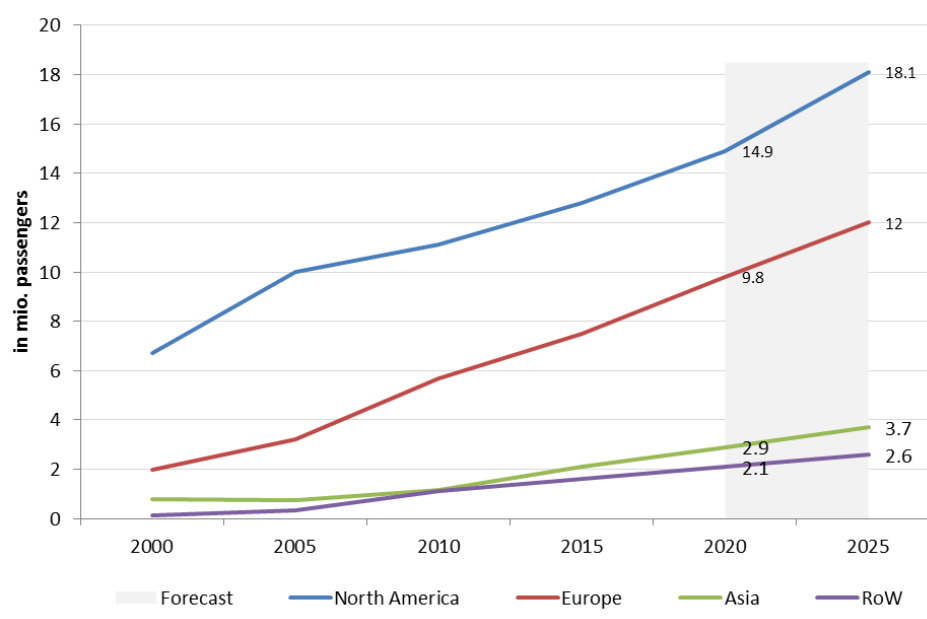
**Table 4. Cruise ship and passenger ship orders as of April 2017**

Shipbuilder	Ship Type	Size in GT	Operators	Expected delivery date
		99 500	Tui Cruises	May 2017
		111 250	Tui Cruises	Apr 2018
		111 250	Tui Cruises	Jan 2019
		183 200	Costa Crociere	Oct 2019
Meyer Turku	Cruise vessels	193 200	Costa Crociere	2021
		180 000	Carnival	2020
		180 000	Carnival	2022
		200 000	Royal Caribbean	2022
		200 000	Royal Caribbean	2024

Source: FMAE Questionnaire, 2017; Meyer Turku.

Finnish marine cluster companies and maritime consultancy experts, such as Ocean Shipping Consultants, expect an upward trend in the cruise ship market in the coming years with steady growth expected in the North American, European and Asian regions (Figure 4). Meyer Turku Yard has an investment plan reaching up to 2019 taking into account the positive outlook on the cruise ship market (FMAE Questionnaire, 2017).

**Figure 4. Passenger growth, 2000-2025**



Sources: CLIA/Ocean Shipping Consultants; Meyer Turku.

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Overall, Finnish yards are very dependent on the global market given the relatively small size of Finland's domestic market and the fact that only special vessels are ordered by domestic operators, such as ice breakers and military ships. Special vessels purchased by Finnish owners are mainly built domestically given the sophisticated knowledge required to design these special vessels such as ice breakers (FMEAE Questionnaire, 2017).

### Marine supply industry

Finland's marine supply industry plays an important role as it provides Finnish shipbuilders with equipment, systems, turn key areas and other solutions representing around 80% of the final production value. Table 5 provides examples of the main marine supply companies in Finland.

**Table 5. Examples of marine supply companies in Finland**

Company, location	Field of business	Facts
ABB Group - Marine & Ports	Marine and ports business; marine technology	<p><b>Finland operations:</b></p> <ul style="list-style-type: none"> <li>About 600 employees,</li> <li>market responsibilities in passenger, dry cargo and ice-breaking vessels whereof current business is largely based on cruise vessels and ice going vessels,</li> <li>global product responsibilities in propulsion solutions, digital solutions, service development,</li> <li>own production in Azipod® propulsion units,</li> <li>about 85 % direct export, about 90-95 % when including indirect exports.</li> </ul>
Rolls Royce Marin	Marine supply	<ul style="list-style-type: none"> <li>570 employees in Rolls Royce Finland (Rauma, Kokkola, Turku),</li> <li>production of a wide range of mechanical azimuth thrusters for use on various applications, including semi-submersible drilling rigs and drill ships, tugs, and offshore vessels and for specialist vessels such as icebreakers and polar research ships,</li> <li>R&amp;D on artificial (ship) intelligence in remote and autonomous shipping operations. Expectation of a reduction in transport costs by around 22% thanks to unmanned navigations as manning makes up with 38% a high share of costs. In addition, this new technology likely reduces emissions compared to standard manned tugs by ~45% in CO<sub>2</sub>, ~62% in NO<sub>x</sub> and ~89% of particulates,</li> <li>recent establishment of an R&amp;D centre for remote controlled and autonomous ships in Finland with a significant share of EUR 230 mio investment,</li> </ul>
Wärtsilä	Technology supply for marine and energy markets; consulting services	<ul style="list-style-type: none"> <li>~18 000 employees.</li> <li>~EUR 5 bn turnover in 2016 of which around 50% comes from marine industry.</li> <li>Wärtsilä focuses on efficiency, environmental solutions and fuel flexibility, among others through digitalization and smart technologies.</li> </ul>
Aker Arctic	Technology design	<ul style="list-style-type: none"> <li>Ship design and engineering, consulting and project development, ice model and full scale testing in company's ice laboratory, ice simulator and training, offshore development,</li> <li>~EUR 14.1 mio turnover in 2015,</li> <li>highest exposure of revenues to the People's Republic of China (hereafter "China") during 2014 and 2016.</li> </ul>



## PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

Cargotec, MacGregor Kaarina	Marine equipment	<ul style="list-style-type: none"> <li>• ~150 employees in Kaarina, Finland; ~2000 employees globally,</li> <li>• ~ EUR 780 million turnover in 2016, comes from ship yards and owners globally,</li> <li>• MacGregor provides integrated cargo handling solutions, equipment and services for merchant ships; as well as a broad portfolio of solutions, equipment and services for offshore support vessels, including rigs, fishery and oceanographic research,</li> <li>• Cargotec is one of the founding partners in the 'One Sea – Autonomous Maritime Ecosystem' a joint industry development project with the objective to enable fully remote controlled vessels in the Baltic Sea in three years and to achieve autonomous commercial maritime traffic by 2025.</li> </ul>
Cargotec, Kalmar	Cargo handling equipment for ports and terminals	<ul style="list-style-type: none"> <li>• EUR 1 687 million of sales in 2016,</li> <li>• ~5 700 employees in 2016,</li> <li>• global presence in 30 countries in 2016.</li> </ul>
Marioff Corporation Oy	Fire protection, a global leader and innovator of high pressure water mist fire protection technology	<ul style="list-style-type: none"> <li>• Turnover EUR 90 million,</li> <li>• ~ 300 employees.</li> </ul>
Elomatic	Technical consulting, engineering, project management, product and service development, turnkey deliveries, products and solutions, software development.	<ul style="list-style-type: none"> <li>• Turnover EUR 55 million in 2016.</li> </ul>
Deltamarin Ltd.	Ship design, offshore engineering and construction services for marine and offshore industries worldwide	<ul style="list-style-type: none"> <li>• Turnover EUR 36 million in 2015,</li> <li>• ~ 400 employees (incl. from associated companies).</li> </ul>

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Foreship	Ship design and engineering.	<ul style="list-style-type: none"> <li>• ~70 employees in 2016,</li> <li>• revenue more than EUR 10 million in 2016.</li> </ul>
Evac Oy	Integrated waste-, wastewater-, and water management systems for the marine, offshore, and building industries.	<ul style="list-style-type: none"> <li>• Turnover EUR 101 million in 2016,</li> <li>• 200 employees in 2016.</li> </ul>
Koja Oy	HVAC systems	<ul style="list-style-type: none"> <li>• Turnover EUR 61 million in 2016,</li> <li>• 250 employees in 2016.</li> </ul>
Almaco Group Oy	Builds and modernizes Accommodation and Food Handling areas for owners and builders in the Marine and Offshore industries around the world.	<ul style="list-style-type: none"> <li>• Turnover EUR 63 million in 2016,</li> <li>• 70 employees in 2016.</li> </ul>
Steerprop Ltd.	Azimuth Propulsors to the global maritime market.	<ul style="list-style-type: none"> <li>• Turnover EUR 33 million in 2016,</li> <li>• 54 employees in 2016.</li> </ul>
Protacon	Technology provider for marine and energy industries and pulp & paper industry. Consulting, engineering, innovative solutions as well as turn key supplies. Digitalization and hybridizations.	<ul style="list-style-type: none"> <li>• Turnover EUR 21 million in 2016,</li> <li>• 250 employees in 2016.</li> </ul>

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Valmet Oyj	Development and supply of technologies, automation and services for the pulp, paper and energy industries. For the Marine sector Valmet provides Automation and Scrubbers	<ul style="list-style-type: none"> <li>In 2016 ~12 000 employees globally and net sales EUR 2 926 million.</li> </ul>
Norsepower Oy Ltd	Design and delivery of Rotor Sail technology for auxiliary wind propulsion of ships.	<ul style="list-style-type: none"> <li>10 employees,</li> <li>established in 2012,</li> <li>approx. EUR 1 million revenue forecast for 2017,</li> <li>Norsepower's Rotor Sails reduce fuel consumption and emissions from ships by producing thrust from wind and reducing the power requirement of the main propulsion system,</li> <li>current orders include Rotor Sail units to be installed on Viking Line's cruise ferry M/S Viking Grace and an oil products tanker owned by Maersk.</li> </ul>
Merima Ltd.	Provides passenger and cruise ship interiors as turnkey deliveries.	<ul style="list-style-type: none"> <li>Turnover EUR 60 million in 2016,</li> <li>82 employees in 2016.</li> </ul>
NIT Naval Interior Team Ltd.	Turnkey projects. Construction of passenger ships, offshore and onshore construction projects especially interior installations, insulation, electrical installation, piping and HVAC.	<ul style="list-style-type: none"> <li>Turnover EUR 77 million in 2016,</li> <li>50 employees in 2015.</li> </ul>
Joptek Oy Composites	Designs and manufactures Wet-Unit-structures of composites materials.	<ul style="list-style-type: none"> <li>Turnover EUR 10 million in 2016,</li> <li>70 employees in 2015.</li> </ul>

*Note:* The number of marine industry companies is about 870 and the number of employees 28 600 (Karvonen et al., 2016).

*Source:* Company presentations during OECD mission to Finland, June 2017.

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Finland's marine equipment suppliers consider that digitalization is a major area for maritime activities in the future, encompassing digital services, power and propulsion automation, software and analytics and vessel control for environmentally-friendly and energy efficient maritime solutions and intelligent shipping. Finland coordinated input to support autonomous ships in IMO MSC 98 meeting. Finland urged IMO to include autonomous ships on IMO strategy already in 2015. The IMO Maritime Safety Committee (MSC) urged in March 2017 Member States and organizations to submit any information and studies on autonomous shipping that enables IMO and experts to fully evaluate and understand the developments in this new technological field (IMO MSC\98\MSC 98-22-7).

### Financial performance

As of 2015, around 867 firms operate in Finland's marine industry and generate about EUR 8 billion turnover, of which approximately EUR 1 billion (12.5%) for shipbuilding including supply provided by marine equipment industry. Within the maritime cluster the marine industry accounts for almost two thirds of turnover while the remaining third comes from shipping companies, port activities and other activities serving the maritime cluster. The total maritime cluster, encompassing the marine industry, shipping companies, port activities and some other activities serving the cluster, made up a total of almost EUR 13 billion in 2015 (Table 6). Although the marine industry experienced a slump in turnover in 2008 following the global recession it has been showing signs of recovery since 2011 with positive growth rates (Figure 5).

**Table 6. Number of enterprises and turnover in the Finnish maritime cluster in 2015**

	<b>Number of enterprises</b>	<b>Turnover (in 1 000 EUR)</b>
Marine industry	867	8 061 300
Shipping companies	252	3 405 600
Port activities	250	1 216 800
Other activities serving the maritime cluster	164	307 400
<b>Total</b>	<b>1 533</b>	<b>12 991 100</b>

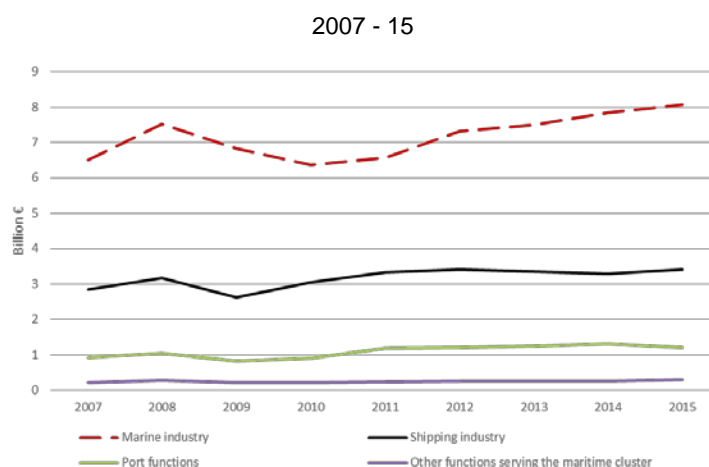
*Notes:* The results are based on a survey of 1 533 companies operating in the maritime sector, which has been conducted by the University of Turku in 2016. Although the university estimates a total of 3 000 companies in this sector this sample covers around 90% of the population as the remaining 1 467 companies are mainly small firms or individual entrepreneurs. Therefore, the results are considered to provide a reasonable presentation of the Finnish maritime industry.

Marine industry encompasses marine equipment manufacturers, turnkey suppliers, designers, software and system providers, shipbuilding, ship repair, offshore yards.

*Source:* Karvonen et al.(2016).

A survey conducted by the University of Turku in 2016 focused on the financial performance of 1 533 companies in Finland's maritime industry. The study's results reveal that the marine industry had the lowest value added per personnel costs between 2007 and 2014 across the four main maritime cluster segments (i.e. port functions, shipping industry and others) with a median value added per personnel costs of EUR 1.23 across all surveyed companies in 2014.

**Figure 5. Turnover of the Finnish maritime cluster and its subgroups**

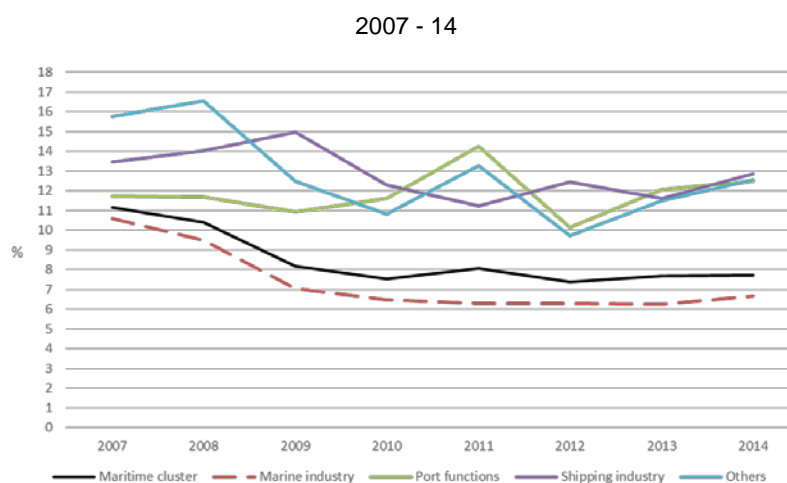


Note: Figures are based on accounts and inquiries.

Source: Karvonen et al.(2016).

Results on gross margins show a similar picture where the marine industry reported the lowest median of gross margins during 2007 and 2014 (years for which data was available) in comparison to port activities and shipping industry. In general, the marine industry's financial performance in this context has been below the one of the entire maritime industry cluster (including shipping, port functions, etc.) at least over the last seven years (Figure 6). The most recent profitability figures (as of 2014) show that the marine industry generated 6.7% in gross margins (median of 1 533 surveyed firms).

**Figure 6. Median gross margin of surveyed companies**

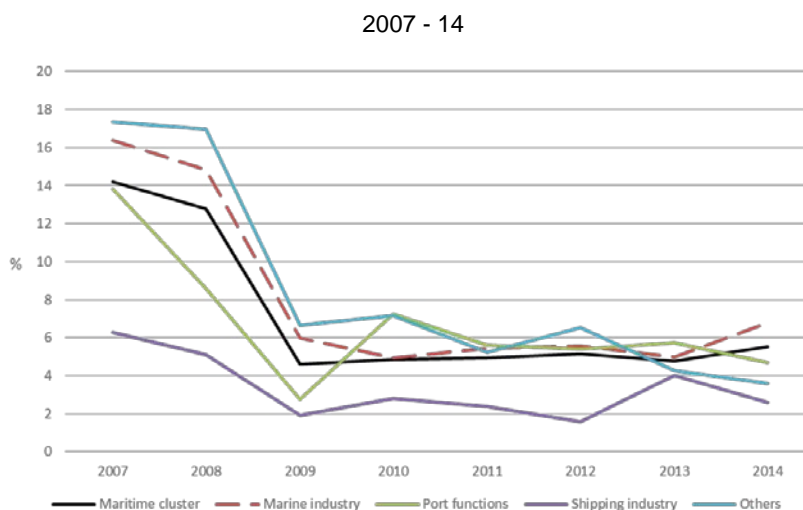


Note: Figures are based on accounts and inquiries of 1 533 firms.

Source: Karvonen et al. (2016).

Although return on investment of surveyed companies (median) has been above the median of the total maritime industry between 2007 and 2014, the marine industry faced a decline in investment profitability by almost 10 percentage points from 16.4% in 2007 to 6.8% in 2014 (Figure 7).

**Figure 7. Median Return on Investment (ROI) of surveyed companies**



Note: Figures are based on accounts and inquiries of 1 533 firms.

Source: Karvonen et al.(2016).

### Employment and Education

The Finnish marine industry employed around 28 800 workers in 2015 which represented approximately 2% of the country's total workforce and 60% of the maritime cluster. Within the marine industry ship yards made up about 10% with 2 800 workers employed (Table 7).

**Table 7. Employment in the Finnish maritime cluster in 2015**

	Employment
Marine industry [Shipbuilding]	28 800 [2 800]
Shipping companies	11 900
Port activities	6 400
Other activities serving the maritime cluster	1 600
<b>Total</b>	<b>48 700</b>

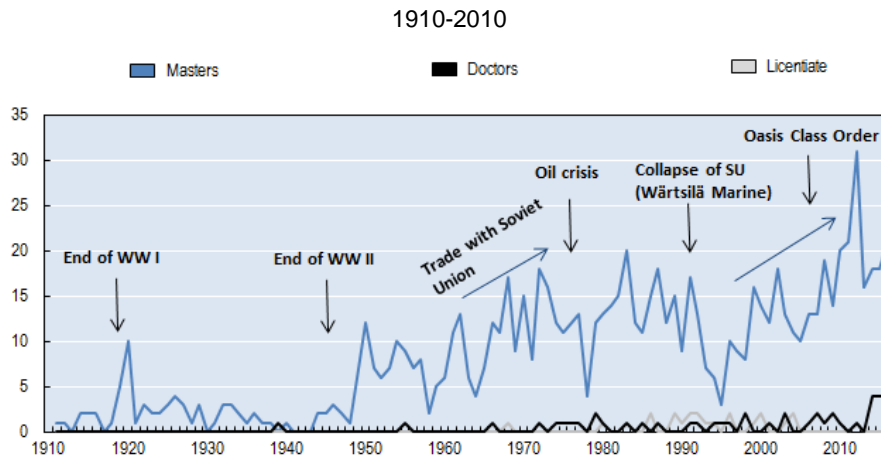
Note: Marine industry encompasses: marine equipment manufacturers, turnkey suppliers, designers, software and system providers, shipbuilding, ship repair, offshore yards.

Source: Karvonen et al. (2016).

Average labour costs per hour in Finland for the whole economy (excluding agriculture and public administration) amounted to EUR 33.2 in 2016 around 10% higher than in the EU-28 with around EUR 29.8 per hour and higher than in the euro area with EUR 25.4 per hour (EC, 2017).<sup>3</sup>

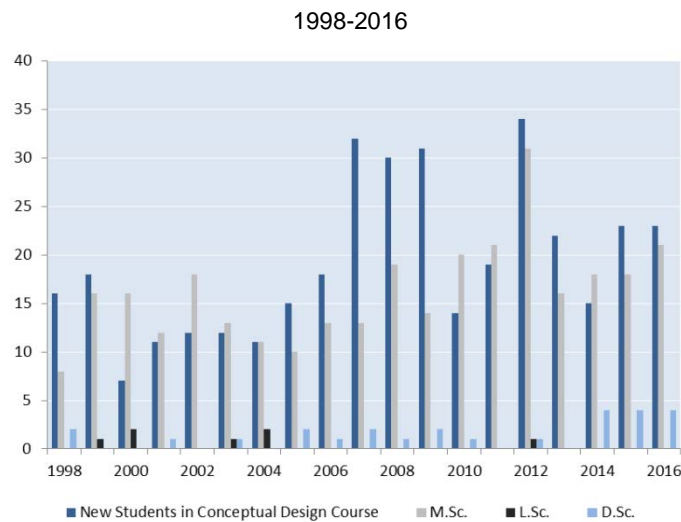
Thanks to Finland's engineering universities specialized in the maritime field, such as Aalto University with its programme to educate naval architects the industry can relatively easily source qualified labour. The Department of Mechanical Engineering at Aalto University - School of Engineering – offers studies in Marine Technology that are applied to the challenges the maritime industry faces. For instance, the university's towing tank, manoeuvring tank and ice tank enables to test their research on real-life conditions.

**Figure 8. Graduated Naval Architects**



Source: Aalto University.

**Figure 9. New and Graduated students**



Note: While in 2013 around one third of graduate students were foreign students the share dropped to about 12% in 2016.

Source: Aalto University

Still in recent years Finland's maritime industry faced challenges to find qualified labour in the sense that students did not register or dropped out once economic conditions in the marine industry deteriorate, as depicted in figure 8 and 9 showing the volatility in the number of graduate and new students at Aalto

## PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

university over the last one hundred years. For instance, following the oil crisis in the 1970s the number of students dropped by 2/3.

To reduce the number of students who do not finish their graduate studies, Aalto University included in its programme an international mobility programme which enables students to study abroad and in other engineering fields. In addition, the university supports their students throughout their academic path to get working experience as early as possible, such as by writing their dissertation on projects within the company. These possibilities enable graduate students to enter more easily the job market and re-orient into other fields if necessary (source: interviews during the peer review mission with a representative from Aalto University). Table 8 shows the first workplace of graduate students at Aalto University between 2005 and 2016, indicating that more than half of the university's graduate students started their working life in the maritime industry and their equipment supplier sector.

**Table 8. First workplace of naval architects, 2005-16**

<b>Company</b>	<b>Number of students</b>	<b>Company</b>	<b>Number of students</b>
Deltamarin Ltd	23	Surma	2
Napa	19	Almaco	2
Arctech Helsinki	17	Neste	2
Meyer Turku	13	VTT	2
Foreship	11	RCCL	2
Aalto	11	SYKE	1
Aker Arctic	10	Onnetomuustutkinta	1
Wärtsilä	8	Finstaship	1
ABB	6	ILS	1
Elomatic	6	Eniram (a Wärtsilä company)	1
DNV	4	Technip	1
RMC, Rauma	4	Sandvik	1
Merivoimat	3	Lloyds	1
Marioff	2	A&W Energy	1

*Note:* 24 students in category "Others".

*Source:* Aalto University.



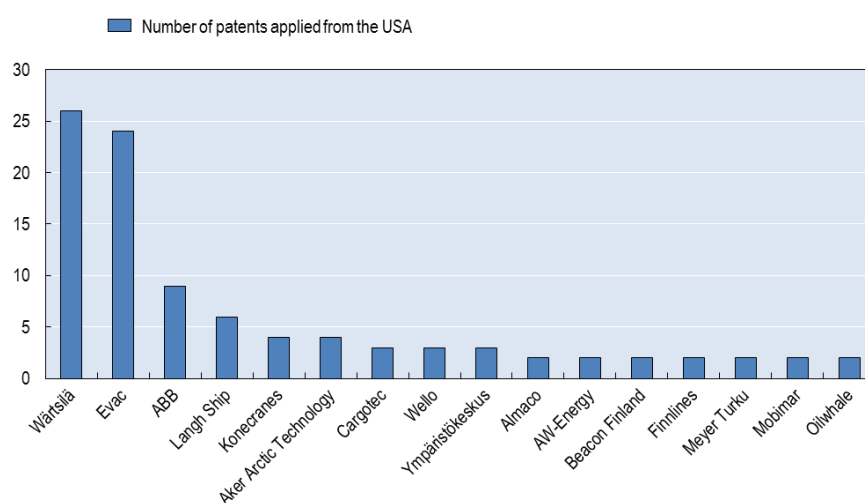
## Technology and Research, Development and Innovation

Finland's maritime industry managed to maintain its international competitiveness thanks to its capability to innovate and develop new solutions which have then sometimes been adopted widely in the international maritime sector. For instance, Oy NIT Naval Interior Team Ltd. developed innovative interior solutions for cruise ships and ferries and Mobimars for instance for entertaining solutions such as on-ship slides or skydiving simulators<sup>4</sup>. Technip Pori invented SPARplatforms for the production and processing of oil or gas. Norsepower has developed Rotor Sail technology, which is a modernised Flettner rotor, for reducing fuel consumption and emissions of ships.

Between 2000 and 2014, 24 companies in the Finnish marine cluster applied for a total of 102 patents in the USA, including 8 applying for one patent only. The majority of patents were registered from marine supply companies. The marine equipment company Wärtsilä applied for 26 patents in the US within these 15 years and is one large company in advanced technologies and lifecycle solutions of the marine and energy markets. Shipbuilding companies Meyer Turku yard and Mobimar applied for patents in the US (Figure 10). Information on patenting as of 2016 reveals that Rolls-Royce applied for 9 patents and increased its patenting activity further in 2017. Please see annex for information on patenting activity of Finnish maritime companies at the European Patent Office (EPO).

**Figure 10. Number of patents applied from the USA between 2000 and 2014**

including shipping companies



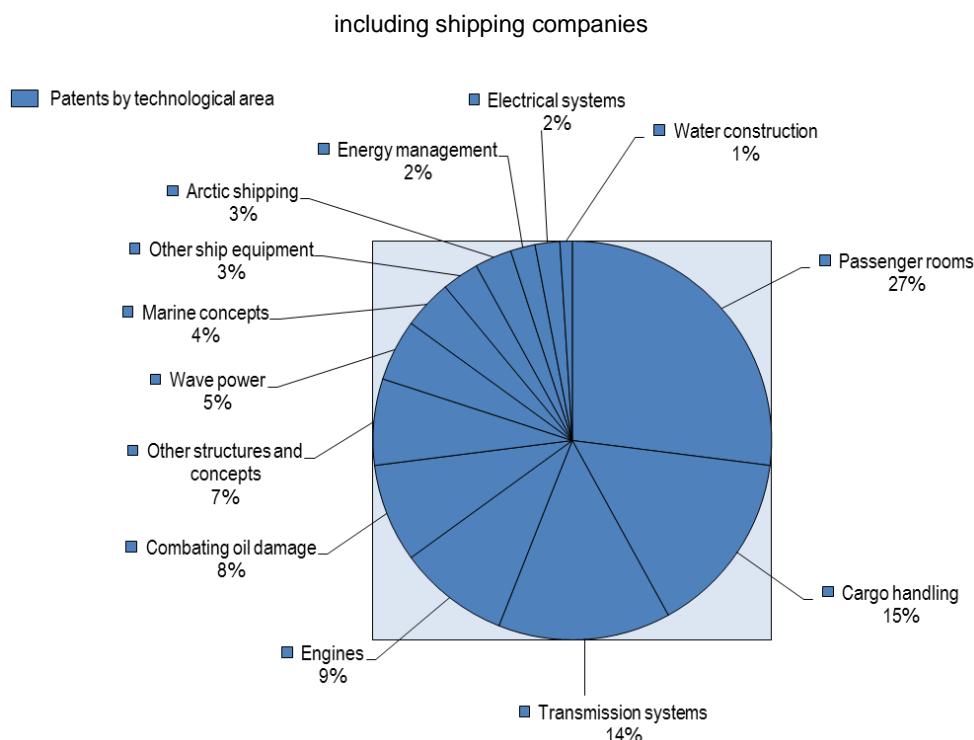
Note: Data includes only companies which have applied for more than one patent.

Marine supply companies: Wärtsilä, Evac, ABB, Konecranes, Aker Arctic Technology, Cargotec, Almaco, AW-Energy; Shipping companies: Langh Ship and Finnlines; Consulting services from Beacon Finland; Shipbuilding: Mobimar and Meyer Turku.

Source: FMEAE Questionnaire, 2017 based on US Patent and Trademark Office [www.uspto.gov](http://www.uspto.gov)

Two thirds of patent applications between 2000 and 2014 are related to passenger rooms (27%), cargo handling (15%), transmission systems (14%) and engines (9%) (Figure 11).

**Figure 11. Distribution of patents in the USA by technological area applied between 2000 and 2014**



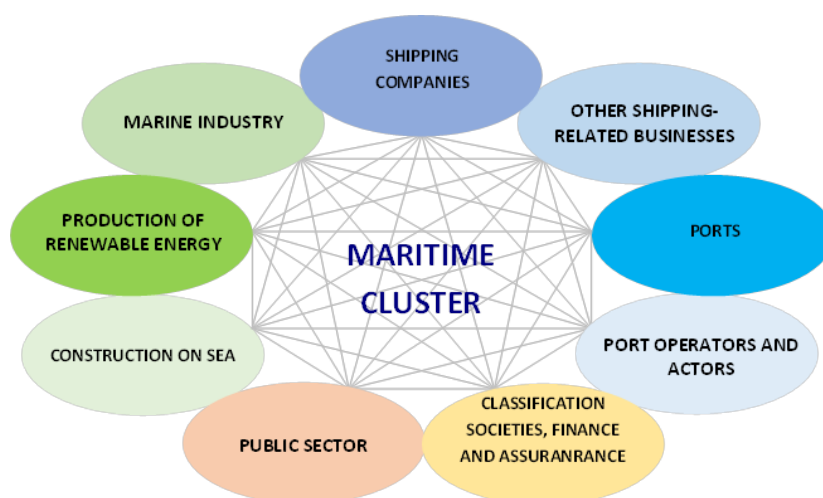
Source: FMEAE Questionnaire, 2017 based on US Patent and Trademark Office [www.uspto.gov](http://www.uspto.gov).

### Maritime Cluster

The Finnish marine industry is part of Finland's maritime cluster which encompasses several segments, such as shipping companies, ports and port operators and classification societies (Figure 12). This cluster is structured in a cooperative way rather than being an established and stable entity. It includes competitors (horizontal relations), companies downstream or upstream in the value chain (vertical relations) of the maritime industry, as well as public sector actors (e.g. research, education and regulation). Communication is often informal but, for instance, the Finnish Ministry of Transport and Communications has a more formal advisory board on marine transports. Different organisations have their regular meetings and arrange also open seminars and meetings for all interested companies. In addition, temporary working groups can be established with relevant participants on actual issues of interest. In 2015, the Finnish maritime cluster consisted of about 3 000 companies operating in various maritime businesses.

In this millennium fast internationalisation of system providers have become more important in the total cluster. Finnish companies have expanded by organic growth and by mergers. With respect to outward investments, a trend arose with Finnish maritime companies having established units in Far East, such as of Wärtsilä and Cargotec. The cluster acquired new customer contacts and led to the development of new technologies since many of the innovations are more and more developed jointly with clients and other companies in a co-creation process. The maritime cluster benefits also from spill-over-effects from other clusters in terms of experience and knowledge, in particular from the energy cluster and a significant number of start-up companies which are internationally orientated, so-called “born-global” over the last 5 to 10 years (FMEAE Questionnaire, 2017).

Figure 12. The Finnish maritime cluster

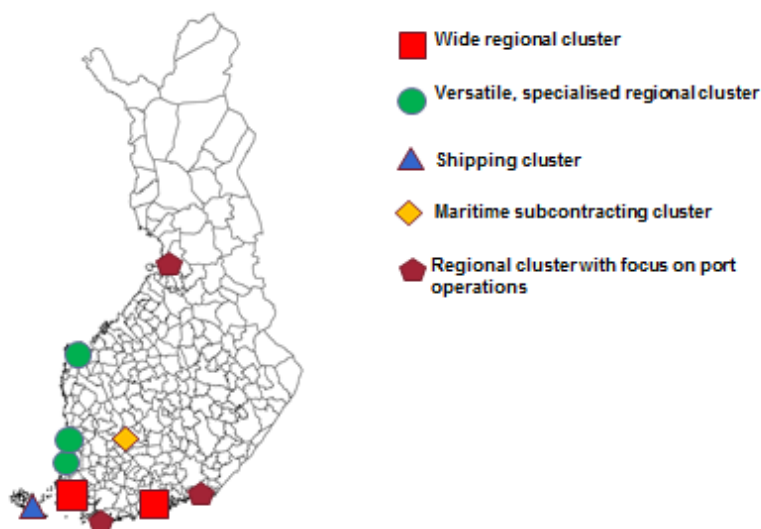


Note: The Finnish maritime cluster studies do not include fishing, travelling and leisure time boating.

Sources: Karvonen et al. (2016); FMEAE Questionnaire, 2017.

There are maritime industry companies throughout the country. As Figure 13 shows the most important regional maritime clusters are located in the south and lower west of Finland. While wide regional clusters, shipping clusters and port operation clusters are mostly located in the south, the versatile, specialized regional clusters are presented in the west of the country.

Figure 13. Selected regional maritime clusters in Finland



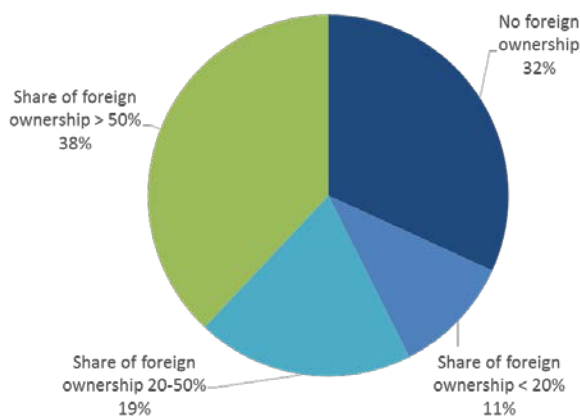
Sources: Karvonen et al. (2016); FMEAE Questionnaire, 2017.

Turku University's analysis of 1 500 limited companies belonging to maritime clusters shows that these companies' total turnover related to maritime activities amounted to around EUR 12.9 billion and

value added to about EUR 3.8 billion in 2015. They employed approximately 48 700 people in the same year (FMEAE Questionnaire, 2017).

About one third of the surveyed companies in the maritime cluster have no foreign ownership and around 38% have foreign owners holding a share above 50% (Figure 14).

**Figure 14. Share of foreign ownership in the Finnish maritime cluster (As of total turnover in 2014)**



Note: calculation is based on n=1 523 companies.

Source: Karvonen et al. (2016).

## Offshore industry

The offshore industry continued to be a major industry in Finland. In 2016, total revenues of the Finnish offshore cluster amount to approximately EUR 1.2 billion, of which exports account for EUR 1.0 billion. Over 170 companies operate actively in the Finnish offshore industry (and partly the same companies operate also in other parts of the maritime industry) and the industry employs approximately 4 600 workers.

The industry has experienced a rapid growth in Finland with an annual growth rate of around 10% in 2009-2014. A prolonged period of low oil and gas prices has wiped out profits and increased uncertainty. This has led to substantial reductions in oil and gas drilling and other activities in traditional offshore business. As a consequence, total revenues of the Finnish offshore cluster fell by 24 % in 2015 and 13% in 2016, representing EUR 1.2 billion in 2016. However, a majority of the companies believe that both offshore revenues and exports will grow moderately in 2017.

To remain competitive, companies operating in the offshore sector have streamlined their business operations. However, major cuts in operating and capital costs have been made, and now companies focus more on finding growth prospects and new business opportunities. In addition, many start-ups and smaller players have developed or are developing unique technology solutions that meet previously unfulfilled customer needs. The offshore sector is evolving into a smarter and more modern industry. With squeezed margins, innovation and technological expertise is ever more seen as the key to long-term profitability.

Players in the offshore market are waiting for the price of oil to return to a level where oil and gas operation and exploration are profitable. Meanwhile, various attractive growth opportunities exist in the market. Some of the most promising opportunities emerge from automation, digitalization, offshore fish farming, and offshore accommodation. Although companies have expanded their product and service

portfolio outside traditional offshore business, developing more efficient ways of oil and gas drilling will remain important (FMEAE, 2017).<sup>5</sup>

### **Industry trends and challenges**

#### *Maritime environmental regulations*

The marine industry could benefit from changes in maritime environmental regulations as retrofitting or certain newbuilding standards are required. A study by the Finnish Transport Safety Agency (Trafi) in 2013 evaluates the costs arising from the following new maritime environmental regulations:

- Amendments to MARPOL Annex IV (sewage discharge requirements for passenger ships in the Baltic),
- revised MARPOL Annex V (bulk carrier cargo residues and food waste),
- revised MARPOL Annex VI (prevention of air pollution; more stringent standards for SO<sub>x</sub> and NO<sub>x</sub> emissions) and the new EU Sulphur Directive,
- new chapter 4 to MARPOL Annex VI (energy efficiency of ships) and
- the Ballast Water Convention

The study estimates that the investment costs imposed by all regulations for existing mid-size bulk carriers amount to around EUR 4.5 million and if Heavy fuel oil (HFO) is used as a fuel with a scrubber the costs amount to about EUR 1.5 million. For newbuilt bulk carriers the same investments are estimated to be EUR 3.2 million for HFO fuel and EUR 1.3 million for Marine gas oil (MGO).

For large existing passenger car ferries, the investment costs make up around EUR 9 million for HFO fuelled vessels and EUR 0.5 million for MGO fuelled vessels. For newbuilt passenger car ferries, the investment costs are respectively EUR 7 million for HFO and EUR 2.2 million for MGO vessels.

#### *Industry challenges*

The Finnish maritime industry is operating in a niche market with high-value added products and services, in particular with its focus on cruise and passenger ships as well as ice going vessels. However, China's government strategy "Made in China 2025" and the country's plan to enter the cruise ship market poses future challenges for the Finnish marine industry as well as other European marine industries (The Maritime Executive, 22 February 2017).

A specific challenge for Finland relates to skills. Although Finland does not presently lack of skilled workforce the country expects significant economic growth in the coming years that will require a trained workforce. To prepare accordingly for the future the country invests in educational programs. Therefore, the Finnish maritime industry aims to invest in cost efficiency using notably more digitalisation, automation and robotisation as well as innovations and strengthening of international networks to counteract a potential downturn in the industry and remain internationally competitive. In addition, the government provides support across all industries for retraining laid-off labour force and facilitate the re-employability opportunities of workers.

## GOVERNMENT POLICIES IN FINLAND'S SHIPBUILDING INDUSTRY

### Strategy for maritime sector

#### *Recommendations for the renewal of and fostering for the competitiveness of the Finnish marine industry (2013)*

In the aftermath of the financial crisis of 2008, the production in the global shipbuilding industry has significantly decreased since 2009. As the crisis also hit the Finnish shipbuilding industry, the Ministry of Economic Affairs and Employment (MEE) appointed a task force in 2013 to give recommendations for the renewal of and fostering of the competitiveness of the Finnish marine industry. The Ministry and the taskforce believed that there are promising opportunities for the Finnish shipbuilding, although the shipbuilding industry faces global over-capacity and the building of more hitch complex ships gradually shifts to lower-cost countries. The taskforce saw that the increasing activity in the Arctic (e.g. R&D) would create demand for Finnish technology and services (including shipping), as Finland has world-leading Arctic know-how. The taskforce also identified a need for a special development programme targeted to the marine industry. These two proposals of the taskforce were also executed, and two programmes were set up; the Arctic Seas and the TEM-Meri.

Arctic Seas is administrated by Tekes. TEM-Meri (2014-16) was administrated by the Ministry of Economic Affairs and Employment. The programme has been completed at the end of 2016. The primary aim of this programme was to strengthen the competitiveness of the Finnish marine industry and to spur the regeneration of the industry. One of the key elements was also the strengthening and fostering co-operation among the whole Finnish maritime cluster; that is, the marine industry, shipping industry, ports, and port operators. Some of the themes rely on co-operation between companies and research institutions, creating new business models for marine industry actors, and recognising new products, services, and markets. MEE allocated EUR 4 million to the programme and ten projects were accomplished. Projects were carried out and financing could only be granted to non-profit organisations.

#### *Maritime Transport Strategy for Finland 2014–2022*

The Maritime Transport Strategy for Finland 2014–2022 was published by the Ministry of Transport and Communications of Finland in September 2014. While the strategy mainly focuses on policies and measures for the maritime industry including shipbuilding, it also touches upon policies and measures enhancing the Finnish maritime cluster. The strategy analyses the changes that took place in the past years and the future challenges, highlighting topics including efficient transport chains that support competitiveness, green growth, Finnish expertise on sea and ice, Baltic Sea considered as a sea of opportunities, and international activities. Box 1 shows a selection of actions mentioned in each part of the Maritime Transport Strategy for Finland 2014–2022.

1. The first part, *efficient transport chains that support competitiveness*, aims to ensure that Finland's foreign trade and domestic waterborne transport are free of disruption, are cost-efficient for the national economy, and guarantee international competitiveness, particularly in the winter months when the waters of many Finnish ports are frozen. It stresses that fairway dues, even after 2017, should not be a larger burden for maritime transport than is the case at present and is not expected to threaten Finland's national competitiveness.
2. The second part, *Green growth from strong maritime cluster*, aims to ensure that Finland will become a frontrunner in environmental technologies for shipping and an exporter of leading expertise in these maritime technologies.

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3. The third part, *Finland – leading expert on sea and ice*, aims to secure sufficient numbers of experts in maritime transport and for this segment of the maritime cluster and improve awareness of the maritime transport sector along with its image and appeal.
4. The fourth part, *Baltic Sea – a sea of opportunities*, aims to ensure that the Baltic Sea will be safe and healthy, attracting recreational activities and tourism to the region and high-quality sea transport services for use within the regional market area, and that the Finnish maritime transport sector will be the Baltic Sea region's leading service provider based on sustainable logistical concepts.

The strategy also sets out a vision for maritime transport in 2030, which was determined in collaboration with the maritime transport sector and with users of its services. The goal of the strategy is to maintain competitiveness on world markets, as well as safety and the environment of the Baltic Sea, especially regarding oil spill accidents.

### **Box 1. Selected actions of the Maritime Transport Strategy for Finland 2014–2022**

#### **Efficient transport chains that support competitiveness**

- developing and maintaining a network of fairways to meet the needs of maritime transport and inland navigation as well as reviewing service levels for icebreaking
- enhancing maritime cluster cooperation by providing incentives for ports to develop their service functions, by improving the operating environment through reducing the administrative burden and by enabling greater logistical efficiency through enhancing the usability of information
- developing national service point on the basis of the existing vessel traffic data management system, which will reduce the administrative burden on businesses

#### **Green growth from strong maritime cluster**

- improving financing opportunities for vessel investments in order that a sufficient number of vessels can be modernised and replaced, and opportunities for new financing arrangements will be investigated, also taking into account the opportunities offered by the European Investment Bank and the Nordic Investment Bank
- making efforts to advance the development and take up of alternative fuel solutions based on the LNG Action Plan for Shipping 2013–2017 as well as seeking an increase in Finnish clean technology ('cleantech') project start-ups and in their financing and marketing

#### **Finland – leading expert on sea and ice**

- giving support for implementation of the measures concerning training, research and expertise in the maritime cluster
- strengthening the operating preconditions for Finland's Arctic maritime industry and shipping company operations based on the measures proposed in Finland's Strategy for the Arctic Region concerning training, research, business and international cooperation

#### **Baltic Sea – a sea of opportunities**

- seeking international regulation through IMO in the environmental regulation of maritime transport as well as acting responsibly within the EU and in accordance with international commitments to improve the state of the Baltic Sea to a good level by 2020

## PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

- securing the safety and convenience of maritime transport as well as minimizing its environmental effects through national and cross-border cooperation

### **International activities**

- having a pro-active and resolute approach to influencing the handling of environmental and safety matters within the IMO, the EU and HELCOM
- strengthening bilateral international cooperation and public and private partnerships especially with the Nordic countries and Russia

### *Significant expected changes in government support measures*

In April 2017, the Minister of Economic Affairs commissioned a report to investigate the means to enhance and support the positive economic development in the southwest of Finland, notably regarding the needs of the maritime industry. A report on Structural Change in Southwest Finland was published in June 2017. The report concluded that long term investments are needed in infrastructure, to enhance mobility of regionally and between professions, and resources for education and research to be able to benefit from the growth potential exist currently the south-west of Finland. The report also suggests making an agreement between the local stakeholders (Regional Councils, municipalities, ELY-Centers, Companies, other relevant parties) and the central government, which should include concrete activities related to:

- improved balance of demand and supply of labour
- accessibility; transport infrastructure for extended supply chains and mobility of labour
- education and skills (focus on engineering)
- research and development - secure knowledge capital (especially in technologies)
- marketing of possibilities in the region
- actions to improve data base on the developments of the regional economy

### **Support measures**

The Finnish government has implemented several support measures based on “The recommendations for the renewal of and fostering for the competitiveness of the Finnish marine industry” and “Maritime Transport Strategy for Finland 2014–2022” launched in 2016.

This section provides an overview of these traditional and new support measures based on reports by the Finnish government and other institutions, including the measures reported in the WP6 Inventory of support measures to the shipbuilding industry update (OECD internal document), as well as other measures reported by the Finnish authorities in the context of the Peer Review. Table 9 shows an overview of the support measures implemented and to be implemented by the Finnish government. Many of these are not only aimed to marine industry, but are applicable to all enterprises. Of those, selected measures are assessed in the succeeding section.



**Table 9. Support measures available for the shipbuilding industry**

	Authority/agency	Start year	End year	Inventory report
Export and domestic credit - pre-delivery financing	Finnvera		On going	Reported
Export and domestic credit - post-delivery financing	FEC loans guaranteed by Finnvera		On going	Reported
Equity investment to the shipyards	Finnish Industry Investment	2015	On going	Reported
Innovation aid	The Ministry of Economic Affairs and Employment	2008	On going	Reported
Arctic Seas Programme	Tekes	2014	2017	Not reported*
Maritime and Offshore from Finland initiative	Finpro and Team Finland	2014	On going	Not reported
Investment aid for retrofitting operations to vessels currently in use	Ministry of transport and communication	2010	2016	Not reported*
Investment aid scheme for environmentally friendly vessels	Ministry of transport and communication	2010	2016	Not reported*

Note; Arctic Seas Programme and Investment aid was mentioned in the presentation on “Finland’s policy initiatives on green ships” given by Mr Peltola at WP6 meeting

### ***Export and home credits***

The Finish system for export and home credits is based on two separate export credit agencies (ECAs); Finnvera and its wholly owned subsidiary Finnish Export Credit (FEC). While FEC offers loans guaranteed by Finnvera to buyers of goods and services from Finnish exporters, Finnvera offers guarantees for loans offered by Finnish Export Credit, banks and other providers.

Finnvera is a specialised financing company which is 100% owned by the State of Finland and is administratively placed under the Ministry of Economic Affairs and Employment. Finnvera’s operations are steered by the relevant legislation, international agreements, and the industrial and ownership policy goals determined by the State of Finland. In practice, Finnvera promotes in particular the activities of SMEs, the exports and internationalisation of enterprises, and regional policy goals. According to Finnvera, their premiums for export guarantees are priced commercially and in accordance with the provisions for minimum premium rates set by the OECD Arrangement on Officially Supported Export Credits (Arrangement) and its Sector Understanding on Export Credits for Ships (SSU). The portfolio for Finnvera’s scheme for export credit guarantees mainly consist of guarantees to the forest industry, shipping and Telecommunications sector.

Finnish Export Credit, a company belonging to the Finnvera group, grants financing for export and ship credits based on the OECD Arrangement on Officially Supported Export Credits (hereafter the OECD Arrangement). The interest rate of the credit is either a floating rate (Euribor or USD Libor) or a fixed rate (CIRR). FEC charges a margin above the base rate chosen by the borrower. FEC charges a handling fee and a commitment fee according to its policies (Finnvera 2017).

Finnvera, together with its wholly owned subsidiary Finnish Export Credit (FEC), provides both pre-delivery financing and post-delivery financing. While the post-delivery financing is so called “buyers’ credit” of which terms and conditions are expected to be in conformity with the OECD Arrangement, the

## PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

pre-delivery financing includes bond guarantees and finance guarantees and is provided following terms and conditions indicated in Table 10.

As for pre-delivery financing, the guarantees are issued in favour of the commercial lenders, who may also approve lower risk insurance cover ratios, thus accepting higher credit risk shares to themselves. The advance payment bonds and construction loans shall expire upon the delivery of the vessel, *i.e.* to falling due and to be repaid when the vessel is ready and the off-taker becomes the owner of the vessel. At that moment, the buyer pays the remaining part of the vessel value to the shipyard. The proceeds will be used for the repayment of the construction loan. Finnvera always requires that there is a committed take-out financing in place prior to the drawdown of the construction loan.

**Table 10. Terms and conditions of pre-delivery financing**

	Loans amount	Finnvera 's risk cover
Bond guarantees for advance payments	15 – 25% of the vessel contract value	Maximum 80%
Finance guarantees for construction loans	Maximum 60% of the vessel contract value	Maximum 80%

Source: Finnvera 's presentation during Peer Review mission

As for post-delivery financing, Finnvera provides buyer credit guarantees, which are credit guarantees to the commercial lenders to cover the risk of the shipping company buying the vessel built by the Finish shipyards. The loan guaranteed by Finnvera, representing at maximum 80% of the vessel value, will receive a 95% Finnvera's risk cover.

The loans with buyer credit guarantees should be aligned with the OECD consensus rules agreed for the ship financing schemes. Ship guarantees are the guarantees in favour of the commercial lenders for the credits granted to Finnish companies engaged in shipping or shipbuilding. Issuing the aforementioned guarantees requires that the relevant credit risk assessment is done by Finnvera, ensuring the economic feasibility of the project, the shipyard or the buyer. The borrowers must also have their self-financing (equity) in place for their 15-30% share. The assessed credit risk rating is reflected to the guarantee premium to be charged for the guarantees as well as to other terms and conditions of the guarantees.

Besides Finnvera guarantees, the Finnish Export Credit Ltd (FEC) has an important role in post-delivery financing.

- FEC grants financing for export credits based on standard OECD terms and conditions, the currency being either in EUR or USD, the interest rates either at fixed rate ((CIRR)+margin) or floating rate ((Euribor or USD Libor)+margin) and charging the commitment fee prior to disbursement of the credit. It is noteworthy that the financing shall be applied prior to the conclusion of the shipbuilding contract.
- FEC financing always requires that there is sufficient Finnish interest involved (ships built mainly in Finland), and there is a co-operation and assignment agreement with the arranging bank who negotiates the credit agreement, administers the credit, its securities and the Buyer Credit Guarantee for the entire credit period.
- FEC financing always requires as security a 100 % Buyer Credit Guarantee issued by Finnvera meaning that the arranging bank as a commercial lender shall provide Finnvera with at least 5% residual risk guarantee.

### *Direct provisions of financing to shipyards*

Tesi (Finnish Industry Investment Ltd), 100% owned by Finnish State, provides financing aiming to promote growth and to develop Finland's venture capital industry. It mainly focuses on fund investment accounting for 80% of their whole investment and on direct investment accounting for 20%. Targets are companies which need capital for growing, board work and sparring, networks and reputation, and increasing shareholder value. Tesi provides financing based on its investment policy and the following criteria:

- Tesi invests only to profit-seeking limited liability company (Ltd) with an independent Board of Directors responsible for investment decisions.
- Tesi invests on market conform terms symmetric to private co-investors.
- Tesi does not include any state aid component in its investment.
- Tesi specifies exit target in advance.
- Tesi's share of the total investment is never more than 50 %.
- Investment criteria are similar to those of private venture capital and private equity investors' criteria.
- As a state-owned investment company, Tesi's operations are governed by laws. In rare special cases related to economic and industrial policy, the owner is allowed to make independent investment decisions.

In September 2014, the Meyer family, owner of the shipbuilding company Meyer family in Germany, and the Finnish State acquired Turku shipyard from STX Europe. Meyer Werft acquired 70 % of the shares, and the State of Finland purchased 30 % of the capital through Tesi (Meyer Werft, 2015). Tesi exited from its investments in April 2015. In accordance with its investment policy, Tesi temporarily owned Tuku shipyard's minority share and accomplished its original objective which is to stabilise the whole Finnish marine cluster.

In December 2015, Tesi and private investors Taaleri and Finda participated in an investment round which increased RMC's share capital to nearly EUR 25 million. This allowed RMC, a shipyard with leading-edge expertise and technology specializing in the construction and maintenance of multi-purpose icebreakers, car ferries and naval vessels, to carry out major shipbuilding projects. Tesi's share of the total investment was 26 %. Tesi still holds 16.3 % of RMC shares. The company has six board members, of which Tesi has the right to nominate one. Tesi's representative in the Board is an external industry expert. (Presentation by Tesi during the Peer Review mission)

### *Research, Development and Innovation (RDI)*

Public Research & Development and innovation schemes are managed by Tekes, the Finnish funding agency for innovation. Tekes financing is applied on projects of precompetitive type, and hence, not applied to research works related to ships on order. The Tekes programmes or tools are not targeted only for marine and shipbuilding industry, but also for other industries. One of its key projects is to create growth thanks to digitalisation aiming to make Finland a favourable operating environment for digital services and business models based on digital technologies.

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Tekes is a government agency, overseen by the Ministry of Economic Affairs and Employment and Economy of Finland, founded in 1983 in order to offer funding and expert services for R&D projects carried out by companies, research organisations, and public sector service providers in Finland. In 2015, Tekes budget amounted to EUR 575 million. Around 65% of the funding was targeted to companies' research and development projects which are carried out by SMEs. Shipbuilding and marine industries are notably covered by Tekes' Arctic Seas Programme and Smart Energy programme.

Tekes' interventions focus on the promotion of future growth, projects aiming to reduce emissions in marine industries and technology development<sup>6</sup> in big data, industrial Internet, artificial intelligence and robotisation which are expected to provide operational efficiency gains. In September 2016, Tekes announced committed financing for autonomous marine ecosystem development and boosting new innovations (Team Finland 2017). The One Sea Autonomous Maritime Ecosystem is an Alliance of maritime (Rolls-Royce, Wärtsilä, Cargotec, ABB, Meyer Turku) and ICT companies (Tieto, Ericsson) intending to introduce autonomous ships in Finland by 2025. The Ecosystem host organisation DIMECC manages a test area for autonomous ships off the coast of Finland, approved by the administration in August 2017.

### *Arctic Seas Programme 2014-2017*

Arctic Seas programme focuses on the reduction of emissions (e.g. cleantech and low emission fuels), information and data analytics of the Arctic area (e.g. monitoring, testing, risk management), and the increase in labour productivity and optimisation (e.g. automatisaton and efficient working equipment), aiming at turning Finland into an internationally attractive centre of Arctic know-how. This programme started in 2014 and is expected to end in 2017 with a budget of EUR 100 million funded by Tekes (EUR 45 million) and by private companies (EUR 55 million). This programme includes projects creating solutions increasing energy efficiency e.g. piloting large scale rotor sails, simulation and optimisation of ship energy flows as well as projects creating tools for enhancing transparency of the environmental footprint of shipbuilding activities.

As of the end of July 2017, 138 projects have been carried out through the Arctic Seas Programme, totalling 36 million EUR of funding by Tekes. Among them, funding via "cleantech and sustainability" R&D-projects, which is one of the largest projects supporting R&D spending in this programme, is expected to reach approximately EUR 20 million with half of the funding provided by Tekes.

### *Smart Energy programme 2017- 2021*

The goal of the Smart Energy Programme by Tekes and Finpro is to promote Finland in its role as forerunner and testbed of smart energy solutions, aiming to support company innovations and export networks through the establishment and development of a strong competence base, the promotion of the birth and growth of new companies, and the use of digitalisation, Internet of things, artificial intelligence and Internet of energy etc. This programme began in 2017 and will continue until 2021. Tekes and private companies each account for half of EUR 100 million budget.

### *Innovation aid (in the forms of direct grants)*

In addition to Tekes' programmes, innovation aid has been granted under the forms of direct grants funding industrial implementation of innovative products and processes. This innovation aid is jointly managed by the Centre for Economic Development, Transport and the Environment for south-west Finland (which grants aids for amounts inferior or equal to EUR 5 million) and the Ministry of Economic Affairs and Employment (which grants aids for amounts superior or equal to EUR 5 million). Projects eligible for

## PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

this innovation aid should be technologically new or substantially improve products and processes when compared to the state of the art that exists in the shipbuilding industry in the European Union.

The aid should represent less than 25 % of the eligible costs. This maximum aid intensity shall not be exceeded through other aid measures. The total maximum amount of aid awarded to a project is EUR 10 million. The terms and conditions have to be consistent with the Government Decree on the State's Innovation Aid for Shipbuilding 364/2015 and General Block Exemption Regulation (Commission (EU) regulation 651/2014). The total amount of R&D support granted to shipbuilding and marine industries via this innovation aid scheme are shown in table 12.

**Table 11. Innovation aids**

In millions of EUR

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Innovation aid	9.0	9.0	4.5	14.9	0	38.9	10.0	12.7	7.4

Source; WP6 Inventory updates (2010-2017)

### *Investment aid for purchasing greener ships*

The Investment aid scheme for purchasing greener ships was announced in 2010. It aimed to promote investments leading to a decrease in the level of emissions by ships. It was elaborated in connection with the proposal by the European Commission to amend the Directive<sup>7</sup> 1999/32/EC on the sulphur content of certain liquid fuels. The main objective of the scheme was to encourage shipping companies to adopt environmentally friendly technologies and to reduce the environmental footprint of the shipping industry.

In 2010, Finland government adopted a Decree including General Guidelines on Investment Aid to Vessels for the purpose of improving environmental protection (European Commission 2011a, European Commission 2011b). This decree set up the conditions to be eligible to this scheme<sup>8</sup>. While the scheme initially only applied to new vessels purchased between 2010 and 2012, it was extended to the acquisition of new ships in line with future EU standards and to retrofitting operations (e.g. scrubbers) after 2013.

The scheme specifies: (i) maximum aid intensities varying from 10% to 60% depending on the size of the company and if the aid supports new-building or retrofitting; and, (ii) a maximum amount of EUR 30 million per vessel. These thresholds were defined in accordance with the provisions of the guidelines and taking into account that extra investment costs that can be supported should allow reaching a higher level of environmental performance than the level required by the European Union's standards. Project eligible for this aid should meet the following requirements.

- The aid recipients have to be an enterprise registered in Finland engaged in shipping operations.
- The ordering of a new vessel has not been concluded.
- The aid recipient is considered to have the prerequisites for continuous profitable operations.
- The project will be implemented within three years after submitting the application.
- The project meets the criteria specified in the Environmental guidelines.

The total budget of the scheme was EUR 220 million (EUR 120 million in the first batch announced in 2010 plus EUR 100 million in the second batch announced in 2013). The total amount of aid granted

was EUR 56 million for two new vessels in 2011 and for 64 vessels for retrofitting investments (50 MGO conversions, 1 LNG conversion and 13 scrubbers). Table 13 shows the amounts granted in first and second batches of this scheme.

**Table 12. Investment aids granted in first and second batches**

	Amounts granted			Budgets
		New vessels	Retrofitting	
First batch (announced in 2010)	EUR 30 million	EUR 30 million	-	EUR 120 million
Second batch (announced in 2013)	EUR 25.8 million	EUR 3.3 million	EUR 22.5 million	EUR 100 million
Total	EUR 55.8 million	EUR 33.3 million	EUR 22.5 million	EUR 220 million

Source: Ministry of Transport and Communications, Finland

### ***Support for internationalisation (i.e. networking, sharing of information, marketing)***

The Ministry of Economic Affairs and Employment provide grants supporting the internationalisation of companies in the maritime and offshore sectors which are managed by Finpro and jointly implemented by organisations coordinated within “Team Finland”. This programme does not provide any aids/grants/financing to individual companies, but provides opportunities for networking (i.e. organizing several buyer events, visiting to shipyards, and participating to industry fairs). The budget of this programme is approximately EUR 1 million per year. This programme began in 2014.

The target of this program is to increase international activities of companies in the maritime and offshore sectors by at least EUR 500 million in terms of turnover in 2015-17 notably thanks to the development of activities for major shipbuilding companies in foreign countries and the involvement in oil and gas projects in international markets. The program aims to reinforce the network of Finnish companies in the maritime sector and to promote combined bids, which would increase the visibility of Finnish companies in international markets. The program is also expected to increase the international visibility of Finnish maritime know-how and the flow of investments to Finland.

### **Assessment of selected support measures**

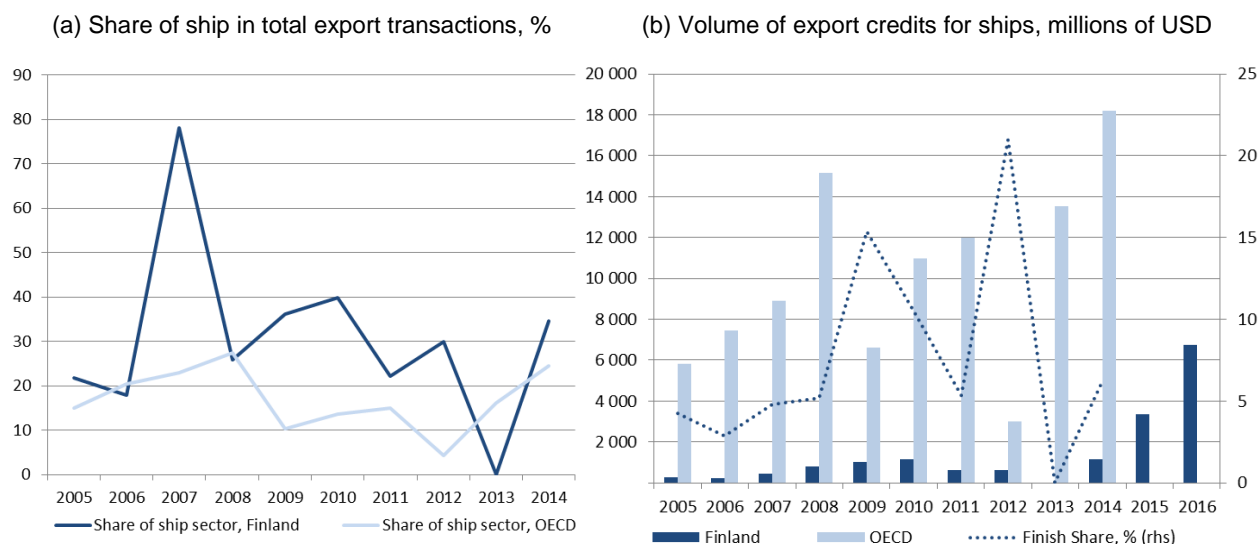
As mentioned in the previous section, the Finnish government provides several forms of support to the maritime sector for various purposes such as promoting its commercial development, supporting ship exports, facilitating innovation and improving its environmental performance. Considering data availability, selected policies are assessed in this section in terms of whether these policies are effective given their announced objectives.

### ***Export and home credits***

Export credits for ships accounted for 16.3% of total export credit transactions between 2005 and 2014 in OECD countries and for 28.4% in Finland (Figure 15). Finish export credit volume has a large share in OECD total export credit for ship sector, representing 15.4% in 2009 and 21.0% in 2012. The volume of Finish export credits for ships have been growing sharply since 2015, totalling more than USD 10 billion of export credits for ships between 2015 and 2016. These transactions between 2015 and 2016 mainly concerned cruise ships. In Finland, loans supporting the exports of cruise ships account for 80%

and those of ferries account for 13% of total export credit transactions for ships between 2006 and 2016 (Figure 16).

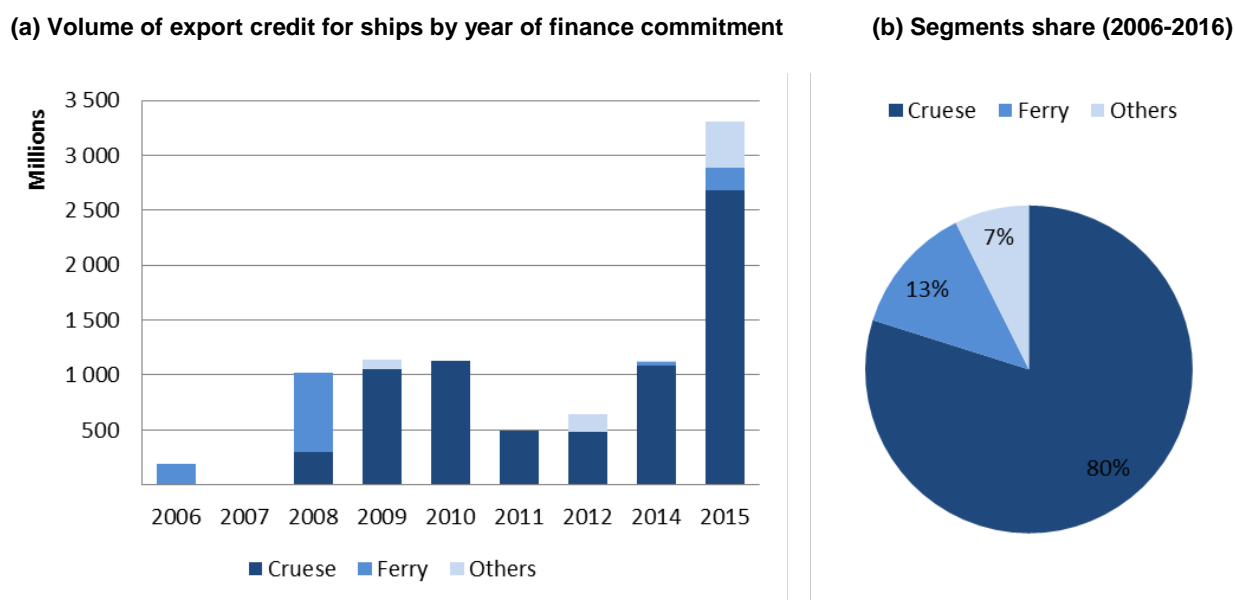
**Figure 15. Comparison of export credit transactions for ships between OECD members and Finland**



Source: OECD calculation based on data in annual inventory submission and data in OECD Export Credit website available at <http://www.oecd.org/trade/xcred/business-activities.htm>.

**Figure 16. Volume of export credits for ships by segments**

In millions of USD



Source: OECD data from TAD

Figure 17 shows the volume of ships delivered by yards located in Finland to domestic and foreign owners, the latter representing more than 90% of ship completions every year except in 2013 (Figure 16a). Finnish shipbuilding industry is export oriented with export credit playing a key role.

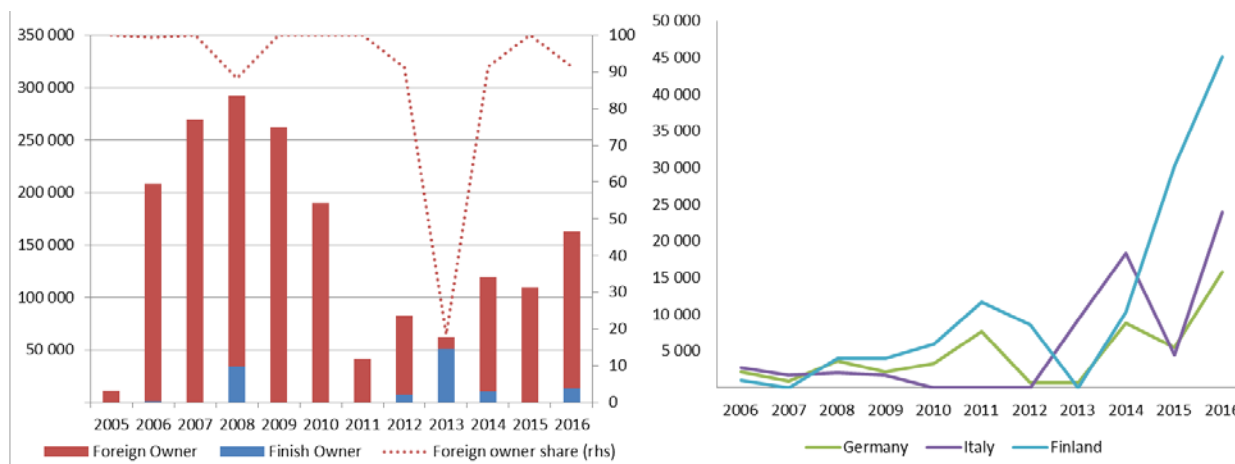
## PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

Export credit intensity can be measured by the ratio of export credits on the total volume of ship exports. Finish export credit intensity has been significantly increasing in the last three years (Figure 17 b). This upward trend in export credit intensity is also shown in Italy and Germany which mainly builds cruise ships. According to Finnvera’s annual report (2017), increasing demand for export credits for ships is driven by the vigorous growth in orders received by the Finnish shipbuilding industry.

**Figure 17. Finnish builders’ export tendencies, in cgt**

(a) Completion volume by owner category, in cgt

(b) Export Credit volume per export volume, in USD per cgt



Source: OECD calculation based on data in annual inventory submission and Clarkson world fleet register

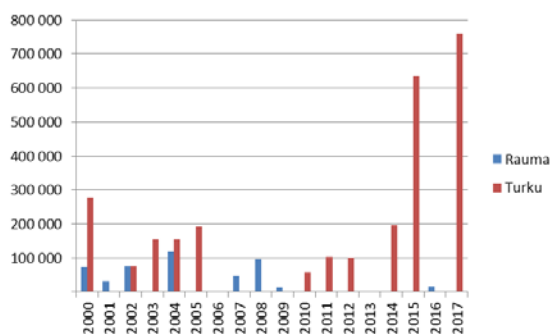
### *Equity investment to shipyards by Tesi*

Finnish Industry Investment Ltd (Tesi) provided funding in equity to Turku shipyard in 2014 and to Rauma shipyards (RMC) in 2015. Tesi’s investment policy requires that Tesi remains a minority shareholder and has an exit strategy. It seems that the investment of Tesi in a shipyard has no specific influence on its order intake as shown by the orders received at Turku shipyard which took only one order of passenger ferry in the period between September 2014 and April 2015 when Tesi owned a minority stake of the company. Moreover, Rauma shipyards took only one order after Tesi acquired RMC’s minority share in December 2015.

It seems however that the change of ownership would have an influence on the order intake. Figures 18, 19 and 20 show annual order intake volume of Turku and Rauma shipyards by ship types. Although both shipyards focused on building cruise ships or passenger ferries, both shipyards diversified their production in terms of ship types during the period when STX and Kvaerner, respectively, held majority shares. After the investment by Tesi, Turku yard concentrated on the production of large cruise ships.

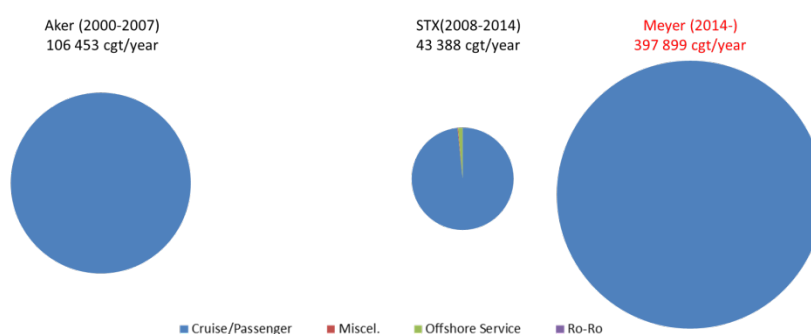


**Figure 18. Annual order intake by Turku and Rauma shipyards, in cgt**



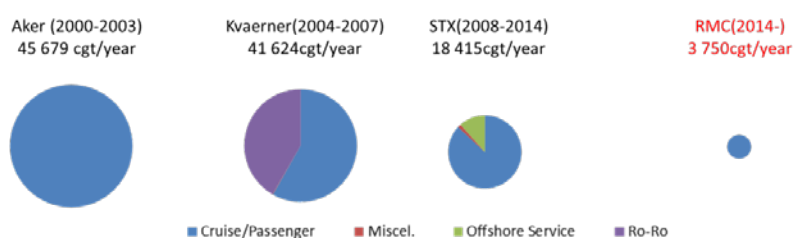
Source: OECD calculation based on Clarkson World Fleet Register

**Figure 19. Annual order intake volume of Turku shipyards by ship type for selected periods**



Source: OECD calculation based on Clarkson World Fleet Register

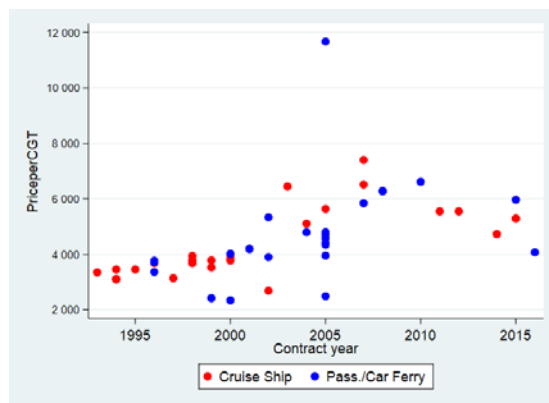
**Figure 20. Annual order intake volume of Rauma shipyards by ship type for selected periods**



Source: OECD calculation based on Clarkson World Fleet Register

The comparison of prices per cgt of transactions involving Turku and Rauma shipyards when Tesi was shareholder of these companies with prices offered by other Finnish yards display no major gaps. Figure 21 shows the price per cgt of the vessels built by Finnish shipyards. Turku shipyards and Rauma each took one order of passenger ferry with a unit price of USD 5.3 and USD 3.6 thousand per cgt, respectively. These values are close to the average or higher than most of the other passenger ferries built in Finland. Robust conclusions cannot be reached in terms of identifying normal prices as several factors influence vessels prices. For example, nominal prices of the ferry ordered to Turku shipyard in 2015 and the ferry ordered to Rauma in 2016 during the Tesi-involved period are very likely to be normal or sufficiently high. This implies that Tesi ownership did not lead to dumping.

**Figure 21. Unit price (nominal) of the vessels built by Finish shipyards, USD per cgt**

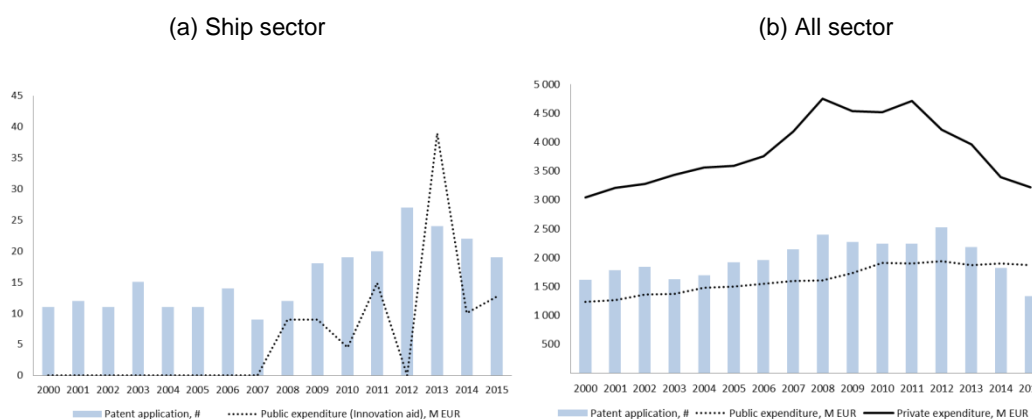


Source: OECD calculation based on Clarkson World Fleet Register

**Research and development (innovation aid)**

Innovation aid, which was approved by the European Commission on 28 May 2008, has been provided to shipbuilding and marine industries since 2008. The innovation aid is applicable for projects which are technologically new or which substantially improve products and processes. After this scheme commenced, the number of published patents<sup>9</sup> by applicants from the ship sector in Finland has been gradually increasing (Figure 22 a). The number of patents related to all Finnish economic sectors remained at the same level between 2008 and 2012 and dropped after reaching a peak in 2012 (Figure 22 b). This implies that the R&D support dedicated to the shipbuilding sector have contributed to stronger innovation activity of the sector in comparison with other economic sectors in Finland.

**Figure 22. R&D expenditure in nominal terms and patent application in Finland**  
In number and millions of EUR

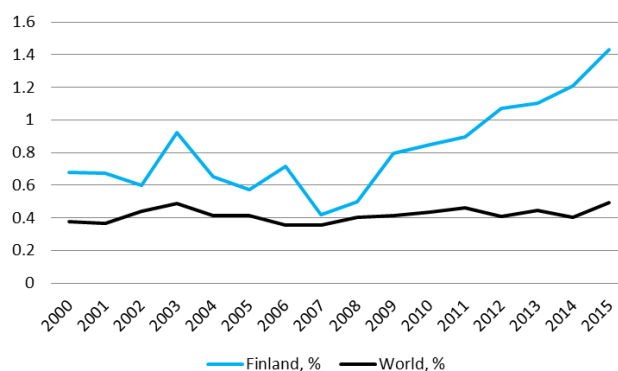


Notes: The total volume of R&D aids/grants provided to shipyard is calculated based on various updates of the WP6 Inventory of support measures. The number of ship related patent applications includes B63B or B63C or B63G or B63H or B63J in IPC classification

Source: OECD WP6 inventory update (2010-17) for volume of public R&D expenditure for shipbuilding, OECD Stat for patent application in Finland, Stat Fi for public and private R&D expenditure.

Figure 23 shows the share of the ship sector in total patent application counts by applicant country. The world ship sector share in total patent applications has remained at approximately the same level since 2000. Ship sector share by applicants based in Finland remained at a relatively downward trend until 2007 and turned upward trend in 2008, showing significant growth until 2015.

**Figure 23. Share of maritime sector in total patent application counts**

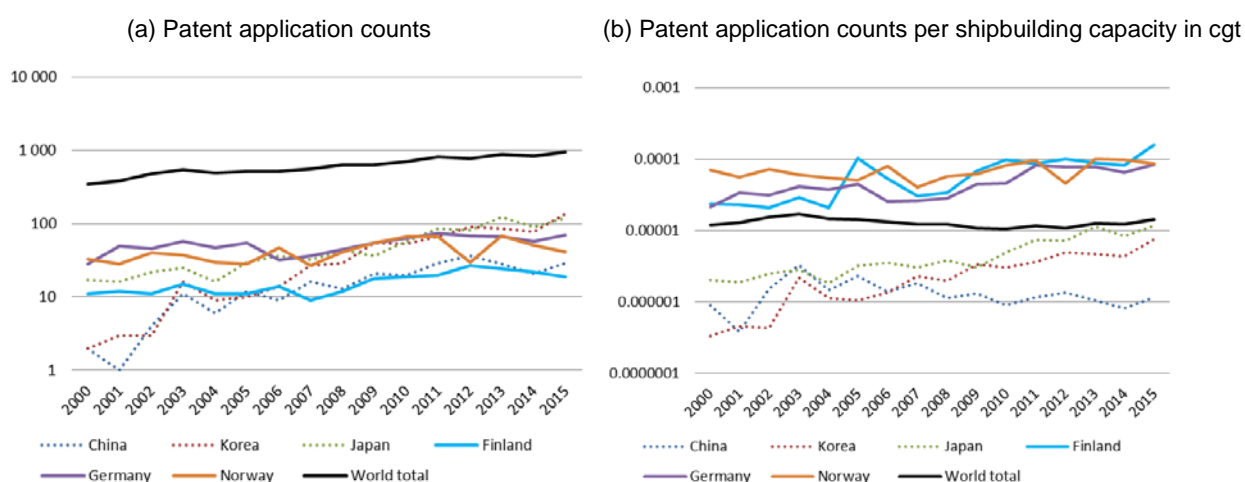


Note; The number of ship related patent applications includes B63B or B63C or B63G or B63H or B63J in IPC classification

Source: OECD Stat

Finland accounts for around 3% of the number of patents related to the maritime sector in 2015. However, Finland’s patent intensity measured by the number of patent application per shipbuilding capacity in cgt, was higher than in major shipbuilding countries (Figure 24). The growth rate of patent application intensity of Finland since 2008 has increased and reached 4.6 times in 2015 which is higher than other shipbuilding economies including Korea (3.8), Japan (3.0) and Germany (2.9) (Figure 24b).

**Figure 24. Patent application counts and counts per shipbuilding capacity in ship sector by country**

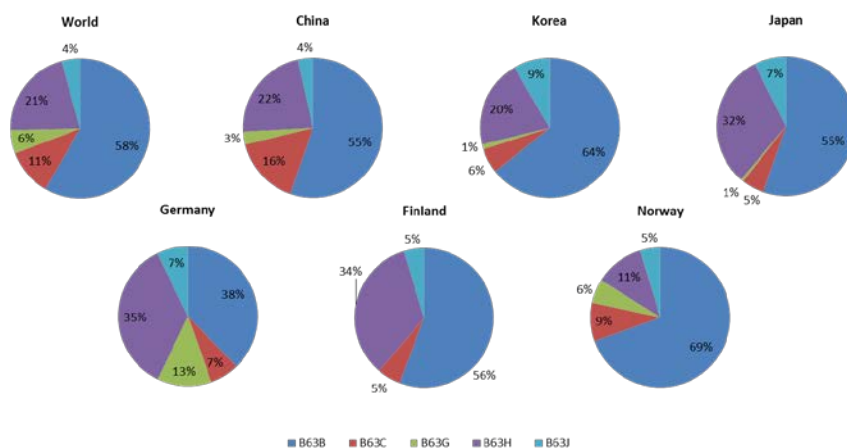


Source: OECD calculation based on IHS Seaweb and OECD Stat

According to data regarding number of patent applications by the International Patent Classification (IPC) code, patenting by companies from the Finnish shipbuilding and other marine industries is especially active in propulsion systems (B63H in IPC) (Figure 25). This reflects that importance of Finnish marine

supply industry in the maritime cluster in terms of employment and turnover. It should also be noted that patents for offence and defence purpose vessels (B63G in IPC), represent 1% of ship sector total, a smaller proportion than in most other European countries.

**Figure 25. Patent application by IPC between 2012 and 2016, % in application counts**



Note; B63B; SHIPS OR OTHER WATERBORNE VESSELS; EQUIPMENT FOR SHIPPING (arrangements of vessel ventilation, heating, cooling, or air-conditioning B63J 2/00; floating substructures as supports of dredgers or soil-shifting machines E02F 9/06)

B63C ;LAUNCHING, HAULING-OUT, OR DRY-DOCKING OF VESSELS; LIFE-SAVING IN WATER; EQUIPMENT FOR DWELLING OR WORKING UNDER WATER; MEANS FOR SALVAGING OR SEARCHING FOR UNDERWATER OBJECTS (floating nets, floating slipways, or the like for recovering aircraft from the water B63B 35/52)

B63G ;OFFENSIVE OR DEFENSIVE ARRANGEMENTS ON VESSELS; MINE-LAYING; MINE-SWEEPING; SUBMARINES; AIRCRAFT CARRIERS (means of attack or defence in general, e.g. turrets, F41H)

B63H ;MARINE PROPULSION OR STEERING (propulsion of air-cushion vehicles B60V 1/14; peculiar to submarines, other than nuclear propulsion, B63G; peculiar to torpedoes F42B 19/00)

B63J ; AUXILIARIES ON VESSELS

In summary, this patenting activity indicates that innovation in the Finnish marine industry developed quickly after 2008, correlating with the launch of the innovation aid scheme. Investment aid offered by Finnish government since 2008 has encouraged the growth of innovation activity in Finnish marine industry notably in the field of maritime equipment such as propulsion system.

### ***Investment aid to support the purchase of greener ships and retrofitting***

The Finnish government has been providing investment aid to support the purchase of greener ships and retrofitting since 2011 in order to comply with the IMO SOx regulation which became more stringent in 2015 in Emission Control Areas (ECAs) and Sulphur Emission Control Areas (SECAs). The regulation requires that all vessels operating in ECAs and SECAs limit the sulphur content of fuel oils loaded, bunkered, and used on-board. These fuel oil sulphur limits (expressed in terms of % mass by mass - m/m) are subject to a series of step changes and after the 1<sup>st</sup> of January 2015 the limit for ECAs and SECAs became 0.10% m/m

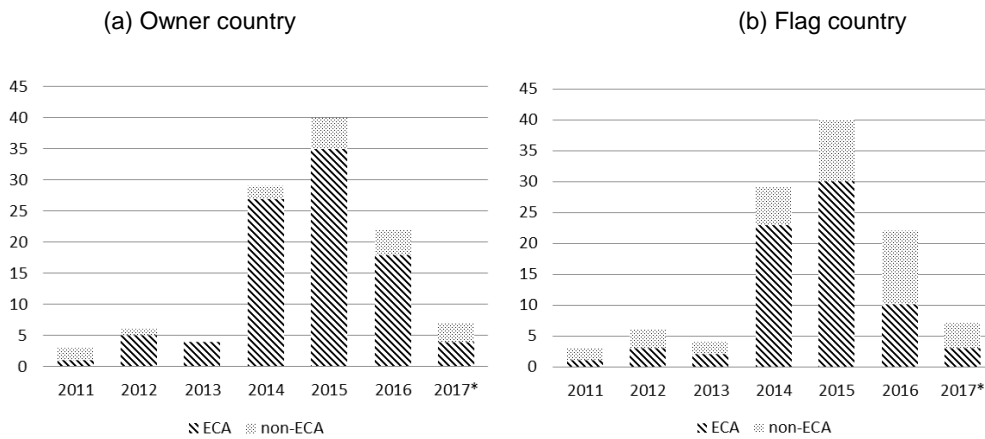
According to the IMO, ships can meet these requirements by using a low-sulphur compliant fuel, including natural gas which leads to negligible sulphur oxide emissions. Ships may also meet the SOx emission requirements by using approved equivalent methods, such as the use of exhaust gas cleaning systems or “scrubbers”, which “clean” the emissions before they are released into the atmosphere.

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The country of ownership or the nationality of the flag has an influence on the routes taken by vessels and if they operate in ECAs or SECAs. Ships retrofitted since 2011 were 85% ECA countries owned<sup>10</sup> and 65% ECA countries flagged<sup>11</sup>, whereas world fleets owned by ECA-countries and flagged in ECA-countries in July 2017 only accounted for 23% (OECD calculation based on Clarkson World Fleet Monitor, July 2017). In particular, the installation of sulphur scrubbers significantly increased in 2014 and 2015 when the new threshold on sulphur emissions entered into force (Figure 26)

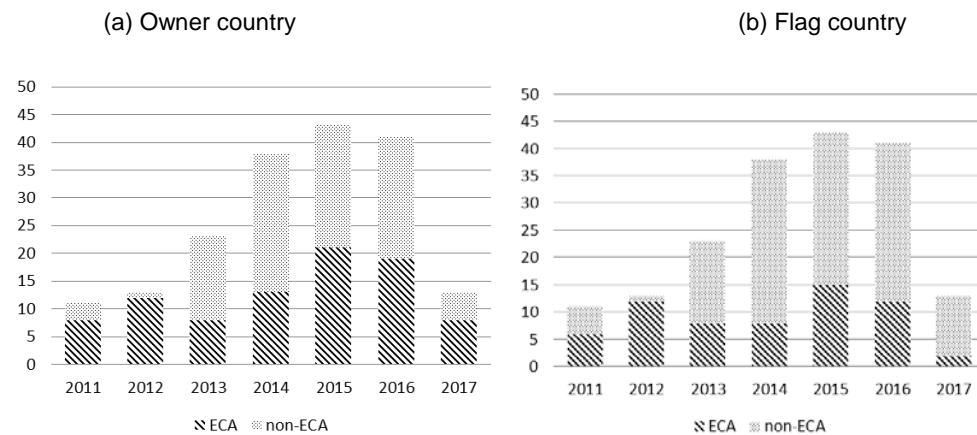
Ship owners located in countries implementing an ECA do not experience a significantly higher share of LNG-fuelled vessels. At the global level, the number of LNG-fuelled vessels has been gradually increasing in recent years both in ECA and non-ECA countries. One of the reasons for this increase is that a lot of recently built LNG carriers are fuelled by LNG as LNG tanks are incorporated into their original designs. LNG carriers account for 90% of the total fleet of non-ECA flagged LNG fuelled vessels; whereas they account for only 20% of total fleet number of ECA flagged LNG fuelled vessels (Figure 27) (OECD, 2017).

**Figure 26. Number of vessels with retrofitting of sulphur scrubbers retrofitting by owner and flag countries, %**



Source Clarkson world fleet register

**Figure 27. Completion number of LNG-fuelled vessels by owner and flag countries, %**



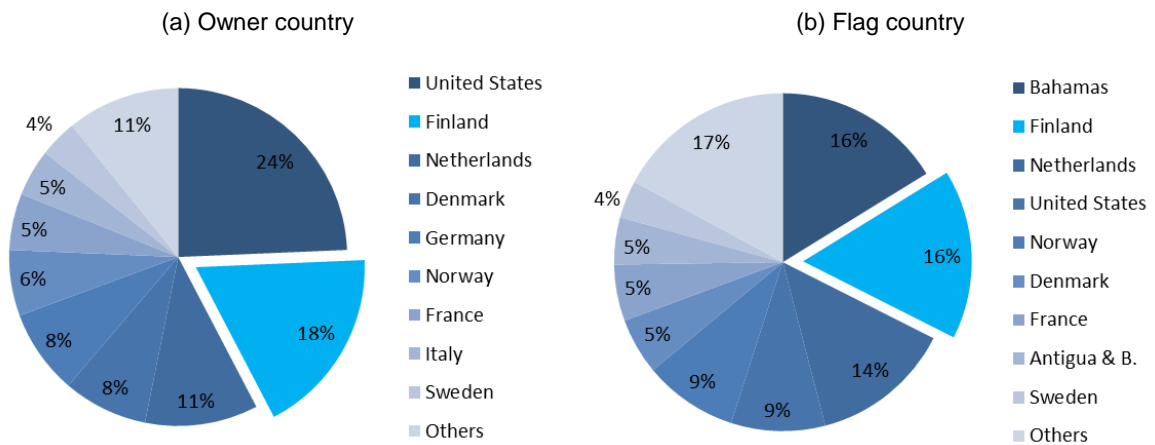
Source Clarkson world fleet register

PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

Figure 28 shows scrubber retrofitting by countries of ownership and flag compared to scrubber retrofitting at the global level between 2011 and 2017. Finnish owned and flagged fleets display a very high share in total scrubber retrofitting, accounting for 18% and 16% respectively in comparison to their share of the global fleet. Most of these ships were retrofitted in 2014 and 2015. Finnish owned or flagged LNG fuelled vessels account for less than 2% of LNG fuelled vessels.

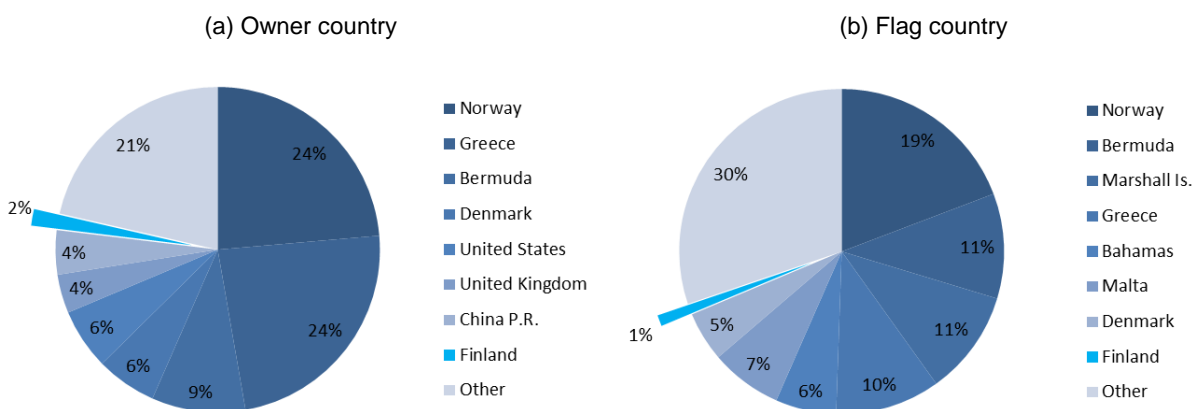
As the investment aid was granted by Finland’s government to two new buildings, 50 MGO (Marine Gas Oil) conversion, 1 LNG conversion and 13 scrubber retrofitting, Finnish ship owners mainly meet the requirements of the SOx regulation by converting existing vessels to MGO fuelled vessels or with scrubbers. The investment aid provided by the Finnish government has contributed to supporting the retrofitting of existing vessels using scrubbers to meet the IMO new requirements on SOx emissions in ECA, but did not apparently contribute to significantly developing the use of LNG fuelled vessels.

**Figure 27. Share of sulphur scrubber retrofitting by owner and flag countries, %**



Source Clarkson world fleet register

**Figure 28. Share of purchased LNG-fuelled vessels by owner and flag countries, %**



Source Clarkson world fleet register

## Analysis of consistency of selected policy measures with international commitments

One of the main goals of the Peer Review process is to strengthen the identification of government measures potentially affecting the shipbuilding sector and to support discussion of these within the WP6. Against this backdrop, this subsection analyses the support measures in Finland in the context of the following selected policy frameworks i) the Arrangement and the SSU, and ii) the WP6 instruments including the Shipbuilding Agreement.

### *The OECD Arrangement and the SSU*

The OECD has developed and is continuously updating “*the Arrangement on Officially Supported Export Credits*” (hereafter, the Arrangement) and its annex “*the Sector Understanding on Export Credits for Ships*” (hereafter, the SSU). The Arrangement (including the SSU) is referred in the WTO’s Agreement on Subsidies and Countervailing Measures (ASCM) as the “Safe Haven”.

According to the Arrangement, export credit is defined as an insurance, guarantee or financing arrangement which enables a foreign buyer of exported goods and/or services to defer payment over a period of time; an export credit may take the form of a supplier credit extended by the exporter, or of a buyer credit, where the exporter’s bank or other financial institution lends to the buyer (or its bank).

While Finnvera’s post-delivery financing has to be compliant with the Arrangement, its pre-delivery financing may not necessarily have to follow the terms and conditions in the Arrangement. In case pre-delivery loans are provided to shipyards, and hence, the loans (and guarantees to the loans) do not constitute export credits within the meaning of item (j) of the Illustrative List in WTO ASCM, it may not necessarily have to be consistent with the Arrangement terms (WTO, DS273, 2005). On the other hand, in case pre-delivery loans are provided to buyers, the loans (and guarantees to the loans) are supposed to be consistent with the Arrangement unless its repayment term is less than 2 years. Export credit loans and guarantees provided by Finland seem to be in full conformity with the SSU.

### *WP6 Instruments*

As the instruments addressing overall measures in the global shipbuilding industry, the WP6 has approved the “*Revised General Arrangement for the Progressive Removal of Obstacles to Normal Competitive Conditions in the Shipbuilding Industry*” (C(82)194/FINAL), the “*Revised General Guidelines for Government Policies in the Shipbuilding Industry and Shipbuilding Agreement*” (C(83)27) and the “*Agreement Respecting Normal Competitive Conditions in the Commercial Shipbuilding and Repair Industry*” (the Agreement), while the Agreement has not entered in force. Still, it should be noted that the Agreement stipulates some concrete criteria in its Annex I, including the list of the prohibited measures. Therefore, relevance with these instruments could help the WP6 for the discussion on policy measures.

#### **Box 2. Preliminary analysis of support measures with the provisions of the “Shipbuilding Agreement”**

Prohibited measures in the Agreement includes export credits inconsistent with the SSU, export subsidies, direct and indirect domestic support, R&D assistance, and regulations and practices such as domestic build requirement. Tekes programmes (Arctic Seas Programme and Smart Energy programme) and innovation aid are assessed in this box in the context of the Agreement

For the support for R&D, the Agreement allows several types of R&D assistances including: a. Fundamental research<sup>12</sup>, b. Basic industrial research<sup>13</sup>, where the aid intensity is limited to 50 % of the eligible costs; c. Applied research<sup>14</sup>, where the aid intensity is limited to 35 % of the eligible costs; or d. Development<sup>15</sup>, where the aid intensity is limited to 25 % of the eligible costs.<sup>16</sup> (OECD, 1994)

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- Arctic Seas programme is considered as a program for basic industrial research, applied research depending, or development on the project. According to the shipbuilding agreement, since the program is basically related to the environment, the limit of total support should be 75% of the eligible costs for basic industrial research, 60% of the eligible costs for applied research, and 50% of the eligible costs for development, subject to the consensus of the parties of the Agreement (OECD, 1994). Therefore, Arctic Seas programme, which is 55% financed from private actors, is considered to be provided within the range of exceptions of prohibited subsidies in the Agreement.
- The Smart Energy programme is considered as a program promoting basic industrial research, applied research or development depending on the projects funded by this programme which is related to the environment. Therefore the assessment of the aid intensity in the context of the Agreement is similar than in the case of the Arctic Seas programme. Smart Energy programme, which is 50% financed by private actors is also in the range of exceptions of prohibited subsidies in the Agreement.
- Innovation aid is considered as a program promoting basic industrial research, applied research or development depending on the project. As the aid does not represent more than 25 % of the eligible costs, it is considered to be provided within the range of exceptions of prohibited subsidies in the Agreement.

### **Possible suggestions for future reporting by Finland in the WP6 Inventory**

According to Table 9, while Finland included four measures each year in recent Inventory updates, this Peer Review overviewed six other measures to evaluate the ones that could also be reported to increase transparency of government policies and measures. Although the improvement of inventory coverage is still to be under discussion at the next WP6 meeting, the following views can be observed in light of inventory submission, in reference to the latest Inventory questionnaire:

- Investment aid managed by the Ministry of Transport and Communication may fall within the scope of measure E “Export or Home credit” in the latest inventory questionnaire if the aid is, in law or in fact, provided only for purchasing ships built in Finish shipyards. While this scheme has been terminated in 2014, Finland reported this scheme at the 121st session of the WP6 which took place 10 November 2015.
- Maritime and offshore programme may not be necessarily submitted as the amount granted is expected to be very limited, although it may fall within the scope of measure B “Indirect transfer of funds by Governments” in the latest inventory questionnaire. This can be discussed in the context of possible improvement of the Inventory coverage, as it includes the discussion on the concept of *de minimis* rule.



## ISSUES FOR DISCUSSION

The aim of the WP6's peer review process is to provide a robust analysis of shipbuilding industry support measures at the country level, accompanied by industry detail, so as to facilitate discussion on the soundness of shipbuilding policy and its impact by the WP6, this section provides tentative issues for discussion on the Finnish shipbuilding industry and accompanying policies.

### *Rising competition in shipbuilding market segments where Finland's yards are operating*

Finland's shipbuilding industry is export oriented with around of its production purchased by foreign shipowners. In this context, rising competition especially in the cruise ship market which is the largest contributor in terms of value added for the Finnish shipbuilding industry is a key challenge.

- How can the Finnish shipbuilding industry and accompanying policies enable the maintenance of the Finnish market share in the global shipbuilding market and notably in the cruise ship and ice breaker segments?
- What are the potential gains in terms of competitiveness of the new innovations (e.g. digitalization) on which Finland's marine cluster is focusing?
- What are the synergies in the marine cluster and how can they be strengthened?

### *High labour costs and access to qualified workers*

As mentioned above in the Peer Review report, Finland is a high-cost country and needs to focus on high value added and knowledge based products. As a consequence, the access to competence and innovation is vital to Finnish shipbuilding industry's competitiveness; and this involves notably the following issues:

- What can be done to support a more systematic approach to improving workers' skills?

### *Slow progress in terms of international environmental regulations*

Finland is at the forefront of international efforts towards more ambitious international environmental regulations. However, according to many experts, the progress of these regulations is relatively slow which raises some issues for Finland.

- What are the trends in terms of greener ship production in Finland?
- What are the impacts of the establishment of the Emission Control Areas?
- How can Finnish policymakers respond to the slow progress of international environmental regulations?

### *General assessment of shipbuilding policy*

Finnish government has implemented several measures based on its maritime strategy and gathered several institutions under "Team Finland"

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- How does the Finnish government assess the efficiency of each of the policies supporting the maritime sector?
- Does this policy assessment, notably regarding the provision of officially supported export credits, include the assessment of a potential market distorting effects?
- Why and how was Team Finland established? And how it can be assessed so far?

**ANNEX I  
NATIONAL AND INTERNATIONAL ASSOCIATIONS AND COLLABORATIONS**

**1. The Association of Finnish Marine Industries (Meriteollisuus ry)** is a co-operation forum for high-technology maritime solution providers, leading marine equipment manufacturers, turn-key suppliers, designers, software and system providers as well as shipbuilding, ship repair and offshore yards.

The association promotes favourable conditions in industrial and economic policy for the Finnish marine industry. The association offers its members, public authorities and the media with the latest relevant information on the marine industry sector in Finland.

Currently, the association has over 80 member companies.

**Main activities**

The association promotes networking, coordinates RDI activities and promotes the application of EU shipbuilding policies in Finland. The Finnish Marine Industries represents the branch at the European Ships and Maritime Equipment Association - SEA Europe. In pursuit of these goals, the association has established several internal working groups, such as:

- Research Committee
- Network Development
- Network Information Management Group
- Network Education Group
- In-service training
- Internationalization
- Communication
- Education
- Design and Regulations
- Financing
- Markets
- Offshore

The association and Finland's Ministry of Economic Affairs and Employment of Finland elaborated also an industry strategy on Smart Maritime Technology Solutions - an update: a strategic research agenda for the Finnish maritime cluster 2017–2025.

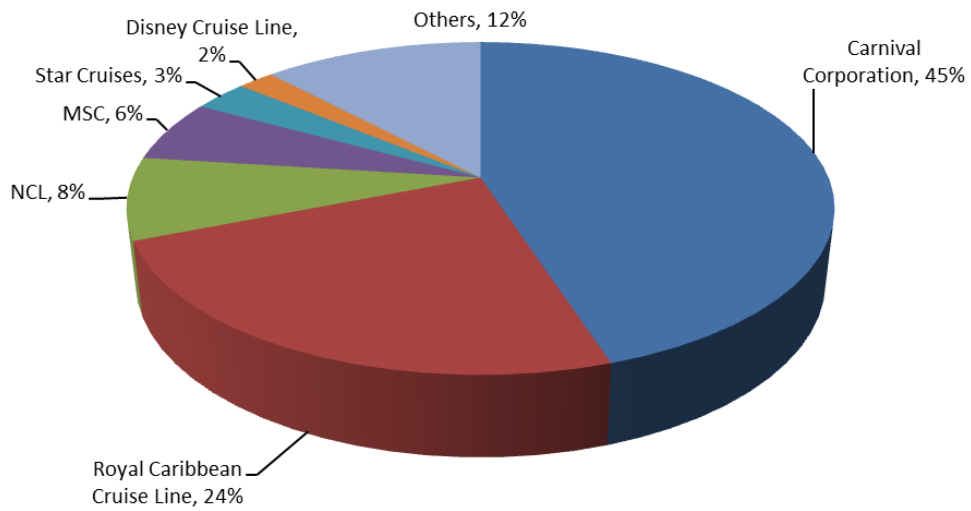
**2. Sea Europe**, [www.seaeurope.eu](http://www.seaeurope.eu) (see above)

**3. Waterborne**, <http://www.maritime-rdi.eu/> - platform for the European collaboration

**4. The Joint Economic Commission of the Finnish and the Russian governments** encompasses two working groups of which one is related to ship building and the other to the gas industry.

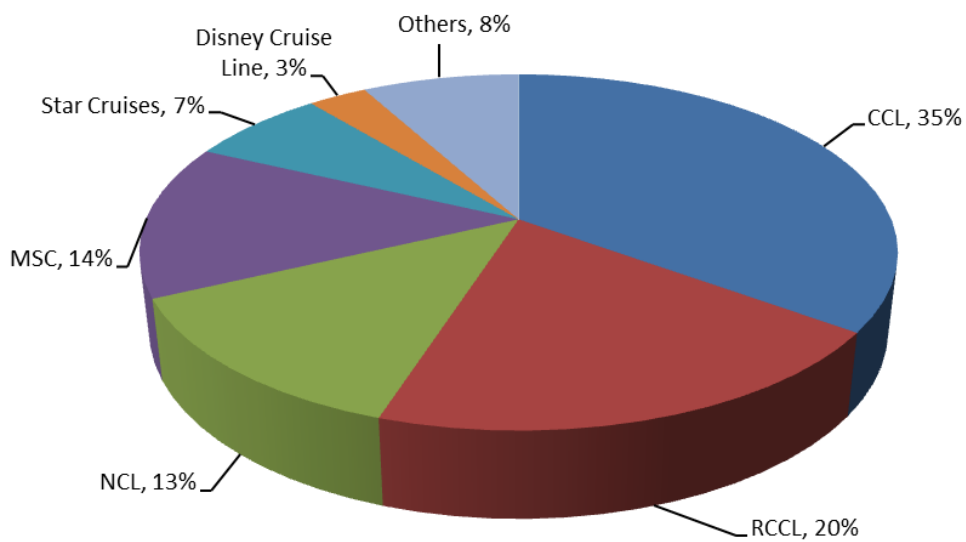
ANNEX II

Existing cruise ship fleet, April 2017



Source: Clarkson Research, IHS Lloyd's Register, Meyer Turku.

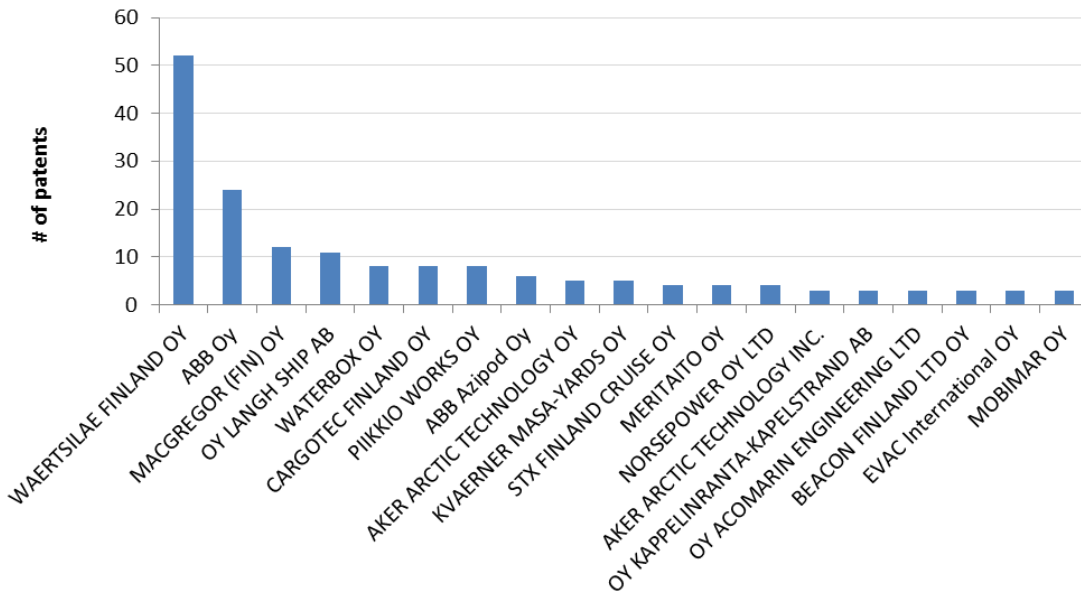
Orders of cruise ships, April 2017



Source: Clarkson Research, IHS Lloyd's Register, Meyer Turku.

PEER REVIEW OF THE FINNISH SHIPBUILDING INDUSTRY

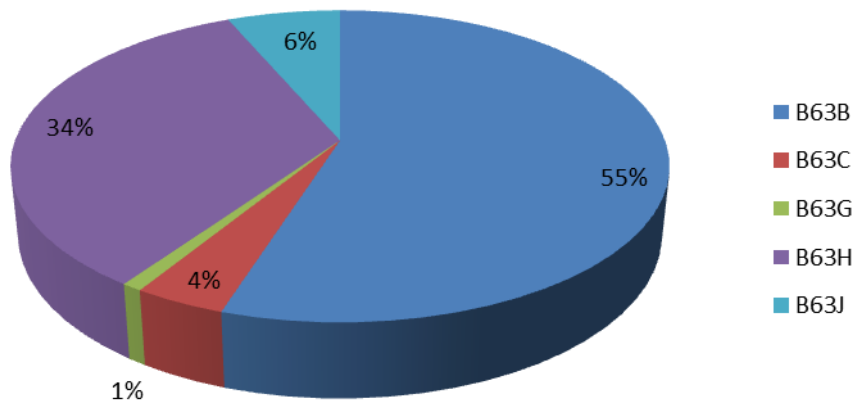
European Patent Office (EPO) patents by company applicant, 2000-2016



Note: including the international patent codes: **B63B** (ships or other waterborne vessels; equipment for shipping; **B63C** (launching, hauling-out, or dry-docking of vessels; life-saving in water; equipment for dwelling or working under water; means for salvaging or searching for underwater objects (floating nets, floating slipways, or the like); **B63G** (offensive or defensive arrangements on vessels; mine-laying; mine-sweeping; submarines; aircraft carriers); **B63H** (marine propulsion or steering); **B63J** (auxiliaries on vessels)

Source: OECD based on EPO.

European Patent Office (EPO) patents by patent category related to ships, 2000-2016



Note: including the international patent codes: **B63B** (ships or other waterborne vessels; equipment for shipping; **B63C** (launching, hauling-out, or dry-docking of vessels; life-saving in water; equipment for dwelling or working under water; means for salvaging or searching for underwater objects (floating nets, floating slipways, or the like); **B63G** (offensive or defensive arrangements on vessels; mine-laying; mine-sweeping; submarines; aircraft carriers); **B63H** (marine propulsion or steering); **B63J** (auxiliaries on vessels)

Source: OECD based on EPO.

NOTES

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- <sup>1</sup> TEKES, the Finnish Innovation Funding Agency, has supported the creation of SHOKs which was formerly the Finnish Metals and Engineering Competence Cluster (FIMECC).
- <sup>2</sup> 1) Kværner Mase-Yards Oy (Archtech Helsinki), Helsinki, 2) Kværner Mase-Yards Oy (Meyer Turku), Turku, 3) Finyards Oy (RMC) Rauma, 4) Mäntyluoto Works (Coflexip&Technip) (Technip Offshore), Pori, 5) Uudenkaupungin Työvene
- <sup>3</sup> Labour costs per hour in the shipbuilding industry or manufacturing sector were not available to the knowledge of the authors.
- <sup>4</sup> See for more information at: <http://www.mobimar.com/turn-key-modules>
- <sup>5</sup> More information on the Finnish offshore industry is available in the report produced by Prizztech Oy and supported by the Finnish ministry of economic affairs and employment in 2017 [http://www.finoffshore.fi/asiakaskuvat/Finnish%20Offshore%20Industry%20Report%202016-2017\\_EN%20Final.pdf](http://www.finoffshore.fi/asiakaskuvat/Finnish%20Offshore%20Industry%20Report%202016-2017_EN%20Final.pdf)
- <sup>6</sup> "DIMECC Design for Value (D4V)" is an example of a recent funding by Tekes. The objective of this project consists of understanding and exploiting the opportunities of digital disruption in maritime logistics value chains.
- <sup>7</sup> The Sulphur Directive entered into force 2015. At the start of 2015, the sulphur limit for marine fuels was cut to 0.1 % in SOx emission control areas in the Baltic Sea, the North Sea and North America's sea areas.
- <sup>8</sup> The scheme was notified to the European Commission and was approved on 7 December 2011
- <sup>9</sup> Number of published patents in this section means number of patents registered under the Patent Cooperation Treaty (PCT)
- <sup>10</sup> ECA-owned vessels are vessels owned by shipowners with nationality of which countries facing emission control area (i.e. Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Latvia, Lithuania, Netherlands, Norway, Sweden, United Kingdom United States)
- <sup>11</sup> ECA-flagged vessels are vessels with flag of countries facing emission control area (i.e. Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Latvia, Lithuania, Netherlands, Norway, Sweden, United Kingdom United States)
- <sup>12</sup> Extract from Agreement Respecting Normal Competitive Conditions in the Commercial Shipbuilding and Repair Industry (1994): The term "fundamental research" means research activities independently conducted by higher education or research establishments for the enlargement of general scientific and technical knowledge, not linked to industrial or commercial objectives.

- <sup>13</sup> Extract from Agreement Respecting Normal Competitive Conditions in the Commercial Shipbuilding and Repair Industry (1994): "Basic industrial research" is understood to mean original theoretical and experimental work whose objective is to achieve new and better understanding of the laws of science and engineering in general and as they might apply to an industrial sector or to the activities of a particular undertaking.
- <sup>14</sup> Extract from Agreement Respecting Normal Competitive Conditions in the Commercial Shipbuilding and Repair Industry (1994): "Applied research" is understood to mean investigation or experimental work on the basis of the results of the basic research with a view to facilitating the attainment of specific practical objectives such as the creation of new products, production processes and services. It normally ends with the creation of a first prototype and does not include efforts whose principal aim is the design, development or testing of specific items of services to be considered for sale.
- <sup>15</sup> Extract from Agreement Respecting Normal Competitive Conditions in the Commercial Shipbuilding and Repair Industry (1994): "Development" is understood to mean work based on the systematic use of scientific and technical knowledge in a design, development, testing or evaluation of a potential new product, production processes or service or of an improvement of an existing product or service to meet specific performance requirements and objectives. This stage will normally include pre-production models such as pilot and demonstration projects but does not include industrial application and commercial exploitation.
- <sup>16</sup> Extract from Agreement Respecting Normal Competitive Conditions in the Commercial Shipbuilding and Repair Industry (1994): The maximum allowable aid intensity for research and development related to safety and the environment may be 25 percentage points higher than those percentages mentioned under b., c. and d. above, under the condition that the Parties Group has approved the project by consensus minus one, or more than 25 percentage points higher if the Parties Group has approved the project by consensus.
- The maximum allowable aid intensity for research and development carried out by small and medium sized shipbuilding enterprises shall be 20 percentage points higher than those percentages mentioned at b., c. and d. above. Small and medium sized enterprises are those with less than 300 employees whose yearly sales figure does not exceed 20 million ECU and which are not more than twenty five percent owned by a large company.

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